# THE ENGINEERING JOURNAL

VOLUME 26

JANUARY-DECEMBER, 1943



PUBLISHED BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET

MONTREAL, QUE.

# THE ENGINEERING JOURNAL

## INDEX TO VOLUME XXVI

### JANUARY TO DECEMBER, 1943

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, JANUARY 1943 | NUMBER 1

"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."

★ ★ ★

# CONTENTS



PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



**Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.**

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* E. M. KREBSER, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville, Ont.

**CALGARY**
*Chairman,* H. J. McEWEN
*Vice-Chair.,* J. G. MacGREGOR
*Executive,* J. N. FORD, A. GRIFFIN, H. B. SHERMAN
*(Ex-Officio),* G. P. F. BOESE, S. G. COULTIS, J. B. deHART, P. F. PEELE
*Sec.-Treas.,* K. W. MITCHELL, 803—17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* D. HUTCHISON
*Vice-Chair.,* C. W. CARRY
*Executive,* B. W. PITFIELD, E. R. T. SKARIN, J. A. ALLAN, E. ROBERTSON, J. W. JUDGE
*(Ex-Officio),* J. GARRETT, R. M. HARDY
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B. STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* STANLEY SHUPE
*Vice-Chair.,* T. S. GLOVER
*Executive,* H. A. COOCH, NORMAN EAGER, A. C. MACNAB, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, W. A. T. GILMOUR
*Sec.-Treas.,* A. R. HANNAFORD, 354 Herkimer Street, Hamilton, Ont.

**KINGSTON**
*Chairman,* T. A. McGINNIS
*Vice-Chair.,* P. ROY
*Executive,* V. R. DAVIES, K. H. McKIBBIN, K. M. WINSLOW, A. H. MUNRO
*(Ex-Officio),* G. G. M. CARR-HARRIS, D. S. ELLIS
*Sec.-Treas.,* R. A. LOW, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* MISS E. M. G. MacGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL, R. B. CHANDLER, S. E. FLOOK, O. J. KOREEN, S. T. McCAVOUR, W. H. SMALL, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER, J. M. FLEMING
*Sec. Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* F. T. JULIAN
*Vice-Chair.,* T. L. McMANAMNA
*Executive,* F. C. BALL, V. A. McKILLOP, H. F. BENNETT, A. L. FURANNA, R. S. CHARLES
*(Ex-Officio),* R. W. GARRETT, J. A. VANCE
*Sec.-Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* H. J. CRUDGE
*Vice-Chair.,* J. A. GODFREY
*Executive,* A. S. DONALD, E. R. EVANS, E. B. MARTIN, H. W. HOLE, G. C. TORRENS
*(Ex-Officio),* F. O. CONDON, G. L. DICKSON, H. W. McKIEL
*Sec. Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R., Moncton, N.B.

**MONTREAL**
*Chairman,* J. A. LALONDE
*Vice-Chair.,* R. S. EADIE
*Executive,* R. E. HEARTZ, J. B. STIRLING, J. M. CRAWFORD, J. COMEAU, H. F. FINNEMORE, R. C. FLITTON, G. D. HULME
*(Ex-Officio),* deG. BEAUBIEN, J. E. ARMSTRONG, J. G. HALL, W. G. HUNT, C. K. McLEOD, G. McL. PITTS
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* C. G. CLINE
*Vice-Chair.,* G. E. GRIFFITHS
*Executive,* A. G. HERR, R. T. SAWLE, G. F. VOLLMER, W. D. BRACKEN, J. W. BROOKS, J. H. TUCK, D. S. SCRYMGEOUR
*(Ex-Officio),* A. L. McPHAIL, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 1870 Ferry Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* N. B. MacROSTIE
*Executive,* W. G. C. GLIDDON, R. M. PRENDERGAST, W. H. G. FLAY, G. A. LINDSAY, R. YUILL
*(Ex-Officio),* K. M. CAMERON, C. J. MACKENZIE, W. H. MUNRO, T. A. McELHANNEY, R. K. ODELL
*Sec.-Treas.,* A. A. SWINNERTON, Dept. of Mines and Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* D. J. EMERY
*Executive,* C. R. WHITTEMORE, F. R. POPE, I. F. McRAE, R. L. DOBBIN, A. J. GIRDWOOD
*(Ex-Officio),* J. CAMERON, H. R. SILLS
*Sec.-Treas.,* A. R. JONES, 5, Anne Street, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldgs., Quebec, Que.

**SAGUENAY**
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER, J. FRISCH, B. BAUMAN, G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS, N. F. McCAGHEY, J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, P.O. Box 33, Arvida, Que.

**SAINT JOHN**
*Chairman,* D. R. SMITH
*Vice-Chair.,* A. O. WOLFF
*Executive,* H. P. LINGLEY, C. D. McALLISTER, C. C. KIRBY
*(Ex-Officio),* F. A. PATRIQUEN, V. S. CHESNUT, G. G. MURDOCH
*Sec.-Treas.,* G. W. GRIFFIN, P.O. Box 220, Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* VIGGO JEPSEN
*Vice-Chair.,* J. H. FREGEAU
*Executive,* E. BUTLER, R. D. PACKARD, A. C. ABBOTT, R. DORION, H. J. WARD, E. T. BUCHANAN, J. JOYAL, H. G. TIMMIS
*(Ex-Officio),* A. H. HEATLEY
*Acting Sec.-Treas.,* VIGGO JEPSEN, Consolidated Paper Corporation, Grand'Mère, Que.

**SASKATCHEWAN**
*Chairman,* A. P. LINTON
*Vice-Chair.,* A. M. MACGILLIVRAY
*Executive,* F. C. DEMPSEY, N B. HUTCHEON, J. G. SCHAEFFER, R. W. JICKLING, H. R. MacKENZIE, B. RUSSELL
*(Ex-Officio),* I. M. FRASER
*Sec.-Treas.,* STEWART YOUNG, P. O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* L. R. BROWN
*Vice-Chair.,* R. A. CAMPBELL
*Executive,* N. C. COWIE, C. O. MADDOCK, C. R. MURDOCK, K. G. ROSS
*(Ex-Officio),* J. L. LANG, E. M. MacQUARRIE, A. E. PICKERING
*Sec.-Treas.,* O. A. EVANS, 159 Upton Road, Sault Ste. Marie, Ont.

**TORONTO**
*Chairman,* W. S. WILSON
*Vice-Chair.,* W. H. M. LAUGHLIN
*Executive,* D. FORGAN, R. F. LEGGET, S. R. FROST, F. J. BLAIR, E. G. HEWSON, C. F. MORRISON
*(Ex-Officio),* C. R. YOUNG, T. H. HOGG, A. E. BERRY, N. MacNICOL, H. E. BRANDON, J. J. SPENCE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD, R. E. POTTER, I. C. BARLTROP, E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT, H. N. MACPHERSON
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C.

**VICTORIA**
*Chairman,* A. S. G. MUSGRAVE
*Vice-Chair.,* KENNETH REID
*Executive,* A. L. FORD, B. T. O'GRADY, J. B. PARHAM, R. BOWERING
*(Ex-Officio),* A. L. CARRUTHERS, G. M. IRWIN, E. W. IZARD
*Sec.-Treas.,* J. H. BLAKE, 605 Victoria Avenue, Victoria, B.C.

**WINNIPEG**
*Chairman,* D. M. STEPHENS
*Vice-Chair.,* J. T. DYMENT
*Executive,* C. V. ANTENBRING, N. M. HALL, T. H. KIRBY, E. W. R. BUTLER, H. B. BREHAUT
*(Ex-Officio),* J. W. SANGER, V. MICHIE, C. P. HALTALIN
*Sec.-Treas.,* THOMAS. E. STOREY, 55 Princess Street, Winnipeg, Man.

# DESIGN AND CONSTRUCTION OF SCANLON DAM, B.C.

WILLIAM JAMIESON, M.E.I.C.
*Field Engineer, Powell River Company Limited, Powell River, B.C.*

**Paper presented before the Vancouver Branch of The Engineering Institute of Canada, at Vancouver, B.C., on October 22nd, 1942**

This dam was recently built to supply additional power to the large paper and pulp manufacturing plant of the Powell River Company Limited, at Powell River, 80 miles up the coast from Vancouver, B.C., and is situated about 16 miles S.E. from the paper plant.

The dam derives its name from one of the pioneer directors of the Powell River Company. Before proceeding with a description of its construction, brief reference will be made to the hydroelectric developments of which it forms a part, and the circumstances leading to its present construction.

The only source of hydro power available for operation of the paper mills at Powell River, up to 1930, was the Powell lake watershed, an area estimated at approximately 580 sq. mi., the run-off from which was utilised to the maximum of its economic development by a turbine plant capable of developing approximately 51,000 h.p. The power developed from this source is used partly for mechanical power which drives the grinders for making groundwood pulp, and partly for conversion to electrical power for the operation of the paper and numerous other machines and tools necessary for pulp and paper manufacture. The hydroelectric plant consists of four generators of a total capacity of 21,000 kva.

In 1929, demands for greater production made it necessary to find a further source of power, and the water rights for the adjoining watershed to the south draining into the Lois and Pasha Lakes were obtained.

This Lois river development 13 miles by air line and 17 miles south by road from Powell River, takes its supply from a chain of lakes known as the Lois or Gordon Pasha Chain. The three main lakes actually included in the reservoir are the Lois, Gordon Pasha, and Khartoum Lakes. North of these is a mountainous country from which they are fed by streams from Horseshoe, Nanton, Dodd, Lewis and Windsor Lakes, and from other lakes at higher levels, two of the higher lakes having recently been added to those accessible to fishermen by the construction of roads for logging operations.

Studies of this potential source of power were greatly facilitated by surveys that had been carried out for a series of years by the Surveys and Engineering Branch of the Department of Mines and Natural Resources, and the Water Rights Branch, of the Provincial Lands Department, and the economical capacity of the development was found to be 27,000 h.p., continuous delivered at Powell River, or 31,800 h.p. on a mill-day basis.

**Fig. 1—Power house and surge tank at Scow Bay.**

The total storage capacity when the dam is finally completed will be about 450,000 acre-feet, and the drainage area is estimated at 184 sq. mi.

The additional power required for certain extensions of the plant at Powell River contemplated in 1930, amounted to 16,000 h.p. or about half the available capacity of this potential development. For economic reasons it was decided to construct a temporary log dam across the Lois River, which could later serve as a coffer-dam during the building of a permanent concrete dam.

In order to ensure that the site selected for the permanent dam was suitable and to have its location definitely determined, a thorough examination of the site was made by stripping the overburden except for the river bed, and a short length near the top, and a considerable amount of exploration work was also done by drilling.

Dr. Victor Dolmage, M.E.I.C., of Vancouver, was called in to examine the geological features, and in his report he described the rock as granodiorite or quartz—diorite of a geological formation known as the Coast Range batholith, and he concluded that this would prove a satisfactory formation for a dam structure. Later this opinion was confirmed when all fractured and weathered rock had been removed.

With the site of the permanent dam approved, the location of the mile-long tunnel which with the connecting penstocks conveys the water to the power house could then be determined, and the construction of the initial development was started in 1930.

This work consisted of a log crib dam which formed a reservoir of 72,000 acre-feet, with a head of 350 ft. above tail water and allowed for a continuous usage of 730 cu. ft. per sec.

The water was delivered through a wood stave penstock 10 ft. dia. and 2,726 ft. long, which extended from the log dam to a point a short distance behind the site selected for the permanent dam. From this point the water was conveyed through a reinforced concrete penstock 12½ ft. dia. for a distance of 776 ft. to a tunnel 5,851 ft. in length. From the lower end of the tunnel a steel penstock 2,591 ft. in length and varying from 12 to 11 ft. in diameter, connects with two 7¾ ft. branches leading to the power house at tidewater on Scow Bay. (See Fig. 1).

The log dam and wood penstock were regarded as being but temporary structures, but the remainder of the installation including the power house with an 18,000 kva. generator, and the surge tank, perhaps one of the most conspicuous landmarks on the Coast were all designed and built as part of the permanent development. The size and height of the surge tank are notable. It is of the Johnson differential type, 30 ft. in dia. and 187 ft. high, carried by a pedestal 121 ft. in height. The tank was designed to function with the log dam whose crest is at Elev. 450 and later with the concrete dam, with crest at Elev. 522.

The Johnson valve for the second generator was also installed and provision was made in the power house for this second generator but this has not yet been obtained.

Due to the deterioration of the wooden structures, after a lapse of nine years, more particularly the head gate section of the dam and the penstock saddles which were attacked and badly damaged by rot and termites, the necessity of making replacements and repairs had to be considered. In view of the large expense involved, and the fact that the permanent dam might soon be required, it was decided to put the money that would have to be expended on repairs into permanent construction, and to build the concrete dam to Elev. 502 with a spillway at Elev. 490, 40 ft. higher than the log dam. Only the section carrying the headgate and headgate machinery was to be built up at once to the full height, Elev. 522.

### Design Features

A comparison was made of the cost of different types of dams, and the variable-radius arch design was selected, this being found to be the most suitable and economical type for the site.

In this design, radii vary with the height and the radii of the extrados are struck from centres different from those of the corresponding intrados. The object of this design is to produce the maximum strength with the minimum amount of material. When the dam is loaded and tends to deform, besides the axial compressive stresses, tensile stresses tend to develop in varying degrees at varying distances from the centre due to shrinkage and other causes, and to take care of these stresses without using reinforcing steel, the variable radius arch design was developed. It is covered by U.S. patents, and while the validity of some of these patents is open to question, the Powell River Company deemed it advisable to pay certain fees on this account, rather than to risk becoming involved in possible litigation. A plan of the dam is shown in Fig. 2.

The limiting stress used in the design was 700 lb. per sq. in.

The main dimensions of the dam are:

| | |
|---|---|
| Length of crest | 680 ft. |
| Length of thrust block | 115 ft. |
| Length of wing wall | 187 ft. |
| Total length | 982 ft. |
| Radial thickness at top | 8′ 0″ (10′ 0″ over parapet walls) |
| Radial thickness at bottom | 37′ 0″ |
| Maximum height | 205′ 0″ |

The concrete crest at Elev. 502 has been temporarily surmounted with wooden flash-boards 7 ft. in height.

The wing wall was provided to guide the waste water to a point below the dam before permitting it to fall into the river, this being done to avoid excessive erosion of the bank carrying the penstock between the dam and the tunnel.

When the dam is raised to its full height an extension in a radial direction from the thrust block at the west end will be provided with five Taintor gates 20 ft. wide and 21 ft. deep and one Taintor gate 10 ft. wide and 10 ft. deep to pass trash and small discharges.

With a view to facilitating contraction and cooling of the


**Fig. 2—Plan of variable-radius concrete dam on Lois River showing layout of dam and wing wall.**

concrete the dam was divided into sections by radial lines approximately 40 ft. apart and as each of these sections formed one continuous pour, with the time between successive pours set at 72 hours, the structure was virtually built up with a number of arched blocks keyed together on radial lines. (See Fig. 3).

The keys on section lines are 2 ft. 6 in. by 1 ft.

### Water Stops

Vertical copper water stops formed from 20 in. wide copper sheets weighing 3 lb. per ft. were located near the upstream face of every construction joint. The various sections of these stops are riveted and brazed together, making them continuous from top to bottom, with the bottom buried in the concrete, below the start of the construction joints. (See Fig. 4).

Horizontal stops of $\frac{1}{32}$ in. galvanized iron weighing 1.5 lb. per sq. ft. were set four inches in the concrete and projecting four inches to join with the next pour. The different sections of iron are riveted together and also riveted at the ends to the copper stops. The joints also soldered to make them watertight.

To provide for the passage of water through the dam while the closure was being made, a 6 ft. dia. culvert was incorporated in the dam as seen in Fig. 3. The ends of this culvert were afterwards plugged, and the culvert filled and sealed with concrete, poured down through 8 in. dia. pipes that had been carried up from the soffit of the culvert for this purpose.

### Form of Contract

The form of contract decided upon provided for a fixed fee, covering all the work specified.

The contractor supplied all personnel, material and equipment necessary for the work, subject to the approval of a duly appointed representative of the company.

A fixed monthly sum for the rental of certified equipment was stipulated, and the payment of this rental was for a definitely stated period, based on the estimated time for completion, and regardless of whether it would be required for a longer or shorter time.

The salaries of the manager and superintendent were also limited to a fixed time, so that there was ample incentive to get the work completed within the scheduled period.

The contractors also took over the operation of the Company's Stillwater railway and wharf, which they used for bringing in supplies, and for hauling logs, freight and passengers in connection with logging operations on the lakes.

The contract covered all phases of the work, with the exception of the provision of drawings for the actual dam structure and appurtenances, which were supplied by the Powell River Company. No penalties were specified, but the company reserved the right to take over the work if not satisfied with the conduct of the work or the progress made by the contractor.

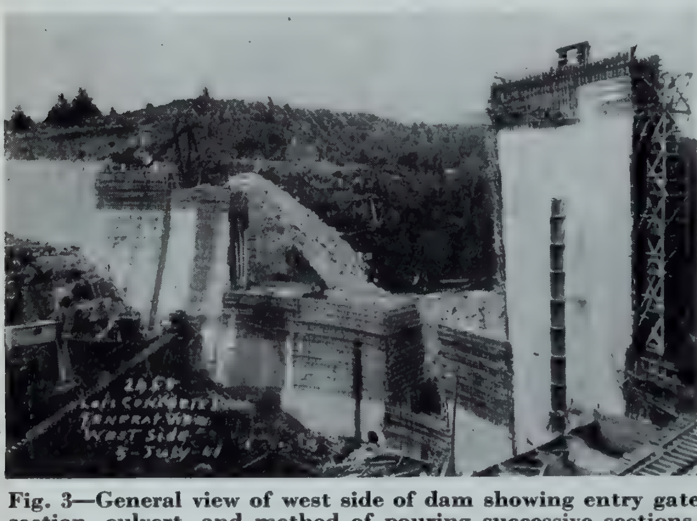


**Fig. 3—General view of west side of dam showing entry gate section, culvert, and method of pouring successive sections.**

The contract having been duly signed, a progress schedule was drawn up in detail, modifications being made from time to time as found advisable or necessary. Generally, except where changes were due to change of policy such as speeding up the work by extra night shifts, the schedules were closely adhered to and were of great value in planning for deliveries of equipment and materials.

### Setting Out

Setting out on the ground a structure of this kind naturally involved a large amount of instrument work, and calculating machines were kept busy for many weeks to provide data required for the field work.

The first thing to be done was to establish the centre line. On this line were located the centre of the curve for the elevation of the top of the dam, and the focal point of the radii of the construction joints. This central point, when determined, was marked on an iron belt set in concrete and duly referenced. As the work proceeded the value of being able to readily pick up the centres of the various curves became obvious and all these were marked on 10 by 10 timbers well secured, extending down the centre line.

On the drawings supplied for the work one common point for each construction joint was given with the radius and angle to it, measured from the centre line at Elev. 522. From these points all subsequent angles were calculated and the distances to the sides of the dam at the various elevations. As the line of the bulkhead for each construction joint was the same as the downstream radius produced through these common or locus points, the bulkheads had to follow the radial line for each 10 ft. in elevation, and they were distorted and twisted to gain this effect, as shown in Fig. 4.

The most practical way of establishing the locus points for each 10 ft. lift or difference in elevation was found to be by means of ordinates from parallel lines established on either side of the canyon, high enough up to be above the top of the dam, and far enough away not to be disturbed. Fortunately the topography of the district made this easy. With the locus points determined, the curves for the extrados and intrados could be run. This procedure in theory appears to be quite simple, but it often happens that in laying out work numerous difficulties are encountered which have to be dealt with as they crop up; the laying out of a variable arch dam is no exception.

In order to keep track of the excavation work, cross sections were taken at close intervals. These levels and cross sections formed a grid over the entire foundation area; a number of points were marked beyond this area, so that the grid at any point could be readily re-established. In laying out and re-establishing these grid lines, some ingenuity was needed as some of the places marked were on unscalable and overhanging cliffs.

The next problem was to establish the outline of the foundations of the dam at each and every elevation so that the excavation, which was for the most part rock, could be taken out the correct width and no wider.

The dust from the rock drills and the blasting made the use of crayon or stakes a waste of time, so lines for the front and back of the dam were run in and painted on the surface of the rock. These curves referred only to the lines of the dam at a particular elevation, and it was also found necessary to paint the contour lines at 5 ft. intervals on the rock walls of the canyon. Starting at Elev. 372 all contour lines at elevations ending in the figure two were painted red and at those ending in seven, white.

The heights of the various contour lines were marked with twelve-inch figures wherever possible on the smooth surface of the rock, and were plainly visible from either side of the canyon. The painted contour lines were about 60 ft. in length, extending well beyond the limits of the excavation.

As the rock work spread out and gangs were set to work at different elevations, a colour scheme was also devised to mark out the excavation required between any two contours, and for this purpose six different paints and combinations of them were used. For example between contours 437 and 447 the limits of the excavation would be marked with blue paint, between 427 and 437 with yellow, etc. Actually these lines were continually being obliterated, but enough of them were usually left to enable the others to be readily re-established.

The centre section or river bottom was excavated in three sections, and the bed-rock was found to be about 50 ft. below the stream bed. The true curve was staked out, and the timbered shafts were sunk a little wider than called for. The curve was then marked out on the top timber.

This brief description of the work of setting out will serve to indicate the methods adopted, which, were found to be satisfactory. It is not necessary to enlarge on the many difficulties that are incidental to such work, when carried out among swinging derricks, rushing trains and trollies, and dripping cement. There were also the smoke and heat caused by rubbish fires and boiler settings, the infernal din of air driven tools and machinery, and the movements of some 300 men working in the confined area in which these operations had to be done.

Our contractors were fortunately able to obtain for us the services of a very capable man for this setting out work.

### Excavation

As previously stated the overburden had been removed over most of the site, and with the exception of the river bed practically all the excavation was rock work. A compressed air plant was installed, comprising one Worthington compressor, one portable Diesel and one gazoline compressor.

Excavation work was started in May, 1940, on the west side, all broken and fractured rock being removed down to bed-rock. The work was arranged as far as possible so as to avoid having to work in the river bed at the time when flood conditions would normally be expected.

Favourable weather conditions and some regulation of discharge and wastage enabled the work to proceed without any serious interference throughout the winter and spring run-off seasons. This regulation was effected by controlling the discharge from the Horseshoe Lake dam, by manipulating flashboards on the log dam, and by the opening and closing of the second Johnson valve at the power house, when it became expedient to do so.

The first section to be carried down to any depth, was the bank on the east side, on which the penstock rested. As it was necessary to keep the generator in operation, special precautions had to be taken to hold the penstock (a 10 ft. dia. wood pipe) in position, while the ground under it was removed. A Howe truss was built to carry this, the ends of the truss resting on sills at either end of the cut. Before the work had progressed very far, the ground at one end of this truss, shewed signs of giving way, and it then became necessary to carry down a shaft to bed-rock, and to build concrete reinforced piers to support the truss. These concrete piers were afterwards incorporated in the body of the dam.

To keep the excavations dry the following pumps were used. One deep well pump capable of delivering 1,400 U.S. gal. per min., with another of 225 U.S. gal. per min., two hand pumps, and three No. 7 sludge pumps. There was also a system of well points which was moved down as the work progressed and proved very satisfactory. The well points consisted of 2 in. dia. steel pipes, drawn to a point at the lower end and drilled with entrance holes which were protected by copper mesh screens. Several of these points, spaced about 5 ft. or other convenient distance apart, were driven about 20 ft. into the gravel, and the upper ends were connected six-inch headers. The water was then drawn up by a special set of pumps supplied by the Moretrench Company, the manufacturers of the points. As the excavation became deeper, the points or another set were driven or worked down into the gravel ahead of the excavation, to bed rock in the river bed.

For breaking up the ground to enable it to be loaded into skips, clay diggers operated by compressed air were found to be very useful.

### Concrete

When the original estimates for the dam were being considered, naturally the question of the concrete mix, and particularly the cement content was discussed. It was noted that similar structures in the United States, American engineers had been using one American barrel (376 lb.) per cu. yd.

A review of published records indicated that with proper control, low water-cement ratio, proper grading and the use of vibrators, satisfactory results could be expected if this same cement content were used, and the estimates were made on this basis.

The grading of aggregates was also carefully considered, and it was decided that the maximum size of coarse aggregate should be 4 in., that the gravel should be segregated into three gradings and combined at the mixer, and that the fineness modulus should be very close to 3.0, with a slump varying from 1½ to 3 in.

Washed sand and gravel for the concrete aggregate, came from Howe Sound, and was shipped by scow to Stillwater, where it was unloaded into hoppers. From there it was transported by rail to the dam site in 5 cu. yd. dump boxes mounted on flat cars, with four-car trains carrying 60 cu. yd. per trip. At the dam a spur track built over the aggregate bins permitted dumping directly from the cars.

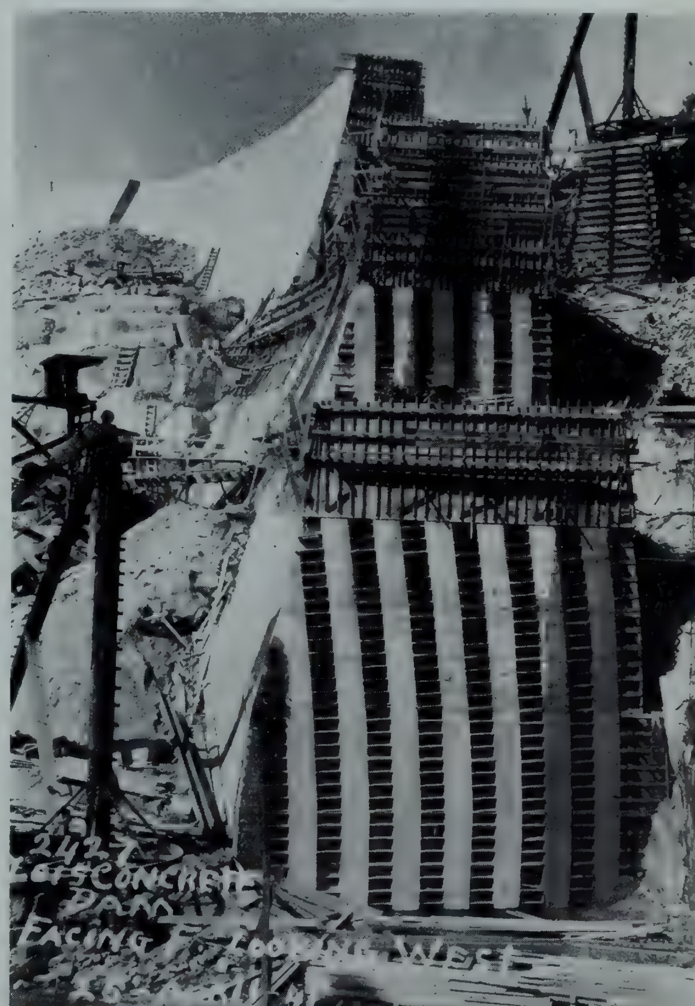



**Fig. 4—Construction joint, showing water stops and distortion or twisting of bulkheads.**

Total storage capacity was 574 cu. yd. in five bins of which two were used for sand and one each for the gravel, in gradings of 4 to 1½ in., 1½ to 1 in., and 1 to ¼ in. From these bins, the aggregate was carried on an 18-in. conveyor belt to bins above the mixing plant with a capacity of 400 cu. yd.

Cement was unloaded from the ships at Stillwater dock, and was transported on a 14-in belt conveyor to sheds on shore having a storage capacity of 16,000 sacks. From there it was carried in box cars to the dam site, and emptied into a silo, having a capacity of 2,500 sacks. From the silo it was conveyed by a 14-in. belt up to a 50-sack hopper built into the weighing house, above the mixing plant.

Cement batches were weighed manually in a hopper on a platform scale and dumped when required into eight-inch pipes, which ran down to the charging hoppers. Here were three Smith tilting type mixers, one of which was 1½ cu. yd. and the other two were 1 cu. yd. capacity. The mixed concrete was delivered by means of three narrow-gauge tracks, running from the mixing plant, to points which could be reached with concrete buggies or derricks. These are shown in Fig. 5.

The wing wall, thrust block and sections A and B of the arch, were placed by using buggies. The majority of the arch sections were placed directly with derricks, and the balance was placed by using derricks and then buggies.

The buckets used were of 2 cu. yd. capacity, and designed as a conical hopper with a gate in the bottom 12 by 24 in. They discharged low slump concrete with practically no segregation.

Two vibrators were used. The larger, which was the more satisfactory, was a Chicago Pneumatic No. 518, and the smaller which was used along the forms was a No. 417 of the same make.

Macdonald & Macdonald, Testing Engineers, were in charge of concrete control. They designed the mixes and made all field and laboratory tests.

The original mix for mass concrete was:

| | |
|---|---|
| Cement | 370 lb. |
| Sand | 1,135 lb. |
| Gravel ¼ in. - 1 in. | 735 lb. |
| 1 in. - 1½ in | 550 lb. |
| 1½ in. - 4 in | 915 lb. |
| Slump—3 in. | |

Just sufficient water was added to give a water-cement ratio of 0.58 to 0.60 by weight. This water-cement ratio was used throughout the work.

For the first few pours some experimenting on the mix was done, using as low as 330 lb. (3.75 sacks) per cu. yd. Only a few yards were poured with this quantity of cement.

**Fig. 5—General view of construction works showing mixing plant, narrow-gauge tracks, etc.**

After this field adjustment was made, the mix used until the end of 1940 was:—

| | |
|---|---|
| Cement | 370 lb. |
| Sand | 1,226 lb. |
| Gravel ¼ in. - 1 in | 794 lb. |
| 1 in. - 1½ in | 566 lb. |
| 1½ in.4 - in | 974 lb. |
| Slump—1 in. - 2 in. | |

Some difficulty was experienced at the gravel pit to get the aggregate in this ratio without wasting some sizes, so at the beginning of 1941 the mix was changed to the following and used for the balance of the work:

| | |
|---|---|
| Cement | 370 lb. |
| Sand | 1,226 lb. |
| Gravel ¼ in. 1 - in | 935 in. |
| 1½ in. - 1 | 700 lb. |
| 1½ in. - 4 | 700 lb. |
| Slump—1 in. - 2 in. | |

In the river bottom, where there was considerable water for the first pours, the cement was increased to 570 lb. to the cu. yd., the 4 in. gravel was reduced and the concrete poured so as to flow under the water, which was kept deep enough to prevent currents which would wash out the cement. Slump of this concrete was six inches.

The mix for the penstock encasement was:—

| | |
|---|---|
| Cement | 480 lb. |
| Sand | 1,420 lb. |
| Gravel ¼ in. - 1 in | 1,200 lb. |
| 1 in. - 1½ in | 900 lb. |
| Slump—6 in. | |

During the early period of the work, a great many slump tests were made, usually three in the forenoon and three in the afternoon. The tests ran as high as three inches, but the majority were around one inch. After the mixing routine had been established it was possible to control the water by visual examination, and these tests were made less frequently, usually at the same time that test cylinders were made.

Sieve tests were made on the sand twice a week, and the average fineness modulus averaged 3.12.

Test cylinders were taken quite frequently until the mix was established, after which time a cylinder was taken every 600 cu. yd. of concrete poured. These were made in test cylinder cans and shipped to Vancouver for testing. Out of 77 reports examined the lowest breaking stress was 3,104 lb. per sq. in., the highest 4,526 lb. per sq. in. and the average 3,578 lb. per sq. in.

All cement was tested by the inspection engineers before loading at the cement plant.

### Mixing and Placing Concrete

The batching was done by weigh batches. After all the aggregates were weighed in the charging hoppers,the cement was delivered to the hopper through a pipe from the weigh house, above the mixing plant.

The mixing time was maintained at three minutes for charging, mixing and discharging as nearly as possible, but on most of the work the time required for transportation and placing set the governing time.

The concrete for the wing wall, thrust block and the western two sections of the arch was delivered by car to a hopper from which it was conveyed and deposited by buggies into chutes.

The balance of the concrete was dumped from the mixers into the buckets set on flat cars and hauled to points that could be reached by derricks. The derricks were then able to place most of the concrete directly from the buckets to its place in the pour.

The concrete was poured in layers about 20 inches thick, there being three layers to a pour.

After depositing from the buckets, the concrete was vibrated with the large vibrator. Efforts were made not to use the vibrator for moving the concrete into place. Only enough vibration was used to bring the paste to the surface, and care was taken to vibrate deep enough to work the upper layer into the previous layer.

A small vibrator was used along the forms to ensure a good appearance of the concrete when stripped.

The surfaces of concrete pours were cleaned off by means of air water jets. This was done from four to twelve hours after the pour was completed, so as not to injure the surface by loosening the aggregate.

On starting a pour, a layer of about ¼ in. of mortar was broomed over the surface.

As previously stated, the time between the completion of one pour and the beginning of the next in the same section was set at 72 hours, although in a few instances this was reduced to a minimum of 40 hours.

Forms were left on where possible for three weeks or more, except bulkheads which had to be removed for adjacent pours. During warm weather sprinklers were maintained where possible.

Steam heated water was used when the temperature was below 40 deg., and the temperature of the water was raised 110 deg. which gave the concrete at the mixer a temperature of 50 deg.

### Grouting

Seams in the foundation rock were pressure grouted to minimize seepage. The depth of the holes drilled in the centre sections varied from 24 to 27 ft. The depth was determined by test holes drilled to 50 ft. or more if sound rock were not encountered. Grouting pipes were also inserted in cracks where it appeared that seepage might take place.

The holes on the upstream side were drilled and grouted before those on the downstream side, and each hole was grouted before the adjoining hole was drilled.

The drilling operations were conducted as follows:—

After the excavation had been carried down to bed rock, 2-in. dia. pipes were installed at points where grout holes were required and extended above river level. This allowed the drilling to be carried on without interfering with concrete pouring.

The drills used were the coring type diamond drill. The diameter of the core was 0.8 in. and that of the drill hole slightly under 1½ in. No difficulty was experienced in drilling through the 2-in. dia. pipes which were approximately 50 ft. long.

The rate of drilling varied, about 27 ft. being a good average for eight hours.

Before inserting any grout, each hole was filled with water and the leakage was determined by finding the time required to empty a 2-gal. pail of water into the hole, keeping the hole just full of water. Leakage was found to vary from zero to 16 gal. per min. and for the majority of holes was between 1½ and 4½ gal. per min.

Grout was mixed in an air driven mixing machine, and forced by air into a barrel which acted as a reservoir for the grout pump. An Ingersoll Rand pump (size 7 by 1½ by 7) was used for pumping into the drill holes.

Grouting started with a thin grout, and if this was taken up freely, the next batch was thickened. This procedure was followed until the hole was taking grout freely at ⅔ of the limiting pressure. Pumping grout of this consistency was continued until refusal. The limiting pressure varied from 60 to 150 lb. p.s.i.

Thirty-seven holes were drilled into the rock and thirty-

**Fig. 6—General view looking east, showing connection to penstock. October, 1941, completed.**

one pipes were set in cracks. The quantity of cement forced in this way into the seams, amounted to over 700 sacks.

### Penstock

The wood penstock was kept in operation until the contractors were ready to build the headgate section. A closedown period of nine days was then required to install the 200 ft. of steel penstock from the existing concrete pipe to the new headgate, and to set up the gate frame, and the 4-ft. dia. vent pipe. The new work can be seen in Fig. 6.

With the exception of this interval and two days required for disconnecting the old penstock, the penstock was kept in continuous use throughout the construction of the dam.

### Headgate Equipment

The electrically operated headgate is of the Broom type. It weighs 25 tons, and travels in girders on a roller caterpillar. The gate and frame were designed by Phillips & Davies of Kenton, Ohio.

The trash racks protecting the head-gate entry, are built of 3 by ⅜ in. steel bars set vertically, welded to rectangular girders and bolted to the beams of the concrete structure. The total width of the rack is 20 ft. and it runs from the bottom of the head-gate section to the top of the dam.

A mechanical rake, also electrically operated, is installed to keep the racks clean, built to the design of the Newport News Shipbuilding & Drydock Company of Newport News, Virginia.

### Quantities

The quantities involved in the present structure included:

50,000 cu. yd. rock and river excavation.
61,000 cu. yd. concrete.
191,000 sq. yd. forms.

Contingent work included a railway diversion and loading works for logging operations.

The cost amounted to approximately $1,100,000.

The erection of the dam was under the supervision of the Powell River Company's engineering department, and Mr. B. C. Condit, Consulting Engineer, Oakland, California, who not only designed the dam, but was also responsible for the conception of the complete development.

Stuart Cameron & Company, Vancouver, were general contractors, and MacDonald and MacDonald, Vancouver, were inspectors of cement and aggregates.

# CONSERVING WELDING ELECTRODES

**An article based on notes kindly furnished by G. R. Langley, M.E.I.C., engineer, Canadian General Electric Company Limited, Peterborough, Ont.**

Welding electrodes have heretofore always been used wastefully. Under the urge of wartime need for conservation of materials, many electrode users have taken steps to cut down the wastage. The general manager of a large American factory recently issued the following notice:—

"In view of the tremendous increase in the use of welding electrodes for the fabrication of war products, with the inability of electrode manufacturers to fill orders in spite of increase after increase in production, every effort must be made to use every piece of electrode to the fullest advantage. Furthermore, some of the electrode coating materials are on the critical list and must be conserved. Hereafter all stub ends must be turned in for salvage and any stub ends longer than 2½ inches will be returned to the operator for further use."

This case is typical of the majority of electrode users in both the U.S.A. and Canada and the total wastage is above 30,000 tons per year with a value about $5,000,000.

The cause of this waste is found in the universal use of "stripped electrodes" i.e., electrodes with the flux ground off one inch at one end to allow insertion in electrode holders. The electrode cannot be burned to closer than one inch from the holder without danger of burning the holder. Several attempts have been made to avoid this waste. One user tried leaving a stub in the holder and welding a new electrode to it. Each electrode added an inch or so to the length of the stub so that it soon had to be discarded. The stub being the same size as the new electrode heated badly and the operator had to pause till it cooled sufficiently to permit a new rod to be welded on. The saving was not large and the scheme did not come into general use. Another plan involved an ingenious special electrode holder for use with "full fluxed" rods. Electrode manufacturers objected to making two varieties of electrodes—full fluxed for the new holder and stripped electrodes for standard holders, and this scheme also failed of adoption.

**Fig. 1—Standard holder and separate stub.**

The following plan overcomes the objections to the previous schemes and permits elimination of all waste.

A piece of steel rod 2 to 2½ in. long, and of a diameter *greater* than the electrode is inserted in any standard electrode holder as shown in Fig. 1. Full fluxed rods are used. With the helmet in the open position, one end of the electrode is firmly grounded and the stub approached close to the electrode as illustrated in Fig. 2. At this point the helmet is dropped and the stub moved the short remaining distance to make contact with the electrode. The stub and electrode do not have to centre accurately. Excellent results will be obtained with them well off centre. With a little practice operators become quite proficient. The time involved is not noticeably greater than required to place an old style stripped rod in the holder and since the standard electrode is 14 in. long, electrodes will be changed only 12/14 times as often.

**Fig. 2—Illustrating the joining of full fluxed electrode to separate stub.**

In addition to the wastage of stubs 2 in. or longer there has been considerable loss due to operators bending electrodes to facilitate reaching certain locations. Bending usually cracks the flux and the electrode cannot be burned past the cracked spot. With the proposed scheme the full fluxed rod can readily be welded on at any desired angle (see Fig. 3), thus obviating the need for bending the electrode itself.

Hand shields are used occasionally and in rare cases the operator may have to work in such cramped quarters as to make the stubbing operation awkward. In such cases a number of full fluxed rods can be welded to stubs before-hand.

It is understood that this conservation plan is already being used by the Canadian General Electric Company, Peterborough Works, Canadian Westinghouse Company, Steel Company of Canada and Hamilton Bridge Company, and is in process of adoption by a number of shipbuilding firms.

The general adoption of this plan would of course result in a decrease in sales of electrodes not only during the present emergency, but after the war. The attitude of the electrode manufacturers that have so far been contacted has nevertheless been entirely unselfish, and their wholehearted support be relied on.

It is hoped that this article will result in still further extension of the use of the scheme described.

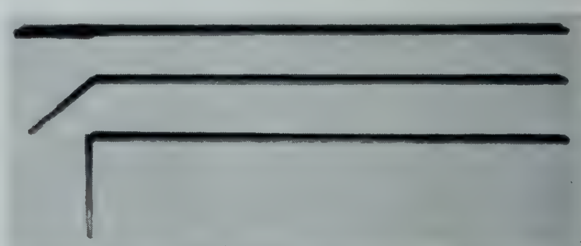


**Fig. 3—Showing electrodes welded on to stubs at various angles.**

# WAR PRODUCTION PROBLEMS— THE STATISTICAL CONTROL OF QUALITY

**A subject scheduled for presentation at the Fifty-Seventh Annual Professional Meeting of the Engineering Institute of Canada, Toronto, 12th February, 1943.**

Introductory Note

As will be seen from the preliminary programme for the impending Annual Meeting of the Institute, to be held in Toronto, the morning of Friday, 12th February is to be devoted to one general session at which war production problems will be discussed. The conservation of critical materials will be the main subject for discussion, the Institute being privileged to co-operate with the Department of Munitions and Supply in reference to this vital matter. In addition, it is planned to devote some time to a topic of very live interest in manufacturing circles—the use of statistics, and the theory of probability, in the control of quality. The importance of inspection in all manufacturing processes is widely recognized but it is only in relatively recent years that inspection has been subjected to mathematical analysis. There are some who think that the use of statistical analysis can, and should, radically change many inspection practices. There are others who consider that such "advanced mathematics" has no place in production control.

The subject is therefore of lively and topical interest; it is hoped that varied and diverse opinions with regard to the matter will be aired at the Toronto Meeting. This was recently the case in London, England, at a remarkable meeting held in the Main Hall of the Institution of Civil Engineers, jointly by the Institutions of Civil, Mechanical and Electrical Engineers. Attended by 720 people, including the Minister of Supply, the meeting lasted for several hours, and was wholly devoted to the subject of the statistical control of quality in production. The topic was introduced by Dr. G. C. Darwin, Director of the National Physical Laboratory, and a general exposition was then presented by Sir Frank Gill, Director and Vice-President, International Standard Electric Corporation. By special permission of the Institution of Mechanical Engineers (in whose *Journal* appeared the record of this notable meeting) The Engineering Institute of Canada is privileged to present these two outstanding contributions, for the general information of its members and for the special guidance of all who are going to participate in the Toronto meeting.

## GENERAL INTRODUCTION

C. G. Darwin, m.c., m.a., Sc.D., f.r.s.
*Director, National Physical Laboratory, London, England.*

I have long been interested in the general subject of tolerances, first from the point of view of pure science and later from the more practical point of view; but the practical viewpoint became much accentuated when I went to the National Physical Laboratory, where a great deal of work has to be done in connexion with verifying manufacturing and inspection gauges. Internal evidence furnished by some of the drawings and gauges led me to the conclusion that certain defects must exist in the principles employed in assigning tolerances. I therefore tried to find how tolerances were fixed. For some months, whenever I met an engineer engaged in any branch of the industry I asked him how the tolerances were determined in the work with which he was concerned. The results were disappointing; some could not answer at all and some gave a partial answer, not sufficient to satisfy my appetite.

As a caricature of the diagnosis at which I arrived, I conceived that when a new machine was to be made the inventor or chief engineer sketched it freehand, perhaps marking the dimensions to the nearest inch. That sketch went to the senior draughtsman, who did the actual design work, dimensioning it all to 1/1,000 inch and then instructing his junior assistant to mark the tolerances. Orders were given that the tolerances should be made as easy as possible; but in his inferior position the junior assistant would take no risks, so he took the smallest number that he knew and halved it. That description of the procedure would be recognized as a caricature and it had much of the absurdity of a caricature; but it had also a little of the resemblance. At all events, rightly or wrongly, I concluded that in the case of a good many engineers there was a defect in the habits of thought which they had been taught. I would not like to say that that applied only to engineers; nearly all education in this and many other countries had suffered from the same sort of thing until comparatively recently. People were taught to think of a dimension or quantity as an exact number or magnitude, whereas the proper way to think about every dimension was to regard it as having a fringe, as being a number plus or minus a little bit, and the magnitude of that little bit was a very important quality of the number.

Without any clear idea of what could be done to improve matters, I was sent, a little more than a year ago, on a tour of duty to the United States. There I came across the method of statistical control of mass-production, and it was obvious at once that that method provided the right approach. A good deal of similar progress had been made in this country too; in particular much brilliant and successful work had been done by the staff of the General Electric Company and by a Committee of the Royal Statistical Society, and it was perhaps ill luck that I never came across it before crossing the Atlantic. That, however, suggested that it was not very widely known, so the present occasion is justified. The method is not by any means widely used yet in America either, though its use is spreading. In both countries it has been principally used in industries associated with electricity, such as the telephone industry, but I want to emphasize that it should be of even greater importance in the mechanical industries, and that it is specially applicable to the manufacture of munitions in all their aspects.

One of the important points in the new method is that it gives reasoned instead of guessed values to the tolerances. I will take as an example the making of time fuses for anti-aircraft purposes, and I am giving away no military secrets in doing so, since the example is fictitious and the data are intentionally inaccurate. Suppose that the lethal area of a bursting shell is such that, if it explodes within $\frac{1}{10}$ second of the set time, it will make a kill. The gunner therefore demands of the manufacturer a fuse with accuracy of $\frac{1}{10}$ second. The manufacturer then works out his method of manufacture, but finds that whereas it is easy to get accuracy to $\frac{1}{4}$ second, he would have a lot of trouble to work to $\frac{1}{10}$ second, and, indeed, he might estimate that for the same effort of work and cost he could not hope to get more than one-quarter as many fuses if they must have the accuracy of $\frac{1}{10}$ second. He therefore tells the military authorities that they can have four times as many

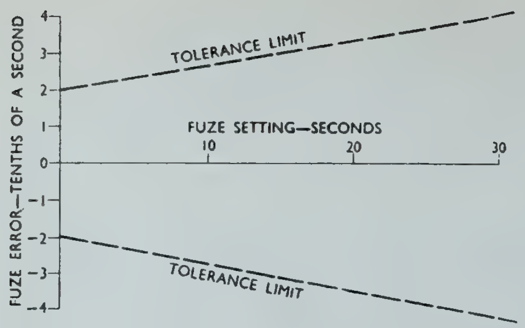



**Fig. 1.—Characteristics demanded in time fuse**

shells with an accuracy of $\frac{1}{5}$ second as with $\frac{1}{10}$ second. The military authorities will see that by accepting the inferior fuse they can get four times as many shells, of which half would do what is required, and therefore the rate of killing will be doubled.

I have over-simplified that example, but it illustrates the point that in a properly organized system of manufacture the user and the maker of the machine ought to confer when deciding the tolerances, because the maker has no direct knowledge of what tolerances would be reasonable. That course would probably be to a certain extent resented by the designer or the user at first, because there might be a feeling of loss of freedom in the choice of the machine. Such freedom is, however, more apparent than real since in practice the user is obliged to make the tolerances as easy as possible, but he has no guidance as to what will be easy. Contact with the manufacturer would enable him to decide the matter so as to avoid on the one hand an unattainably high standard, and on the other, tolerances so easy that the manufacturer could provide him with a better machine without extra trouble. To summarize, the custom has been for the user to demand from the maker a machine to be made as well as possible, whereas he ought to demand that it should be made as badly as possible—or, perhaps more accurately, as badly as permissible. It is in that aspect that statistical control gives the right information.

A good many varieties of procedure are called for in the circumstances of applying statistical control. First, there are the two classes of control, according to whether quantity or quality was concerned. It may be a measure, say of a length or perhaps an electrical resistance, which has to fall within certain prescribed limits; for such examples, measurements of each specimen are recorded for analysis. In other cases the test is qualitative, i.e., the specimen either passes or fails to pass a test. For example, a vessel is either watertight or it is not; and even the measure of a length might fall in that class if it is tested with a gauge. There is another distinction which divides either type of work into two classes. Some tests, such as a measure of length, can be applied to every article made, but other tests are destructive. In measuring the tensile strength of a bar the test must of necessity be done only on a sample, and it is obviously important to have the sample as small as permissible. Moreover, even when every specimen could be tested, great economy will result in testing a sample only. Sampling is thus one of the main features of the process; and the determination of the advisable fraction of the whole number to be sampled forms an important part of the duty of the statistician. Then again the practical problem of statistical control itself falls into two parts, for there is first the business of starting a new process and applying statistical control, and then the business of continuing it, after the control has been established. All these matters are described in War Emergency Publication No. B.S. 1008, of the British Standards Institution.

I will take as an example a time fuse, and again I will intentionally falsify some of the facts. I learned of this example from Colonel Simon, who has shown great brilliance in developing methods of statistical control for munitions in the U.S.A. arsenals. Certain limits of tolerance have been assigned by gunnery experts. Figure 1 shows the characteristics required in the time fuse. The horizontal line shows the different timings of the fuse, and the two widening dotted lines show the tolerances which the military authorities allowed to the manufacturers. The dotted lines expand a little to the right, since it is easy to get a fuse to behave accurately at a short time and comparatively difficult at a longer time. The fuses failed to fulfill the tests assigned, since at the longer times the band of tolerances was too narrow at both ends. The matter was then handed over to Colonel Simon, and he succeeded brilliantly in putting it right.

To simplify the story, I will assume that Colonel Simon had been called in at the beginning. In that case, Colonel Simon would first of all separate the batches of fuses from different localities, and he would group the fuses from a single locality into batches of five. All the fuses would then be set at 20 seconds; each fuse would then be timed and the average time and the "range" (the difference between the shortest and longest among the five) would be worked out for each batch and plotted on separate graphs. From the "range" chart it is possible, with the help of tables constructed by statisticians, to draw on the average time chart a pair of limits within which the dots should fall.

If the points plotted for fuses made by one particular tool fall outside these limits, it is a sure indication that something is wrong with the process; the statistician cannot say what the fault is—though in some cases he can go so far as to say either that there is only one thing wrong or else certainly several things wrong. It is for the engineer to re-examine the process and find the fault. Next, of course, similar work must be done at the other fuse settings. Once that has been done, and the whole system is in control (supposing that the accuracy is good enough for the user) much less sampling is needed; but at intervals a group should be taken and tested in the same way. Such sampling nearly always gives warning of impending trouble, before the trouble is so bad that the fuses would actually fail in their test.

When I was preparing my present remarks, I tried to make a diagram similar to Fig. 2 by plotting sets of points taken at random, as I thought that that would suffice to illustrate the process. However, in checking to see whether the actual values that would be derived from my chart would be anywhere near correct, I found that they were hopelessly wrong. Then I tried to amend the chart to make it more nearly right, and again failed entirely. Finally, I selected a chart from one of the British Standards Institution publications, plotted from actual results. The point I wish to make is that it would be almost impossible for anybody to cheat by the method of statistical control; no ordinary man could make up out of his head anything that corresponds to the laws of probability. That is a very surprising fact, which ought to increase confidence in the process, because any attempt to fake results would at once be apparent to an inspector if he had any knowledge of statistics.

Figure 3 shows the results obtained for fuses made by one of four or five manufacturers. It will be seen that at

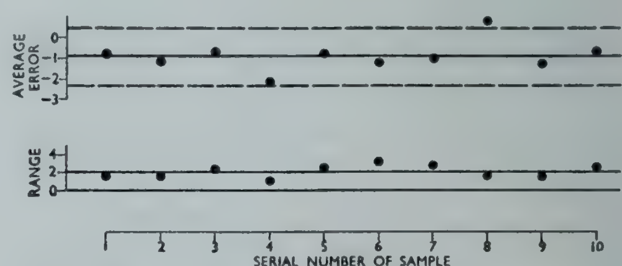



**Fig. 2.—Average error $X$ and range $R$**

about 25 seconds a considerable number fall well outside the tolerances given by the Army, yet their tolerances are much finer than those specified. Of fuses made by the remaining manufacturers, some give curves like that shown and some give curves with an upward tendency; and it was by mixing all the fuses of all the makers together in the original test, without examining them separately, that the idea arose that the designed tolerance was unnecessarily severe.

Having obtained the curves referred to, it is only necessary to re-graduate the time markings on the fuses. As a result, an article which systematically fails to pass its test was, with a quite trivial change, found to be actually better than had been asked for. As a consequence of his work, Simon found that the old tests had destroyed something like twice as many of the fuses as were destroyed under the method of statistical control and he was thus able to make an important reduction in the number tested.

When I first came across the method of statistical control in the United States, I was convinced that it was of the highest importance and that it ought to be adopted widely in England, but I had considerable misgivings as to whether it could be started in the middle of a war. When visiting the Bell Telephone Laboratory, New York — the premier works in which the process had been introduced in America —I asked Dr. Shewhart whether he thought that the process could be introduced during the war. Dr. Shewhart's reply was quite definitely that there was no reason why it should not be applied piecemeal to one article after another, in the middle of the war, that it would not delay production, and that people would soon get used to the change.

As bearing out this view, I would mention that when I visited Frankford Arsenal, a large military shell factory, I asked one of the chief colonels there what he thought about the introduction of statistical control in munitions work. (Although the method had been in existence for a good many years, in munitions work it is rather new, and I therefore expected that, Frankford being an old-established arsenal, those in authority there would be rather conservative.) The reply I received was that statistical control seemed to be the only sensible method to apply.

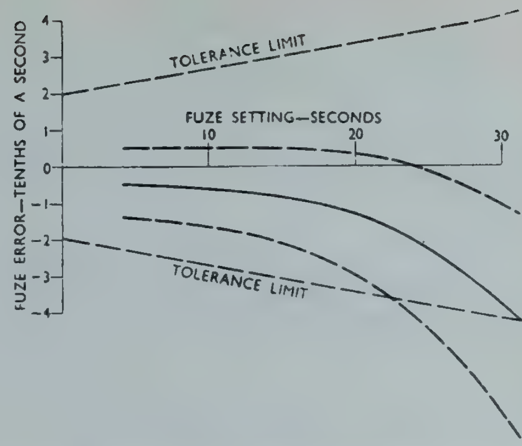



**Fig. 3.—Limits demanded and results obtained with time fuses**

In many works statistical control will be no great novelty, since in many instances all the records necessary for establishing statistical control are already being kept, and it would merely involve a slightly different way of utilizing those records to make them yield up two or three times as much information as they had given in the past.

It could not, of course, be expected that the method was a panacea for all troubles, and I expect that in some cases it may prove unsuitable, but I venture the forecast that the opposite would much more often be the case, and that many processes to which, at first sight, it seemed inapplicable, would later be found to benefit greatly by the introduction of statistical control.

# POPULAR EXPOSITION OF THE APPLICATION OF QUALITY CONTROL


Sir Frank Gill, K.C.M.G., O.B.E.

*Director and Vice-President, International Standard Electric Corporation, and Chairman, Standard Telephones and Cables, Ltd., and of Creed and Company, Ltd.*


(1) *Introduction.* The following is a simple, popular, but incomplete exposition of the statistical foundations of quality control, easily grasped by busy engineers.

We have not the necessary knowledge to manufacture articles in large quantities and all having identical essential qualities, therefore tolerances are introduced into specifications. If a number of similar articles are taken and some quality, illustrated here as a dimension,† is measured in each, we get a frequency distribution such as illustrated in Fig. 4, where the majority of the articles cluster round about the average measurement.

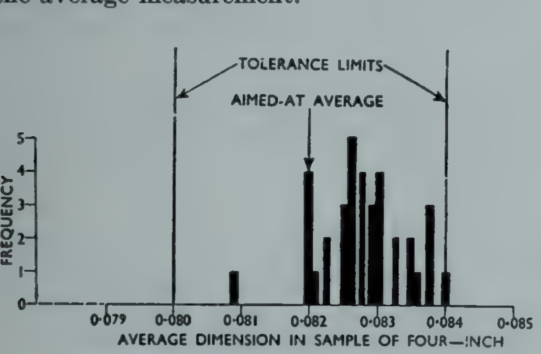



**Fig. 4.—Frequency distribution**

†For brevity, these remarks do not refer to quality control as related to proportion defective.

Using the data given by these measurements we can, by the probability theory, convert this figure, obtained from a relatively small number of measurements, into what it would be if a very large number were taken. This is shown in Fig. 5. The area in Fig. 5 has been very exhaustively studied and its properties are so known that it may be applied to a chart of the type shown in Fig. 6, on which frequent measurements, for example, the product of a machine tool can be plotted. This chart shows (*a*) the nominal dimension required, and (*b*) the plus and minus tolerance limits.

In Fig. 7, three lines are added to the chart: (*c*) the average dimension actually produced and (*d*) two statistical control limits, rather finer than the tolerance limits and set quite easily by the simple application of multipliers to the figures obtained from the measurements. These multipliers are based on probabilities.

The chart shows, as news and not as history, current information of the degree to which the desired qualities are being embodied in the product, the extent to which variation must be expected and be therefore inevitable and harmless, and the cases where the samples show harmful tendencies or actual "action points," so giving warning for instant action before the tolerance limits are reached. The main object of quality control is to improve the uniformity of the product up to the point where a "state of control" exists, that is when all, or substantially all, the plotted

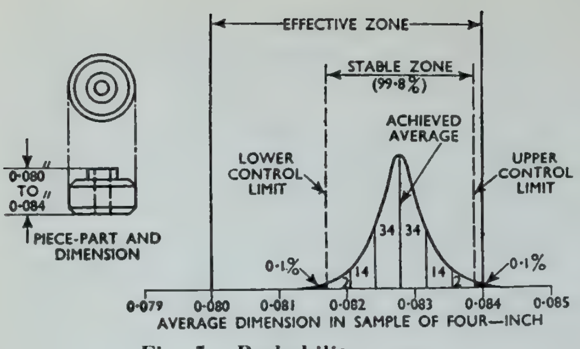



**Fig. 5.—Probability curve**

points lie within the two statistical control limits. When this is attained a train of benefits accrues.

In broad outline nothing in the new technique *appears* to be very new; but there *is* much in it which is different from the ordinary practice of factories. The following table shows the steps in parallel columns:—

| Without quality control | With quality control (measurement) |
|---|---|
| Inspector<br>Takes samples<br>when he thinks necessary<br>measures | Inspector<br>Takes samples<br>regularly—to plan<br>measures<br>records<br>averages<br>plots<br>records cumulative averages<br>records cumulative ranges<br>uses probability control limits<br>exhibits continuous news, open to production dept., of quality being produced, thus tending to prevent rejections. |
| Uses purchase specification tolerances | Uses purchase specification tolerances |
| Passes or rejects | Passes or rejects |

These changes are not difficult to make; but their effect is important.

(2) *Application.* Prolonged research has established so much, that a tool has been made and, as is the case with many tools, can now be used by those who know little of the design. The operating instructions are what must be known, not a checking up of the research already done. Anyone interested may study the statistical fundamentals and will be the more expert for so doing, but it is wrong to think that nothing can be done to apply this technique until statistical experts are available.

Statistical assistance is useful if coupled with factory experience; but care is required to prevent an unpractical mind from disturbing production. What, therefore, should be the attitude of the manufacturing man wishing to investigate this technique yet unable to add statistical knowledge to his factory experience? Many factory engineers are competent to take the simple directions and to do useful work without a statistical expert, if one is unobtainable; while so doing they will find their knowledge expand, so that there will be fewer cases in which such help is required, thus relieving the difficulty caused by the assumed fact that not very many statistical experts with factory experience are available.

Factory engineers should at once begin to study the rules for the application of quality control and not by studying the statistical foundation. They should accept this foundation as already established and proceed with practical study.

(3) *First Steps.* The first steps seem to be:

(i) To study War Emergency Publication No. B.S. 1,008 (1942), of the British Standards Institution. This Standard is simple and direct and will enable the factory man to set up quality control charts, using measurements,* and to put such charts into practice.

(ii) To decide which of the products on which the factory is engaged is suitable for the use of quality control. Obviously the first thought is of repetition work, whether continuous flow or in batches of considerable size.

(iii) To answer the question, "Which cases and how many for a start?" The short answer seems to be, "Look for cases where the rejects are high; select a few of the most troublesome of these and set up charts for very few, say not more than six at first."

(iv) To explain fully to all concerned what is being done and what is aimed at; the explanation should be so full that the element of surprise (so often the cause of misunderstanding) shall be absent.

(v) To make detailed written instructions for each step and each class of shop personnel concerned.

(vi) To begin plotting charts of the selected processes for a few days without putting in the control limits. Where no queries arise, perhaps one week will be sufficient.

(vii) To use the average of the averages given by the trial period, set up the control limits and maintain the charts.

(viii) To introduce quality control gradually in those places where it is appropriate as a regular part of the factory routine.

A copy of the written instructions actually given in one case is shown on p. 15.

(4) *Should Quality Control be Introduced During War Time?* This war is unlike any other in our experience; whether we recognize it or not, all are involved in a struggle which affects all we value and may affect our very lives. Effective, fast production is tremendously important, yet to-day production is subject to numerous unusual causes of hindrance, such as: less skill in labour, poorer maintenance, fatigue, illness, worries, less tractable materials, or substitutes for normal materials. All these adversely affect manufacture, and the results may be summed up in two words "more rejects"; or, better still, more man-hours, machine-hours, etc., rendered ineffective through rejects.

Less rejects will, in effect, give reduced waste in man-hours, machine-hours, space, materials, etc., and so result in greater production; waste is always costly. This is surely a strong appeal to all interested in speed and in effective production.

Because the effectiveness of a firm's inspection can be so well judged by the control charts, quality control should be a method which appeals to those interested in the philosophy of the Services Inspection Departments, namely, that when they are satisfied that a firm is doing a first-class inspection job, the Services will leave inspection

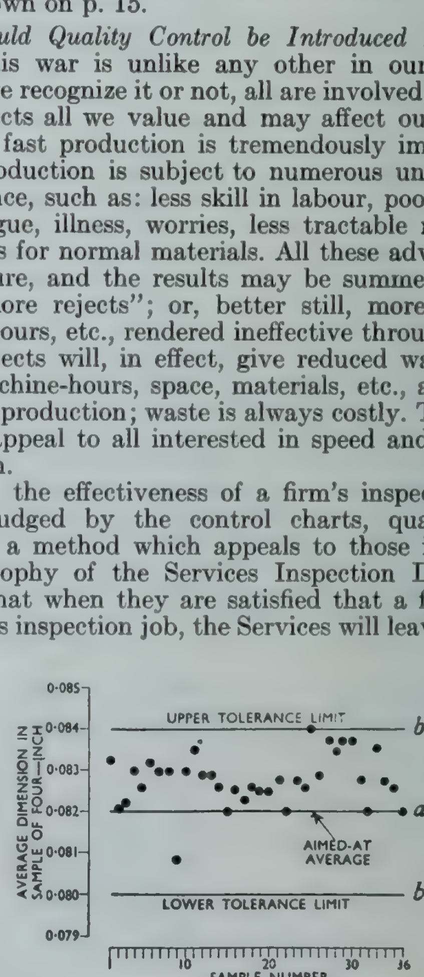



**Fig. 6.—Direct plottings**

*See footnote, p 13.

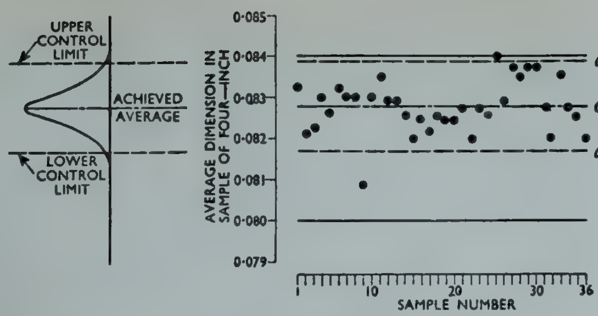



**Fig. 7.—Control limits**

to the firm. If a firm has a job suitable for quality control and uses it, not only should the quality of its product improve, but it will also have clear evidence of the quality of its inspection which can be used to justify the Services Department leaving inspection to the firm, with full confidence in the result. Obviously, however, the mere use of quality control charts does not justify leaving inspection to the firm, or inspection by samples, unless the quality has been brought into the "state of control."

The foreword in the British Standards Institution's publication No. B.S. 1,008 (1942) is highly significant. What was it which caused the War Department to request the American Standards Association to issue an Emergency Defence Standard on this matter? It is believed to be because, while a certain number of large undertakings were using quality control, very many smaller concerns were not, perhaps owing to the clouds and complexities by which it was surrounded; and so we get this very simple and direct instruction arising out of the war. Just because we are at war, every method of increasing production and every technical improvement are necessary. Recent events must have made everyone realize how important is production and that everything leading to speed and accuracy is vital.

(An example of a simple quality control system is given below, and is followed (on p. 17) by Sir Frank Gill's concluding observations.)

## Illustration of a Simple Quality Control System as Actually Applied in a Factory.*

### *Instructions for Control of Quality of Product through Percentage Inspection* †

#### *General Instructions*

1. The following procedure is designed to govern the inspection of all manufactured items on which the nature of the work performed can be measured quantitatively, e.g. weight of explosive charge in various components, explosive power of detonators in terms of weight of sand crushed, specific gravity of cast or pressed materials, burning time of fuses, etc., except where 100 per cent inspection is performed.

2. *Sampling Schemes.* The sampling scheme described herein is based on a sample of five items per hour, and is practical on the majority of production orders. In some instances, however, the cost of sampling may prohibit this procedure; whereas, in others, more extensive sampling may be advisable, especially at the beginning of an order. Hence, the shop inspector will submit his recommended sampling scheme to the department chief for approval prior to production. The procedure for other sampling schemes is covered in notes on sampling schemes.

#### *Duties of the Foreman*

3. *Sampling.* Take a sample of five items from the assembly line each hour, day or other period of time, as instructed by the shop inspector.

4. *Recording Observations.* Accurately measure each sample with regard to size, weight, explosive power, or other characteristic described by the respective drawing and specification and record the measurements in the order taken.

5. *Computing Data.* (*a*) Take the sum of the five recorded measurements of the group and divide it by 5. This figure is known as the "average" or "mean," and is designated by the symbol $\overline{X}$ (bar $X$).

(*b*) For each group of five, subtract the smallest recorded measurement from the largest recorded measurement. This figure is a measure of dispersion and is commonly known as "range" or "maximum dispersion," and is designated by the symbol $W_t$ ($W$ sub $t$).

(*c*) Table 1 shows a sample of foreman's data.

(EXTRACTED FROM) TABLE 1

*Foreman's Data for First Day's Sampling*

| | | | |
|---|---|---|---|
| 1st group of five....... | 39.0 | 1st highest............ | 39.0 |
| | 38.0 | 1st lowest............. | 36.5 |
| | 36.5 | | |
| | 37.6 | 1st range.............. | 2.5 |
| | 38.9 | | |
| | 5)190.0 | (Similar calculations are made by the foreman for the remaining seven groups). | |
| 1st average............ | 38.0 | | |

*Shop Inspector's Data for First Day's Sampling*

| | | | |
|---|---|---|---|
| 1st average............ | 38.0 | 1st range.............. | 2.5 |
| 2nd " ............ | 38.4 | 2nd " .............. | 2.0 |
| 3rd " ............ | 37.9 | 3rd " .............. | 2.0 |
| 4th " ............ | 37.9 | 4th " .............. | 2.3 |
| 5th " ............ | 38.6 | 5th " .............. | 2.1 |
| 6th " ............ | 38.3 | 6th " .............. | 1.9 |
| 7th " ............ | 38.1 | 7th " .............. | 2.3 |
| 8th " ............ | 38.0 | 8th " .............. | 2.1 |
| Average of 8 averages... | 38.15 | Average of 8 ranges..... | 2.15 |

*Computation of Control Limits*

See paragraph 10 (*a*)‡ Average of 8 averages, 38.15 = $\overline{\overline{X}}$.

" " (*b*) Average of 8 ranges, 2.15 = $\overline{W}_t$.

" " (*c*) $\overline{W}_t \times 0.594$ on "average" chart = 1.28 = ±Spread of control limits.

" " (*d*) $\overline{W}_t \times 2.08 = 4.47$ = Upper control limit on "range" chart.

$\overline{W}_t \times 0.254 = 0.55$ = Lower control limit on "range" chart.

6. *Plotting Data.* (*a*) Plot the chart described below on cross section paper. Head the chart "Control Chart for ......................" (inserting the name of the item sampled), "Samples of five" followed by the production order number. On the face of the chart indicate the lot number or batch from which the samples were taken, the approximate daily production, and the designated measurement that the items should meet, e.g. weight of charge 30.0 gr.±2.0 gr., per drawing 70–1–11, revised 6–20–36. (*See* Figs. 8 and 9).

(*b*) On the pieces of cross-section paper mark a horizontal scale across the top for the working days of the month, e.g. September 1st, September 2nd, etc. Ordinarily, 1 linear inch for each day is convenient. If the paper has eight divisions to the inch, one division will represent a working hour of the working day.

(*c*) Mark two vertical scales on the left-hand margin of the paper—one near the top for the purpose of recording the averages ($\overline{X}$), and one a moderate space below it for recording the ranges ($W_t$).

(*d*) Plot the observed average ($\overline{X}$) for each group of five (*see* paragraph 5 (*a*) above) opposite the vertical scale for averages (*see* paragraph 6 (*c*) above), and under the horizontal scale for date and hour (*see* paragraph 6 (*b*) above).

*Taken from Appendix C of *An Engineer's Manual of Statistical Methods*, by Leslie E. Simon. Published by John Wiley and Sons, Inc., New York; and Chapman and Hall, Ltd., London, 1941. Reproduced here by special permission of the publishers.

†The author has pointed out that the system illustrated is not of general application.

‡On page 16.

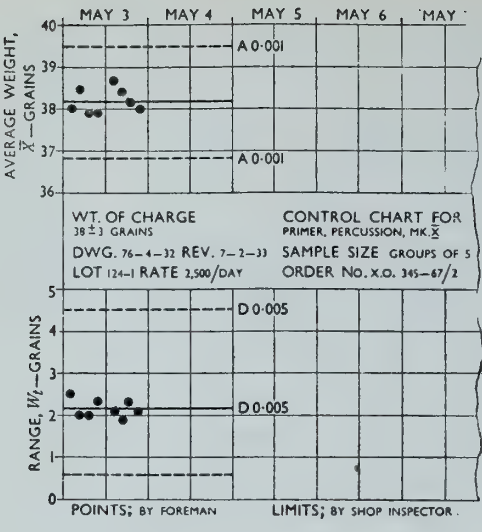



**Fig. 8.—Chart for quality control**

(*e*) In like manner plot the observed range ($W_t$) (*see* paragraph 5 (*b*) above) opposite the vertical scale for range and under the appropriate date and hour. Data should be plotted as promptly as practicable, and at least prior to the observation of the next group of data.

7. *Foreman's Interpretation of the Chart.* Limits will be placed on the chart by the shop inspector within which practically all points should fall (*see* paragraphs 10 and 13 below). If any points fall outside of these limits call the shop inspector without delay.

8. *Disposition of Charts.* The Foreman will conspicuously post the chart in the nearest office to the place of work while the work is in progress and, upon the completion of the production order, will forward the chart to the department office for file, *as a record of the quality of the product.*

9. *Delegation of Duties.* In lieu of personally performing the functions outlined in paragraphs 1–8 inclusive, the foreman may designate one or more trusted assistants to do them under his supervision. Such assistant may not in any case be the workman who performs the work being sampled.

*Duties of the Shop Inspector*

10. *Computing and Plotting Control Limits.* (*a*) After the data from between eight and eighty groups of five have been plotted (*see* paragraph 11 below), compute the average of the observed averages. This figure is designated as $\bar{\bar{X}}$ (bar bar $X$). Draw a heavy horizontal line on the chart for averages at the computed figure and under the hours for which the samples were taken. *See* Figs. 8 and 9.

(*b*) Compute the average of the eight to eighty observed ranges. This figure is called $\bar{W}_t$ (bar $W_t$ sub $t$). Draw a heavy horizontal line on the chart for ranges at this value and under the hours for which the samples were taken.

(*c*) Multiply $\bar{W}_t$ by 0.594 and plot two heavy dotted lines on the chart for averages parallel to the heavy line at $\bar{\bar{X}}$ and located at $\bar{\bar{X}} \pm 0.594\ \bar{W}_t$. Mark each of the lines A 0.001.

(*d*) In like manner, plot two heavy dotted lines on the chart for ranges, one at 2.08 $\bar{W}_t$ and one at 0.254 $\bar{W}_t$. Mark each of these lines D 0.005.

11. *Judging and Interpreting of Charts.* (*a*) Practically no plotted values of $\bar{X}$ should fall outside the dotted limits A 0.001 (theoretically only one above and one below in a thousand). Hence, the presence of a point outside the dotted limits is a very strong indication that the general level of quality (weight of material in a component, size, strength, or other quality) is changing from time to time. The shop inspector will advise the foreman to investigate at once to determine if someone is doing something wrong, if some machine is functioning wrong, if a change has been made in the raw material, etc., and the shop inspector will also report the situation to the department chief without delay.

(*b*) A significant deviation of $\bar{\bar{X}}$ from the mean value designated by the drawing or specification obviously calls for measures to bring the average of the product in closer alignment with the designated average, and the shop inspector will advise the foreman accordingly. The $\bar{X}$ from eighty groups of five is generally so near the true value of the product sampled that for purposes of control it may be treated as such.

(*c*) Practically no plotted values of $W_t$ should fall outside the dotted limits D 0.005 (theoretically only five above and five below in a thousand). The presence of a point outside these limits is a strong indication that the variation in the product (lack of uniformity) is greater than it should be. The same action will be taken as outlined in paragraph 11 (*a*) above.

(*d*) With respect to both charts, the plotted dots should be scattered rather evenly on both sides of the central line; the greater portion should be near the central line, and only relatively few should fall near the dotted limits. Trouble can frequently be forestalled by a study of the charts. If there is a general drift of the plotted points on either chart toward the bottom limit or the top limit, a timely investigation may eliminate the cause of the drift and prevent the occurrence of a point outside the limits. In like manner the too frequent occurrence of points at a value other than in the immediate vicinity of the central value indicates erroneous observations probably due to a faulty measuring instrument, use of an instrument not sufficiently sensitive for the work involved, or bias on the part of the observer. Action same as outlined in paragraph 11 (*a*) above.

12. *Number of Groups on which Limits should be based.* In the interest of accuracy, convenience, and economy of labour, it is desirable to have limits plotted on the data from eighty groups of five (a normal 10-working-day period). However, at the beginning of a job, limits should be calculated on the first eight plotted points; then after a total of sixteen have been accumulated, then after a total of forty, and finally after eighty, all preceding points included in each successive calculation. The next set of limits will be based on the next eighty points, namely, points No. 81 to No. 160 inclusive, etc.

13. *Predicting Limits.* The importance of these charts lies not so much in disclosing that trouble occurred yesterday, or last week, as in *disclosing it instantly*, or before it occurs. Hence, it is most important that limits exist for

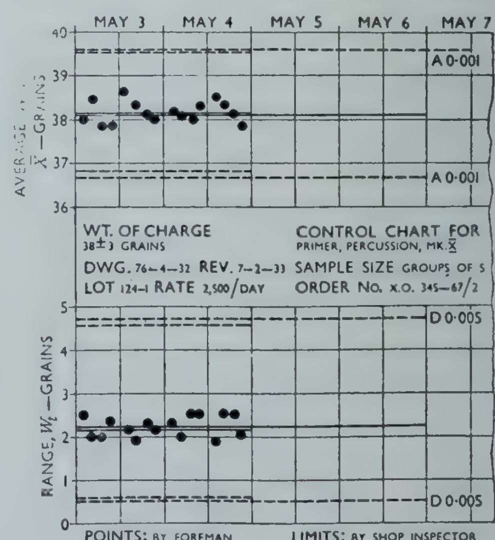



**Fig. 9.—Chart for quality control**

the plotted points (*see* paragraph 7 above), *before the points are plotted.* To accomplish this purpose, the shop inspector will, at the time he computes and plots a set of limits for a period of from eight to eighty plotted points, extend these limits in light lines for the next data period. These extended limits are binding upon production for the next period during which another set of plotted points are being accumulated (*see* paragraph 7 above). The limits from the accumulated data will then serve as a check on these extended limits and as a basis for new extended limits. This procedure is clearly illustrated in Figs. 1 to 7 inclusive. Thus, when limits are calculated as detailed in paragraph 10 and extended as detailed in this paragraph, there are always limits predicted ahead, except for the first eight points. Even this deficiency can be supplied by taking advantage of data from a previous order, and this procedure should be followed if such data are available.

14. *Meeting Drawings and Specifications.* The meeting of drawings and specifications (as most of them are now written) is often more a matter of engineering, judgment, and interpretation than of mathematical statistics. In general, the drawing or specification will state that the product (presumably meaning every item thereof) will be $A \pm d$. Actually, there is no way of knowing if every item falls within the limits $A \pm d$ unless every item is sampled and, if the sampling be destructive, there is no product left. However, if the product has showed "control" during manufacture; i.e. practically no points have fallen outside the control limits; no exhibition of a pronounced drift or trend; and, if the number of plotted points be large (e.g. forty or more) then it can be said with reasonable certainty that approximately 90 per cent of the individual items will lie between $\overline{\overline{X}} \pm 0.707\ \overline{W}_t$; 95 per cent between $\overline{\overline{X}} \pm 0.843\ \overline{W}_t$; and 99½ per cent between $\overline{\overline{X}} \pm 1.21\ \overline{W}_t$. (For $\overline{\overline{X}}$ and $\overline{W}_t$, see paragraphs 10 (*a*) and 10 (*b*) respectively). Upon completing each period of eighty points the shop inspector will note on the chart "approximately 99½ per cent within $\overline{\overline{X}} \pm 1.21\ \overline{W}_t$," substituting for $\overline{\overline{X}}$ its numerical value and for $1.21\ \overline{W}_t$ its numerical value.

### *Notes on Sampling Schemes*

15. *Time not a Factor.* It is not necessary that the groups of five be taken each hour. All the rules outlined above apply with equal force if the groups of five be taken every half hour, every five minutes, day, week, or other period of time, just so long as the observations are grouped in fives. Hence, in devising sampling schemes, sampling may be increased or decreased at will by merely varying the time interval.

16. *Grouping.* Groups of four can be used just as readily as groups of five by changing all 5's to 4's and changing constants as follows:—

Paragraph 5 (*a*)..........Divide by 4 instead of 5.
Paragraph 10 (*c*)..........Change 0.594 to 0.750.
Paragraph 10 (*d*)..........Change 2.08 to 2.26; and 0.254 to 0.185.
Paragraph 14.............Change 0.707 to 0.798; 0.843 to 0.952; and 1.21 to 1.36.

Groups of 10 can be used instead of groups of five by changing all 5's to 10's and changing constants as follows:—

Paragraph 5 (*a*)..........Divide by 10 instead of 5.
Paragraph 10 (*c*)..........Change 0.594 to 0.318.
Paragraph 10 (*d*)..........Change 2.08 to 1.755 and 0.254 to 0.439.
Paragraph 14.............Change 0.707 to 0.536; 0.843 to 0.637; and 1.21 to 0.913.

For a given number of observations, the relative precision of results obtained by the use of groups of 4, 5, or 10 under the method outlined is practically the same. However, the smaller groups are to be preferred because of their greater sensitivity to a changing cause system, which is of relatively great importance in manufacture.

Revised: 1/15/37

Leslie E. Simon,
*Capt., Ord. Dept.*

(Sir Frank Gill's concluding observations, in continuation (from p. 15) of the text of his exposition of the subject, are given below.)

(5) *Conclusion.* Many persons say, "We have used Quality Control for years," really meaning that they have used methods for controlling quality, but not *quality control* as now understood. The marks which distinguish quality control from all other methods seem to be:—

(i) Regular measurement of small samples.
(ii) Instant charting of sampling results.
(iii) Control limits fixed by statistical method, not by guesswork or by the junior assistant.
(iv) Exhibition of charts where the production force can easily fulfil their duty of knowing the information on them and when to take action. It would not be of much use for the railway signals engineer to provide perfect signals unless the driver of the train could see them and realize his duty to obey them.

Inspectors following this method will enlarge their role from that of merely guarding quality turned out to that of also assisting production—a more satisfying job.

Increased production is not to be obtained merely by encouraging shouts from onlookers urging more effort and longer hours. It is also affected by expert planning, the maintenance of smooth unbroken flow of materials, machine tools, labour, orders and the use of best methods, and one of these—in the appropriate cases—is quality control. In the first instance the burden of investigation and application of this new aid lies with the management of factories and, with the two British Standard Specifications, they now have the means to push this matter with all the intense energy that the war situation demands.

But in addition, the Government has a place; in paragraph 33 of its Eighth Report, 26th March 1942, the Select Committee on National Expenditure, while agreeing that the primary responsibility of ensuring the best use of materials and labour must rest with the management of factories, stated: "The Government has an important duty in checking up how this responsibility is in practice discharged both in its own establishments and in industry generally." Lastly, on the 24th and 25th March 1942, the Minister of Production, in the House of Commons, referred to subjects which affected all three Production Ministries and asked for suggestions, particularly for increasing production without increasing plant or labour force. Engineers now offer to Mr. Lyttelton—in quality control—a real contribution to these subjects referred to by himself, and by the Select Committee. Perhaps it will not be indiscreet to say that undoubtedly engineers will be interested to know what use the Minister finds for it.

# ENGINEER TRAINING IN CANADA

Major J. P. CARRIÈRE, s.c., r.c.e., m.e.i.c.
*General Staff Officer, Directorate of Military Training, National Defence Headquarters, Ottawa.*

## Army Requirements

It has been truly said that this is an engineer's war. The need for engineers is felt in all activities relating to the war effort, in the army, in the air force, in the shipyards and in munitions, arms and other factories on the home front.

The unprecedented development of Canadian industries since the beginning of the war and the subsequent employment of engineers in these industries, together with the demands of the army, navy and air force, has drained the existing supply of professional Canadian engineers. The annual production of engineers from our universities is far from sufficient to fill the continued requirements.

Faced with this problem, the army is forced to train as engineer officers, candidates of a lower standard of education than that of graduate engineers. The immediate need of the army is for reinforcement officers possessing a general knowledge of military engineering science, capable of personal development as experience is acquired, and capable of commanding efficiently a section of engineers in the field (approximately 60 men).

## Distinctive Features of Military Engineering

Engineering practice in civil life to-day is characterized by specialized organization, resulting in rapid and efficient execution of works in which cost and durability are the important factors.

In military engineering, in wartime, the necessity for speed, often combined with lightness and mobility of plant, equipment and materials, override technical perfection and (within limits) cost.

The distinctive features of the organization and technique of military engineering are:

(a) The almost complete absence of specialization.
(b) The wide range of general engineering embraced.
(c) The necessity for speed.
(d) The capacity for improvisation.

In connection with this last feature, military engineering has been described in lighter vein as: "The art of employing tools, equipment and materials for totally different purposes than that for which they were originally intended."

The necessity for exploiting the wide resources of engineering science to military purposes renders it essential that military engineers should be in close touch with the latest developments in civil practice.

## Duties of Engineer Officers

The duties of engineer officers in the field can be stated broadly as follows:—

(a) To advise the commander on engineer problems affecting contemplated plans of operations.
(b) To execute engineer projects required in the furtherance of adopted plans of operations.
(c) To assume tactical command of mixed forces in the field, when necessary.

It therefore follows that the training of engineer officer candidates must aim at teaching:

(a) A full appreciation and understanding of engineering problems which affect all types of military operations.
(b) Methods of executing engineer works required in the field, by means of standard equipment or by improvisation from the slenderest resources.
(c) The characteristics, tactics and limitations of mixed forces in the field in all types of military operations.

## Selection of Personnel

To make up for the present shortage of professional engineers, the army accepts as candidates for commissions in the Corps of Royal Canadian Engineers, individuals who have a knowledge in mathematics sufficient to allow them to learn and understand simple formulae relating to the design and execution of simple engineering structures, the use of explosives and other military engineering activities, who are alert and keen and who possess qualities conducive to good leadership. Preference is given to men who have been employed in engineering activities in their civil employment.

Such candidates are taken either from civil life or are selected from the ranks in the army.

Personnel selected as suitable officer candidates are posted to one of the Canadian officers' training centres.

## Officers' Training Centres

The function of officers' training centres is to impart to selected soldiers from the rank and file, and to civilians, the elementary knowledge essential to the formation of junior officers of all arms of the service.

This includes studies of the principles of modern warfare, the characteristics, functions and employment of the various arms, and the theory of administration and command of military forces. This is supplemented by elementary studies of the detailed characteristics and functions of that arm of the service to which they have been allotted.

The course at officers' training centres is of twelve weeks duration. During the first six weeks, the candidates are given instruction in the appreciation of military situations, the correct method of issue of orders and messages, first aid, the elements of gas warfare, leadership and morale, military law, map reading, organization and administration, methods of training troops and infantry weapon training. They are hardened physically by means of drill, physical training, marches and sports and are also taught to operate motorcycles.

The following two weeks of the course are devoted to tactical exercises in the field.

For the final four weeks of the course, the candidates are grouped in accordance with the arm of the service to which they have been allotted, for preliminary studies of specific subjects related to that arm.

*Canadian Army Photo*

**Fig. 1—Standard floating bridge equipment.**

*Canadian Army Photo*

**Fig. 2—Improvised bridge.**

In the case of engineer candidates, these subjects comprise field defences, organization of engineer works, the use of ropes and spars, the design and erection of improvised bridges and ferries, the theory and use of explosives, the theory of water supply, methods of making engineer reconnaissances in the field and the preparation of military engineering reports.

R.C.E. candidates who successfully complete the course are granted commissions as 2nd lieutenants in the Corps of R.C.E. Then they proceed to one of the Canadian engineer training centres for advanced training.

### Advanced Training for Officers

The functions of Canadian engineer training centres, as regards officer training, is to complement the elementary instruction given at officers' training centres, to train officers in the practical application of the subjects taught and to practise officers in the actual command of small bodies of troops.

The training at Canadian engineer training centres is divided into two main stages:

(a) A twelve weeks course.
(b) "Apprenticeship" lasting from one to three months.

The course is a continuation of and complement to the course given at officers training centres. The subjects taught are: Chemical Warfare, Weapon Training, Drill, Training Methods, Motor Transport, Map Reading, Air Photo Interpretation, Military Law, Leadership, Organization and Administration, Reports, Appreciations and Orders, Security and Intelligence, Field Defences, Mining, Water Supply, Accommodation and Sanitation, Obstacles and Mines, Demolitions, Roads and Tracks, Concrete Design in the Field, Signal Training, Tactics, Combined Operations and Bridging.

It will be observed that to cover such a wide range of subjects, (many of which are technical subjects) in a period of 12 weeks, is a big undertaking. However, it is not intended to produce specialists in any subject but to impart a general military engineering knowledge to all candidates, on the assumption that they will improve this knowledge during their period of "apprenticeship" and in the field.

The period of "apprenticeship" which follows the course varies from one month to three months duration. The length of time depends entirely on the aptitude and keeness of individual candidates. The commandants and instructors at Canadian engineer training centres are the judges who decide when an officer is suitable for despatch in the field as a reinforcement section commander.

The maximum period of training given at organized training centres, provided the candidate does not fail on any course, is therefore, nine months. If we add to this the time spent in examination of the candidates before selection, the time necessary to move from one training centre to the other, the time spent on travel from Canadian engineer training centres to the army in the field, and other unforeseen delays, we can safely say that it takes ten months to a year to produce and despatch each reinforcement officer.

### Specialists Training

Reinforcement officers are despatched to an Engineer Reinforcement Unit where they may be held for further training, or from which they may be sent direct to units in the field. Demands for the replacement of casualties is the governing factor. While at either Engineer Reinforcement Unit or with a unit in the field, a selection is made of officers who show special aptitudes. These specially selected officers are given special training in one or more advanced engineering subjects.

At the moment, most of this specialized training is carried out at the School of Military Engineering, England. Special courses are given in Fieldworks, Bridging, Demolitions, Motor Transport, Engineer Intelligence, Tunnelling and Bomb Disposal. Three specialized engineer courses for officers are given in Canada at the moment: Camouflage, Bomb Disposal and Driving and Maintenance of Military Vehicles (wheeled and tracked).

Experienced engineer officers are also selected from time to time to attend senior officers' courses or staff courses leading to senior or staff appointments.

### Training of Other Ranks

Training of other ranks for the Corps of Royal Canadian Engineers follows the policy adopted for the training of officers.

Recruits are allotted to the Corps by Army Examiners after interviews and tests. They then go through an eight weeks course of basic training and follow this up by an eight weeks course of advanced training at Canadian Engineer training centres.

On completion of this latter course, sappers are posted to trained soldier companies where further training is carried out pending despatch to the field as reinforcements.

This applies to non-tradesmen only. In the case of trade trainees, these have to complete advanced training and quality as sappers before attending trades schools, where courses of from 3 to 16 weeks duration are given, depending on the trade. They are then posted to a trained soldier

*Canadian Army Photo*

**Fig. 3—Standard bridging equipment.**

*Canadian Army Photo*

company pending despatch to the field as reinforcements.

The requirements for tradesmen in engineers are about seventy-five per cent of the total requirements for reinforcements.

### Conclusion

Summarizing the above, it can safely be stated that the time required to qualify candidates as engineer reinforcements is as follows:

| | |
|---|---|
| Officers | 10 to 12 months |
| Tradesmen | 6 to 10 months |
| Sappers | 5 to 6 months |

Provided the input of officer candidates and recruits is maintained at a level to conform with the theoretical output for which the training machinery has been set up, reinforcements for the Canadian Army will continue to be produced at a suitable rate.

**Fig. 4—Left: Standard floating bridge equipment.**

# IRON ORE OCCURRENCES IN THE LAKE SUPERIOR DISTRICT

**With special reference to the Steep Rock Occurrences.**

J. G. CROSS, M.E.
*Port Arthur, Ont.*

**Paper presented before the Lakehead Branch of The Engineering Institute of Canada on November 11th, 1942.**

There are six producing ranges on the American side of the Lake Superior area. These are: the Vermilion range, the Mesabi, the Cuyuna, the Gogebic, the Marquette, and the Menominee (Fig. 1). These ranges are expected to produce this year about 100,000,000 tons of iron ore.

The Mesabi range is by far the greatest producer, and also has one of the greatest ore reserves. This range produces about eighty-five per cent of all the iron ore produced in the Lake Superior area. The range itself is about one hundred miles long, of which seventy miles is productive.

The highest grade ore is produced from the Vermilion range, but the quantity is small. Some of the other ranges produce special types of iron ore, such as the Cuyuna range, where iron ores high in manganese are mined. Different mines on the same range produce different types of ore, and, in fact, several different types of ore are often mined from the same mine.

The iron content of the ore is not the determining factor in the grade. Silica, sulphur, phosphorus, and other impurities are very important factors in determining the value of the ore. For example, for certain types of steel, phosphorus is very undesirable, and for other types, such as spring steel, it is necessary. It is important, therefore, for the steel maker, that a great variety of ores should be available for him to choose from, in order to make a product which will meet various exacting specifications.

The question naturally arises why there are so many extensive deposits on the American side, and so few on the Canadian side. Why have the Americans over four hundred iron mines, against our one—the Helen ? The areas are not widely separated, and the rocks are similar.

The answer to this is fourfold:

1. The rocks on our side of the line are largely of the igneous type, while those of our neighbours to the south are largely sedimentary. The sedimentary rocks are more favourable host rocks for iron ore, particularly hematite, than rocks of igneous origin.

2. Folding and deformation of the strata are necessary, in order that surface waters may circulate through the iron-bearing formations, and remove such impurities as silica and so enrich the iron content of the residue. Iron ore of commercial grade is the result. The depth of folding of the strata, and the nature of surrounding terrain, will, of course, act as factors determining the depth to which circulating ground waters can penetrate. This, in turn, governs the size, richness, and vertical extent of the ore bodies. Other factors enter also, but they need not be discussed here.

3. Erosion has been much more intense on the Canadian side than on the American. Probably any ore bodies that did occur in our area, and did not go to great depths, such as those at Steep Rock, have been removed. Across the border, erosion was also extensive, and much of the richer ore of the Mesabi range was removed by erosion and glaciation, but enough still remained to make this the most extensive of all the iron ranges in the Lake Superior area.

4. The Mesabi range extends across the border into our own particular area, between Loon Lake and the boundary, but no iron ore deposits have ever been found, either in this area, or for the forty miles or so that it extends into the state of Minnesota. The reason for this is that the iron formation, at the time the greatest concentration of ore was going on, over a period of millions of years, in Precambrian days, was covered by a mantle of igneous rocks, and so protected from surface waters, and other concentrating agencies. The remnants of this igneous covering still remain as sills that top the high hills around Thunder Bay, such as Mount McKay, Pie Island, Thunder Cape, etc. These tough-weathering, igneous cappings give our district a rugged and pleasing topography, but at the expense of iron ore deposits that undoubtedly would have occurred, had cappings not been there. Once the iron formations emerged from beneath these igneous rocks, the weathering agencies had a chance to act upon them, and rich iron ore concentrations were the result.

### Iron Ore Occurrences at Steep Rock Lake

This area is well within the Precambrian Shield, so it might reasonably be asked: Why are there such extensive occurrences of iron ore here? The answer is that a terrific convulsion of nature caused such a deep fold that even the extensive erosion and glaciation to which the area was subjected failed to remove the iron ore bodies completely. It must be remembered, however, that millions of tons of ore were removed by glaciation, but as in the Mesabi range, there was still some left.

The Steep Rock area was first deeply folded along an east and west axis. This folding was intense, and the flat-lying sediments were folded into an almost vertical attitude. Later, a series of sharp folds occurred with a north and south axis. This folding was super imposed on the original East and West fold, and the result is a very complicated structure. These foldings, particularly the latter, with the north and south axis, produced intense fragmentation and shattering of the strata, which had its greatest intensity at the apex of the folds, as might be expected.

These areas of greatest deformation formed channels through which iron bearing, circulating waters could move. However, in the case of Steep Rock, the mineral-bearing solutions came up from below, and not from the surface downward. No doubt there was some enrichment from surface waters, but any ore formed in this way has possibly been removed by glaciation and erosion. The Steep Rock occurrence is not unique in this respect, many iron ore deposits have occurred by this "replacement" process, but it is not common on the American side of the Lake Superior Basin. This replacement type of ore body is a favourable indication that the ore will continue to possibly great depths, since the mineralization came from below and not from above.

### Size and Extent of Ore Bodies

The iron ore occurrences at Steep Rock Lake are extensive, and give promise of a very large tonnage (Fig. 2). The "A" ore body was the first discovered, and this, as far as explored, has a length of nearly a mile and a maximum width of over two hundred and fifty feet. The "B" ore body, a mile and a half to the south, has a length of about a mile as far as explored, and a maximum width of over one hundred feet. The "C" ore body, three miles to the north-east, has not been sufficiently explored to give any dimensions, but indications are that it is quite large, possibly larger than the "A" ore body. Furthermore, there is a strong probability that other ore bodies will be found, one west of the "A," and one or more south of the "C" ore body.

In reality, the Steep Rock occurrence is an iron range that is completely submerged, with a length of about fifteen miles, following the folding of the strata. The ore-bearing possibilities of this area have been only partially explored, and, no doubt, when the lake is drained, further ore bodies will be found.

### Nature of the Ore

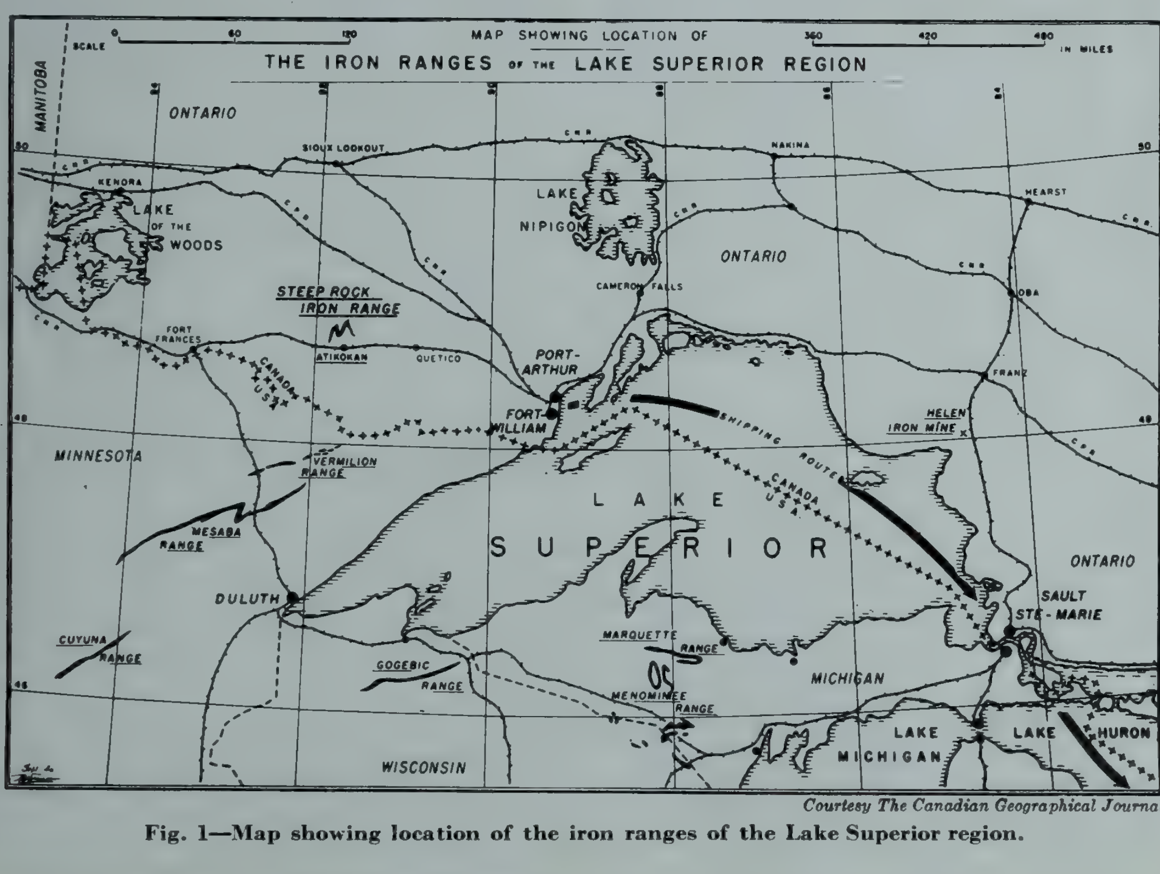
The Steep Rock ore is exceptionally high grade, averaging about sixty per cent iron, low in impurities. A test made very recently showed that it gave excellent results in the open hearth furnace, and, of course, it would be excellent material in the blast furnace. As an iron ore, it has no peer, not even the much touted Swedish ore. Much of the ore produced will be "hard" ore, which is in such great demand for making steel by the open hearth process. There will soon develop in the United States, and in this country, a shortage of this type of iron ore.

### Possibility of Finding other Iron Ore Occurrences in this Area

By "this area" is meant the Lake Superior area on the Canadian side of the line. The sequence of unusual geological events that gave rise to the Steep Rock occurrences of iron ore, is remarkable. It is hardly to be expected that ore occurrences on such a vast scale will be found elsewhere within the Lake Superior district. However, the Precambrian Shield is large; and to the north, in Labrador, and around the Hudson Bay watershed are great areas of rocks where iron ore might be found.

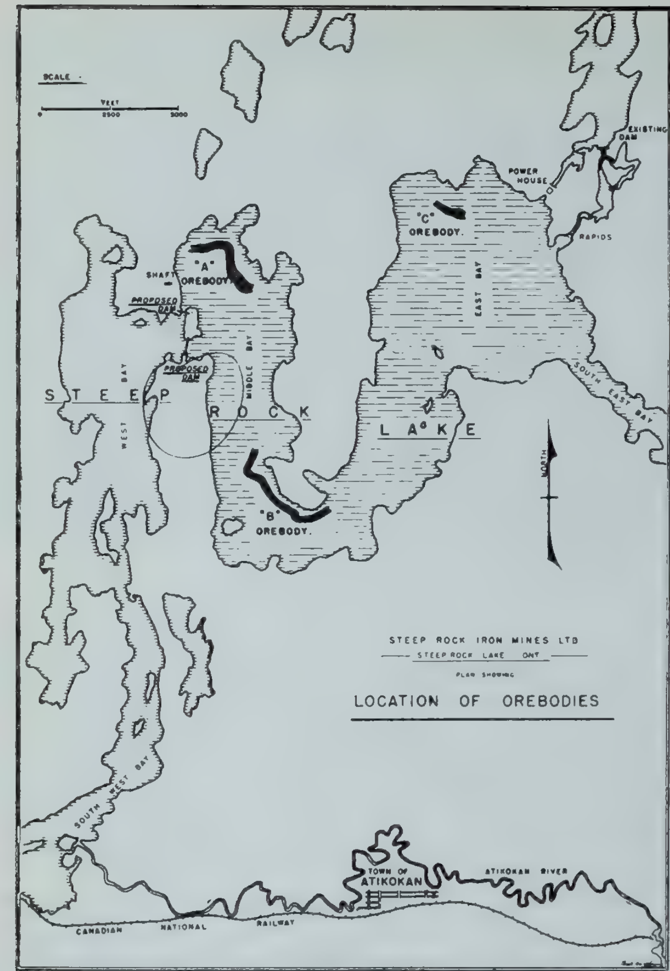
The recent discovery of ore in Labrador is an example. No doubt, other important iron ore discoveries will be made when these vast hinterland areas are more thoroughly prospected.

We must not lose sight of the fact, however, that ores that might be concentrated or beneficiated occur in great abundance, in this particular area, tributary to the head of the lakes. It is not intended to discuss these at the present time, but undoubtedly these low grade ores will be used in




*Courtesy The Canadian Geographical Journal*

**Fig. 1—Map showing location of the iron ranges of the Lake Superior region.**




*Courtesy The Canadian Geographical Journal*

**Fig. 2—Map showing location of ore bodies at Steep Rock Iron Mines.**

ever increasing amounts as our supply of high grade ores diminishes. There are extensive areas of iron formation in the vicinity of Shebandowan, Shabaqua, east of Lake Nipigon, and west of Fort William to the American boundary, that might produce large quantities of commercial iron ore through some method of concentration and beneficiation or both. The New Helen Mine at Michipicoten, is an example of this.

Canada is a big consumer of iron and steel. Hitherto we have had to import most of the iron ore for our purposes, and also many millions of dollars worth of iron and steel as manufactured products. At the present time we are paying staggering amounts for such manufactured products, the exchange alone, last year, amounting to over twenty-five million dollars.

Iron ore and coal are the life blood of any country, and the great prosperity of our neighbour to the south has been due in large measure to an abundance of these commodities. Now that we have an abundance of iron ore ready to be developed, we should use this bountiful gift to our greatest advantage.

We should manufacture all the iron and steel we ourselves need, and much more, for export. Special steels, such as alloy steels should not be neglected. Electrolytic iron will probably have a considerable field for special purposes, such as seamless tubing, etc. We should be well to the fore in securing an adequate supply of cheap electric power for this purpose. We are not so well supplied with coal, but we have water power, and we should see that our water power supply is kept well in advance of requirements. Where there is water power available at reasonable cost, there industry will develop. Electric alloying furnaces and electrolytic iron-producing plants require large quantities of power, and we should have this power available. A dollar's worth of iron ore will produce fifty dollars in finished products. Let us not be hewers of wood, and drawers of water. We have the brains, let us see that we use them to the best advantage. Let us adopt and adhere to the policy: Canadian Iron for Canadian Industry!

# THE SPIRIT OF A PEOPLE

JAMES W. PARKER
*President, The American Society of Mechanical Engineers*

**SUMMARY—It is necessary for the country's welfare that thinking people exert leadership among their fellows. Public opinion will be formed by the kind of thinking the better informed element of the population is doing. Men must discriminate between truth and fallacy, lest the public mind mistake shadow for substance. Turn over in your minds the political doctrines of the past three decades. In innumerable instances we have plainly allowed professionalized politicians, professionalized teachers, and professionalized publicists to mislead us. We have let our system of primary and secondary education be taken so far out of the hands of the public it serves that certain professional educators seriously question the people's right to be heard. Human incentives to work and progress will be destroyed if some of these teachings are followed to their logical conclusion.**

**Whose duty is it to combat false doctrines? Whose but the intelligent people now so much engrossed in their private undertakings? We are committed to the perpetuation of the great ideal of a government which shall reflect in its courses the faith and the aspirations of a new nation. Its people are becoming amalgamated to an extent we do not yet realize by the pressure of great events. They are united now in a common cause. Men are re-examining their beliefs in the light of the realities of the present day. I believe devoutly that the people are returning to the faith of their fathers, inarticulately but surely.**

That this customary address by the President to the members of the Society is, by that same custom, given at the end of his term of office, implies at least an expectation that he will report something of the year's experience. I have visited many of the sections and student branches during the past twelve months although by no means all of them. My acquaintance with members has been considerably increased and I have learned much from them of their observations of other people and of their own attitudes of mind.

The younger men in the student branches are almost all of them affected directly by the war. Most of these engineering students expect shortly to be in the armed forces and they are puzzled to know whether or not they will be given opportunity to make use of their engineering training or will be able to resume that training after the war. A wiser national policy might have obviated that problem and have prevented the almost irreparable waste of trained man-power now threatened. It is, I suppose, one more consequence of the country's mental unpreparedness for which a price must be paid. Because of my belief that there will be great need in the future for men with a thorough training in the fundamentals of technology, I have urged these young men to finish their engineering education whenever circumstances permit; to finish it now if the time is afforded them before entering military service, to come back and finish after the war if need be. I have seen enough of the effects of the last war on young men's careers to give them that advice without hesitation.

The members of the Society themselves are for the most part deeply immersed in the war effort. They are busy in the traditional ways of engineers, their efforts directed toward the effective adaptation of American industry to the manufacture of the materials of war. The techniques of quantity production are applied. Hitherto closely guarded methods are being pooled to that end. We can be everlastingly grateful that without significant exception, responsible men in industry have made common cause with their peacetime competitors. Their engineering staffs are working joyously in this new-found freedom from commercial restraint.

It is not surprising, I supposed to have found men, nevertheless thoughtful about the future. The admonition of Past-President Batt in his address to the Society in 1940 that engineers give heed to the changes that will inevitably be upon us after the war, has given the impetus to some of this thinking. People are aware of impending social-economic change. They are aware of the coming impact upon the existing order of an acquired internal debt of unimagined proportions, of the seriousness of the job of shifting into peacetime pursuits the army of workers now being trained in the special skills of war production. The productive capacity of industry is being greatly enhanced, but there can be no doubt that the genius that made possible such a conversion of product for war will find means for shifting back to the ordinary uses of a world at peace. The question about which men's minds are puzzled is what kind of a world we shall be living in, what the incentives, what the opportunities. Engineers are wondering whether the product of so vast an industrial machine can find a market or, if not, how the men and women workers now so much in demand can find employment. There is something significant in the fact that members of the engineering profession are turning their thoughts to such matters. When changes come, as come they will, the country should this time have the benefit of the thinking that engineers can contribute.

After going about the country, my strongest impression is that the nation is more homogeneous in thought and purpose than we ourselves have been believing. The variety, even the diversity, of races that have merged themselves to make up the American people has brought not disunion but a marked toughening of the fabric. The racial contributions have been many and they vary from the stamina and innate courage of some elements to the imagination, the high intellect, and the sheer inventiveness of others. They are evidenced by the breadth of scientific research, going forward, the capacity for organization, the very adaptability of the workers. Our fathers planted more wisely than we in this later generation have believed, and the fruits of their planting are the manifold accomplishments of a nation formed out of the raw materials of older countries that have come to a new world of infinitely greater freedom and opportunity. One finds proof of it in so many ways. The very names in the Membership List of the Society bear witness to the color and variety of the pattern in which this nation is woven. And with all the singleness of purpose encountered everywhere, one is aware of an absence of rancor, as of an older people who have attained tolerance with their maturity. It is one of the strongest indications one sees of their confidence in the ultimate outcome of the world conflict. It is implicit, for instance, in the action of our Government in removing all civil disabilities from the half million or more of Italian folk rated until a few weeks ago as enemy aliens.

History is a melancholy record of the decay and overthrow of institutions and beliefs built up for generations with long painful effort and devotion. Time and again nations have indomitably faced devastation and still lived. They have survived military defeat and revolution and even the sweeping away of religious concepts and still lived. Whether a people can survive such changes will depend upon the toughness of its spirit.

Our national fabric will be tested even though we shall be spared military defeat. I believe our people now are facing a trial of their faith in self-government, challenged as it has not been challenged for generations. Part of the serious thinking that men are doing is about their own beliefs and the things their sons are growing up to believe.

---

Presidential Address delivered at the Annual Meeting, New York, N.Y., Nov. 30-Dec. 4, 1942, of The American Society of Mechanical Engineers. Dr. Parker, who is vice-president and chief engineer of the Detroit Edison Company, Detroit, Mich., is well known to many Canadian engineers. His address is reproduced here through the courtesy of *Mechanical Engineering*, where it appears in the January, 1943, issue.

And they are beginning to discover unsuspected instinctive preferences such as determine the character of a people. They are the key to deeply rooted beliefs it has been too much the fashion to flout in these latter days. It is not much wonder that strangers have misunderstood the spirit of the American people. We have ourselves misunderstood it.

Years ago a poet whose authorship some of you will recognize wrote these verses describing the North American as seen through the eyes of his own spirit:

His easy unswept hearth he lends
From Labrador to Guadalupe;
Till, elbowed out by sloven friends,
He camps, at sufferance, on the stoop.

Calm-eyed he scoffs at Sword and Crown,
Or panic-blinded, stabs and slays;
Blatant he bids the world bow down,
Or cringing begs a crust of praise;

But, through the shift of mood and mood,
Mine ancient humour saves him whole—
The cynic devil in his blood
That bids him mock his hurrying soul;

That bids him flout the Law he makes,
That bids him make the Law he flouts,
Till, dazed by many doubts, he wakes
The drumming guns that—have no doubts;—

That stings some, even yet; but have we held ourselves in much better repute? Have we not been believing prosperity has weakened our fiber? The brave concept of a new country offering sanctuary to the oppressed people of the earth is well-nigh gone. Jacob Riis and his almost religious belief that America is a melting pot of diverse peoples from which a finer civilization will be cast have grown dim in our minds. Our bookshelves have abounded with historical fiction whose authors' purpose seems to have been to prove all we had been taught to revere was but the apocryphal account of legendary figures little resembling the far different and less admirable characters of the actual past.

And, as a matter of fact, have we followed very closely the paths we laid out for ourselves when we were a younger people? We know now we might have guided better and encouraged our immigrant population. We have suffered injustice and discrimination to mar the record of our industrial growth. In a spirit of sheer selfishness we have unnecessarily limited access by other peoples to our markets, and in admitting this we must admit our own share of responsibility for the troubles of impoverished peoples abroad after the armistice of 1918.

I believe men are beginning now to understand these things better, for I think we have been facing realities since the Japanese attack at Pearl Harbor. We have had to look to the leaders of our Government to reach grave decisions —decisions that may make or mar the future of the country; and I believe we have come to examine those leaders with a more discriminating sense. As one thinks over the lives of the country's statesmen in past crises, the anxieties and doubts of men faced with awful decisions become very vivid. I see now no lack of reverence for Washington and Grant and Lincoln. They stand out of the past, figures of great moral and intellectual stature. I think Will Shakespeare was indulging a playwright's impulse to write claptrap when he said, "The good is oft interred with their bones." We have so many to indulge the public taste from sensationalism that one must see plays and read newspapers with more than ordinary discrimination.

It is necessary for the country's welfare that thinking people exert leadership among their fellows. Public opinion will be formed by the kind of thinking the better informed element of the population is doing. Men must discriminate between truth and fallacy, lest the public mind mistake shadow for substance. Turn over in your minds the political doctrines of the past three decades. In innumerable instances we have plainly allowed professionalized politicians, professionalized teachers, and professionalized publicists to mislead us. We have let our system of primary and secondary education be taken so far out of the hands of the public it serves that certain professional educators seriously question the people's right to be heard. Human incentives to work and progress will be destroyed if some of these teachings are followed to their logical conclusion.

Whose duty is it to combat false doctrines? Whose but the intelligent people now so much engrossed in their private undertaking? "We have left undone those things which we ought to have done" and I feel certain our sins of omission, judging from the results, outweigh a hundred times all the crimes of those Theodore Roosevelt called malefactors of great wealth.

Ladies and gentlemen, we are committed to the perpetuation of the great ideal of a government which shall reflect in its course the faith and the aspirations of a new nation. Its people are becoming amalgamated to an extent we do not yet realize by the pressure of great events. They are united now in a common cause. Men are re-examining their beliefs in the light of the realities of the present day. I believe devoutly that the people are returning to the faith of their fathers, inarticulately but surely.

In the 1917 sequel to the verses I quoted earlier in this address, Rudyard Kipling described well the hard road we must travel:

Not at a little cost,
Hardly by prayer or tears,
Shall we recover the road we lost
In the drugged and doubting years.

But, after the fires and the wrath,
But, after searching and pain,
His Mercy opens us a path
To live with ourselves again.

The times cry out for a leader of the spirit of this people.

### A TECHNOLOGICAL HIGH COMMAND

From *Proceedings of the I.R.E.*, July 1942.

**How fast is the U.S. moving toward it? Too slowly, for the movement is measured by the rate at which technical men move up into decisive positions in the military and war administration.**

Technology as a whole—science, development engineering, industry, and technical labour—is the driving force against the two great inertias that lose wars.

The first is the inertia of the military mind. Charged with the safety of its country in war and the leading of men in battle—responsibilities from which flow its unassailable right to choose its own weapons—the military mind rests heavily on the tried and traditional, and is the least open to innovation of any segment of society. Its technical branches, therefore, are mainly specification and testing adjuncts to the top procurement divisions, which, over the years, have built up close connections with big industrial suppliers and depend heavily on those suppliers' engineering departments.

The second great inertia, closely linked with the first in modern war, is the inertia of industry's heavy investment in plant and equipment. It tends to hold on to old methods, machines, and products and resist any sudden changes or innovations, such as wars demand. This inertia becomes so great in an advanced industrial society, even in peacetime, that some of the most advanced technological corporations, like General Electric and General Motors, spend many millions of dollars a year combating it. They set up development engineering groups—distinct and separate from the corporation's bread-and-butter engineers working on products in production. These development groups have no other purpose in life than to prove that everything the company makes is no good and can be made better. On the broader scale of the country and the war, development engineering is the great missing link in the structure of U.S. technology for war.

A quick look at three broad technological areas will show that all is not yet well. The points at which technical decisions are made today are the most critical spots in the world. For nothing moves—neither money, nor plants, nor production, nor armies—until the technical decision has been made as to what is to be produced. Technology is the initiating force. If the wrong decision is made, or it is flubbed, or delayed, it may upset a whole series of technological imponderables that can only be measured approximately in terms of time, money, and lives wasted.

Take the case of the Napier Sabre liquid-cooled engine. More than a year ago a British group brought a Napier Sabre to Washington, fresh from successful tests in England, to offer it to the army and OPM. It claimed 2,000 hp. It was looked at by OPM production and looked over by OPM's aircraft section. Then from March to August, 1941, the engine rested on blocks at Wright Field, the army testing grounds, waiting to be tested. Army engineers were too busy on the military equivalent of bread-and-butter engineering, or work in production, to get around to it. It never did get around to NACA—for NACA, though it is top body in U.S. aeronautical research, is only advisory and in many cases must wait until a problem or an engine is presented to it. If the army sits on the problem or the engine, nothing happens. So still without a test, the Napier Sabre was turned down by a joint munitions committee of the U.S. and Britain at Washington. Brass-hats pooh-poohed its claim to 2,000 hp. and doubted whether that power could be supported in a frame—though the Napier Sabre was then flying over England. Not much later, further development of the Sabre in England shot its performance well beyond 2,000 hp. to a revolutionary new peak in engine output.

The second great technological area is in shortages and allocations of raw materials. This area is so vast and complicated that no more than a side glance can be given it here. By an intricate series of relationships, the great shortages in metals and materials that develop as the U.S. goes to total war move back upon one another until finally there are shortages in everything except wood, clay, and glass. Unless the highest technological skills in each industry are brought into full play for maximum expansion of production, conservation of materials, substitution of other materials, and allocation of what materials there may be, this can be the most destructive phase of total war for the whole U.S. economy. The total result is a further, unhealthy concentration of the economy that may never be reversed. Destruction cannot be escaped in war. Only by making the highest technology of an industry the guiding line—which means free exchange of technical advice and know-how, pooling of patents, and free creation of new competitive plants and processes—can the destruction be limited and shortages attacked at their source.

Except for a few bright spots, mostly in the allocation of hard-pressed strategic metals, this is the darkest side of the war administration's record. The OPM businessmen resisted any big expansion to begin with, and then administered the resulting shortages and necessary allocations generally on the principle that existing corporate hierarchies must be maintained so that all might come out of the war in nearly the same order and positions as they entered it. Nothing is more vain than the belief that life can be picked up at some future date where it left off in 1939, and events are already crumbling the illusion. One of the first fronts upon which it began to crumble was aluminum, where war shattered the notion that production could be expanded without creating permanent competition for the Aluminum Company of America. But the belief hangs on and still produces delay.

The third large area of technological action is conversion of industry to war, meaningless without a clear technical plan. Production may roar on at a terrific pace and still produce *matériel* inferior to or merely equal to the enemy's weapons. For the technology of conversion is again conversion to what? The army, for lack of any independent development engineering, has never had any clear plans for such relatively new weapons as tanks, beyond over-all and general combat specifications. Not until late last February did the tank corps establish its first laboratory to get the basic physical and psychological data for picking tank men and adapting machines to them.

Instead of designing a tank engine—a six months' job for any crack engineering group, and a job that the British did in three months, the U.S. rushed its M-3 tanks into production by pulling a Wright radial airplane engine off the shelf and making it do. It is now generally admitted that the radial engine is unsatisfactory for tanks, and M-3's are being partly discontinued.

Detroit is going about making tanks as it made automobiles, with all the rigid, corporate lines still up, instead of settling for one bang-up standardized model in which each company unit would concentrate all of its engineering skill on developing a part. Instead of working as a cooperative whole, engineering staffs are to all practical intents split into three corporate compartments, each working on a whole tank, and each duplicating part of the work of the others. This might be the best way to go about development, if the army followed up by picking the best tank or best units out of all three tanks and standardizing on them. But the need for tanks is now so pressing that, once the tanks are along toward production, no army supply division will have the opportunity to pick and choose. So the army will use all of them. This will mean a servicing and supply problem in the field of major proportions; spare parts for three different engines and transmissions, in addition to two different kinds of fuel for the gasoline and Diesel power units. Such makeshifts may be the burning order of the day. But they don't represent the highest technology of the world's leader in standardized mass production, and two years have been frittered away for lack of any real technical plan or forethought. It is never too late to make a start.

### THE PIG IRON MARKET

From *The Engineer*, (London), October 16, 1942

The allocations of pig iron show for fourth-quarter delivery that there will be no contraction in the demand. For some time past consumers' principal anxiety has been to obtain the better qualities of pig iron. Far more hematite could be used than is available, and in consequence there is a heavy demand for low phosphoric and refined irons, which are used as substitutes to an increasing degree. For work in which the use of hematite is essential the Control releases this quality, but it is becoming more and more difficult to obtain licences and, of course, consumers who ask for this quality for purposes for which, in the opinion of the Control it is not absolutely necessary, have little chance of obtaining it. Months ago the call for substitutes created some tightness in the market for pig iron, which could be most easily substituted for hematite, and the stringency shows a tendency to become more acute. By carefully supervising distribution, however, the licensing authority has been able to maintain adequate supplies of these alternative irons to consumers employed upon essential work. It is probable, however, as time goes on that the release of refined and low-phosphoric pig iron will be even more restricted. Liberal supplies of high-phosphoric foundry pig iron are available, and whilst the light castings industry is poorly employed, it is probable that stocks will increase. It has been found difficult to utilize the plant of the light foundries in war work, but over the last few months a certain amount of work of this description has come their way. The shadow of concentration, however, still hangs over the light castings foundries and the tendency which has been noticeable for foundries to restrict their buying to hand-to-mouth quantities until full details of the scheme are available is still apparent in the market. On the other hand, the heavy foundries and engineering foundries are important consumers of pig iron, but their requirements are chiefly of the higher qualities.

### OIL AND THE ALASKA HIGHWAY

From *Trade and Engineering*, London, Sept., 1942

Construction of the Alaska Highway through Canada and requirements of oil in connection with defence of the north Pacific coast have given a new importance to the oil resources in the Fort Norman area on the lower Mackenzie river. Some new drilling in the Fort Norman field has been done last summer and it is expected that practically all the petrol requirements of the Northwest Territories will be supplied from the Fort Norman production.

The actual output from the Turner Valley is limited by "allowables" to keep within the capacity of the present pipe-line to Calgary. Although no plans have been announced for an additional pipe-line from this field, additional carrying facilities undoubtedly will be provided as soon as the proved available supply of oil warrants it. Further detailed investigations of the extensive oil sands in the McMurray area of northern Alberta have been made by engineers of the Consolidated Mining and Smelting Company of Canada on behalf of the Dominion Government, and efforts are being made to solve certain technical problems of production and marketing. On the recommendation of the Oil Controller, the Governments of the Dominion and the Province of New Brunswick are co-operating in making a serious exploration of the oil shales which are found in extensive areas in New Brunswick.

### WOOD MANHOLE LIDS FILL WARTIME NEED

From *National Lumber Manufacturers Association*, Washington, D.C.

Wooden manhole covers are helping war booming communities solve a problem posed when the War Production Board banned the ordinary iron variety.

First tried by Los Angeles county, California, the wooden manhole covers built of solid timbers specially treated with a salt preservative to resist termites and decay, have proved highly successful.

The WPB order was designed to save 500 pounds of critical metal which normally goes into each cast iron installation—250 pounds in the lid and 250 pounds in the frame. Some cities already have experienced delays in the installation of sewage facilities for war housing projects due to a shortage of metal manhole covers.

The Los Angeles county surveyor's office developed the wooden substitutes and Surveyor Alfred Jones asserts the idea is suitable for city and county use throughout the nation.

These wooden lids may be constructed in either circular or hexagonal design by laminating short lengths of plank. They may be built in local wood-working shops without extensive fabricating equipment. Tests show that the pressure-treated wooden covers have ample strength and durability.

**Alfred Jones, Los Angeles County Surveyor, explains the wooden manhole installation to Miss Beverly Hoyt.**

## ECONOMY IN THE USE OF NON-FERROUS METALS

From *The Engineer*, (London), Sept. 18, 1942

The following statement has been prepared by the Non-Ferrous Metals Control and issued by the British Standards Institution on behalf of the Control:—The enormously increased demand for non-ferrous metals for war purposes and the restriction of supplies make it necessary for the most stringent economies to be effected in their use. It is no longer possible to maintain peacetime standards of perfection and it is the duty of all to ensure that the quality of the material employed is never higher than is absolutely necessary. The need for economy applies to all non-ferrous metals, including those most commonly used in cast copper alloys, such as tin. Approximately one-third of all the tin used in this country goes into copper alloys. It is essential, therefore, that tin-bearing alloys should never be used if a tin-free material can be employed, and that, where this is not possible, the tin content should be reduced to a minimum. To assist users to meet this urgent need, a new range of standards for copper alloy ingots and castings, Nos. 1021-8-1942, has been prepared and issued by the British Standards Institution at the request of the Non-Ferrous Metals Control. Attention is drawn to these standards, which immeditaly supersede certain existing standards. The following general considerations should be borne in mind:—(a) Never use a non-ferrous metal or alloy unless it is certain that there is no substitute available which is in more plentiful supply; (b) where a non-ferrous material is necessary, use the least possible weight of the lowest possible grade; (c) make sure that all scrap is kept clean and free from contamination, use the highest possible proportion of scrap, but never of a higher grade than is absolutely necessary; (d) do not hoard your scrap; if you cannot use it for approved purposes, sell it and put it back into circulation; (e) if you are accumulating in your works residues such as skimmings, casters' ashes, sweepings, etc., and cannot re-use them in your own products, the Control will advise you where this material can most usefully be directed. With particular reference to British Standard alloys, the following points are of importance:—(1) Practically all requirements for cast gun-metals and brasses can be met from the following alloys:—For very special applications, 88/10/2 (B.S. 382-3), 88/8/4 (B.S. 1021-2); for high-grade work, 86/7/5/2 (B.S. 1023-4); for general work, but only where a tin-bearing alloy is essential, 85/5/5/5 (B.S. 897-8); for general work in place of tin-bearing alloys, type A brass (B.S. 1035-6); for all work where a copper alloy is not required to have any special properties, type B brass (B.S. 1027-8). (2) The most efficient use of scrap is essential. On no account should the grade of scrap used be of higher quality than that of the alloy in which it is to be incorporated, unless to counterbalance the use of a still lower grade of material. (3) When sufficient supplies of scrap are not available to meet demands, virgin material must be provided. As far as possible, it must be used only in the highest grades of alloy (e.g., B.S. 382-3, B.S. 1021-2, or 2 B 8 phosphor bronze). Virgin metal or material of comparable quality should preferably be employed in castings of alloys made direct in one melting stage. This releases ingot-making capacity for the production of lower-grade alloys from mixed or other scrap of an indefinite composition which requires to be melted in bulk under properly controlled conditions. (4) B.S. 1025-6, type A, casting brass, has been designed to take care of the lower grades of scrap unsuitable for the better qualities of wrought products. The aluminium content has been kept low to ensure a good casting material. Elements other than copper and zinc are impurities and are allowed up to the limits stated only to cover such quantities as may be present as impurities in the scrap from which the brass is produced. (5) B.S. 1027-8, type B brass, has been designed to take care of the lowest grades of scrap only; principally material more highly contaminated with aluminium, which is allowed as an impurity up to 1.25 per cent. Allowable elements other than copper and zinc are impurities only and must never be added intentionally. If proper care is taken to avoid the contamination and mixing of scrap and swarf the quantity of material available for use in type B brass should be greatly reduced.

## THE INTERNATIONAL CONTROL OF TIN

From *The Engineer*, (London), October 16, 1942

Countries supplying more than half the world's total supplies of tin have been overrun by the Japanese and in these circumstances the International Tin Agreement, which has been published as a White Paper, has an appearance of unreality. The signatories to the Agreement are the Governments of Great Britain, Belgium, Bolivia, and Holland. The agreement provides for the setting upof an International Tin Committee, upon which Malaya has five votes, Bolivia and the Netherlands Indies four each, and the Belgian Congo and Nigeria two each. It also provides for three consumers' representatives, one representing the Government of the United States, one consumers in the United States, and one consumers outside the United States, who are to "tender advice" to the Committee. By the misfortune of war, the Governments of Belgium and Holland are operating from London, whilst the tin resources of Malaya and the Dutch East Indies are in the hands of the Japanese. The Belgian Congo, however, remains under the control of the Dutch Government. In the opening paragraph it is stated that the signatory Governments "consider that it is necessary and advisable that steps should be taken to regulate the production and export of tin in and from producing countries, with the object of keeping world's stocks at a normal figure, adjusting in an orderly manner supply to demand, and, at the same time, making available all the tin that may be required and preventing rapid and severe oscillations in price." The Agreement provides for standard tonnages, which are defined as the annual rate of permissible metallic tin when the quota is 100 per cent; quotas are the percentage of standard tonnages which may be exported in any quarter of the year. The standard tonnages are given as Belgian Congo, 20,178 tons; Bolivia, 46,768 tons; Malaya, 95,474 tons; Netherlands Indies, 55,113; Nigeria, 15,367 tons; total, 232,900 tons. The agreement provides that the stocks of tin and tin in concentrates within any territory shall not at any time exceed 25 per cent of the standard tonnage of that territory. The International Tin Committee may, however, permit this percentage to be exceeded in particular cases. Needless to say, under the present conditions of restricted supply the present quotas are fixed at 105 per cent. Probably, the idea in entering upon a restrictive agreement at this time is to ensure, so far as possible, the continuation of the international control over the production and export of tin after the war.

## MORE CANADIAN AIR SERVICES

From *Trade and Engineering*, (London), Sept., 1942

The Canadian Pacific Railway Company has brought under its control ten air transport companies serving Labrador, northern Quebec, north-western Ontario, the northern reaches of the Prairie Provinces and British Columbia, the Yukon, and the shores of the Arctic Ocean, and has now inaugurated regular air services to vast areas in the Dominion's "hinterland".

This replacement by a single system—namely, Canadian Pacific Air Lines—with an excellent organization and strong financial backing of the former independent companies sometimes referred to as "bush lines," establishes northern commercial aviation in Canada on a sound basis. It has special importance at this time because of the great increase in air traffic in connection with the defence of the Pacific coast and Alaska, but it will have a longer range value as well in facilitating the opening of the northern territories and the utilization of their rich natural resources.

# FIFTY-SEVENTH ANNUAL GENERAL

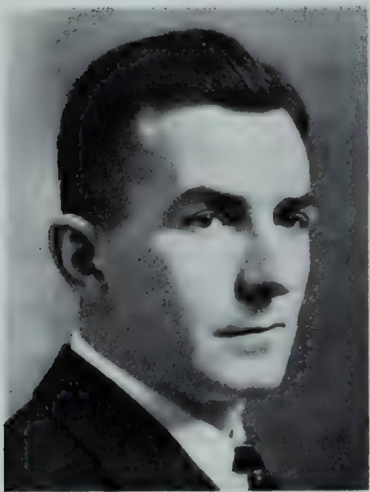
W. S. WILSON
*General Chairman*

# TORONTO —

## THURSDAY AND FRIDAY

## THE ENGINEER

### PROG



ROBERT F. LEGGET
*Chairman of the Papers Committee*

**THURSDAY, FEBRUARY 11th**

9.00 a.m.—**REGISTRATION.**

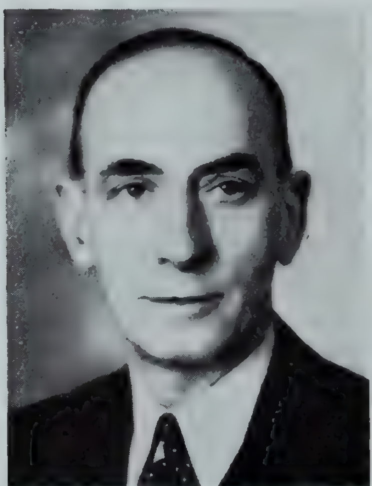
9.30 a.m.—**ANNUAL GENERAL BUSINESS MEETING.** Announcement of election results. Address of retiring president, Dean C. R. Young.

11.00 a.m.—**THE ENGINEERING FEATURES OF CIVIL DEFENCE.**—A general discussion, under the chairmanship of John E. Armstrong, of the work of the Institute's Committee on this subject.

12.30 p.m.—**LUNCHEON MEETING,** to be addressed by Brig.-General C. L. Sturdevant, *Assistant Chief of Engineers, U.S. Army, Washington, D.C.* on **The Alaska Highway.**

2.30 p.m.—**INDUSTRIAL RELATIONS**—Presentation of certain fundamentals, as a basis for discussion. Professor M. S. Viteles, *Professor of Psychology at the University of Pennsylvania,* and *Director of Personnel Research and Training for the Philadelphia Electric Company,* will speak on **A Scientific Approach to the Problems of Employee Relations.** Dr. Bryce M. Stewart of the *Industrial Counselors Inc., New York,* until recently *Deputy Minister of Labour for Canada,* will speak on **The Role of the Industrial Relations Executive in Company Management.**

7.30 p.m.—**ANNUAL BANQUET AND DANCE.** (Dinner Jackets).



STANLEY R. FROST
*Chairman of the Publicity Committee*

### AN EXHIBITION

**The Conservation of Critical Materials**

The Department of Munitions and Supply has organized at 55 Bathurst Street, Toronto, a remarkable exhibition of machine parts, components, castings, forgings, etc., illustrating what can be achieved in conserving critical materials. All who have seen it agree that the exhibition is a remarkable testimony to engineering skill in design, fabrication, and production.

The exhibition will be open throughout the meeting but special arrangements are being made to accommodate members of the Institute, and of the Association of Professional Engineers of Ontario, during Saturday morning, 13th February.

NICOL MacNICOL
*Chairman of the Entertainment Committee*

**Special return tickets are supplied by the railways at the rate of one and a half of th**

ND PROFESSIONAL MEETING

# ROYAL YORK HOTEL

## EBRUARY 11th and 12th, 1943

## ND THE WAR

DR. F. A. GABY
*Chairman of the Finance Committee*

## MME

FRIDAY, FEBRUARY 12th

9.30 a.m.—**TECHNICAL PROBLEMS OF WAR PRODUCTION.** This session is planned in close consultation with the Department of Munitions and Supply. **Conservation of Critical Materials** is the first general subject which will be discussed.

The subject of **Statistical Control of Quality in Production** will then be introduced to the meeting. Reference to pp. 11-17 of this issue of the *Journal* will show the interest aroused by this matter in Great Britain. A discussion will follow.

2.30 p.m.—**LUNCHEON MEETING** to be addressed by DESMOND A. CLARKE, *Director-General of Shipbuilding, Department of Munitions and Supply,* on **The Battle of the Shipyards.**

2.30 p.m.—**POST-WAR PLANNING AND RECONSTRUCTION.** WARREN C. MILLER, *chairman of the Institute Committee on Post-War Problems,* will preside. PRINCIPAL F. CYRIL JAMES, of *McGill University,* and *chairman of the Federal Government's main Committee on Reconstruction* will open the discussion. General discussion will then be invited.

8.30 p.m.—**JOINT SMOKER** with the Association of Professional Engineers of Ontario.

DR. A. E. BERRY
*Chairman of the Hotel Arrangements Committee*

C. F. MORRISON
*irman of the Registration Committee*

## LADIES' PROGRAMME

A special programme of entertainment for the ladies is being arranged which includes visits, an afternoon tea and an informal party on the Friday night.

Visiting ladies will be the guests of the Branch at both luncheons.

W. E. BONN
*Chairman of the Reception Committee*

**ılar one-way fare for persons travelling in groups of ten or more on the going trip.**

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

### NATIONAL SELECTIVE SERVICE

By the time these words are read National Selective Service as an entity will have disappeared. After almost ten months of trial on another basis, the Government has decided to turn over to the Department of Labour all controls for manpower. There will not be great changes in legislation, and in form at least, the new set-up has much in common with that established by the former director, Elliott M. Little. It is inevitable that some revisions will be required, and doubtless the announcements about to be made will take care of them.

In theory at least the control of manpower through the regular divisions of the Department of Labour is a sensible plan, but no plan is as important as the people who administer it. It is to be hoped that the officials of the department do not overlook this fundamental truth. Up to the time of writing, with only a part of the plan disclosed, there are insufficient indications of the acceptance of this principle.

Selective Service properly recognized and administered should be larger than the Department of Labour itself. If it is planned to make it only an adjunct of the department, nothing but miserable failure can follow, and frankly there have been enough of these already in our manpower and labour policies. It is the wish and hope of every citizen that the Government sees the size and importance of the task to be done, and makes its immediate plans accordingly. In times like these we cannot afford the luxury of bungling.

Probably no group of people are more concerned with manpower supply and control, than are the engineers. Themselves, a substantial section of manpower, they are interested almost beyond any other group in labour—both skilled and unskilled. The success or failure of a system of labour supply and control is of great importance to them, not only in their own projects but in the broader field of their interest in the welfare of the country.

In this instance, Canadian engineers have still another interest. Up until recently, selective service had been largely in the hands of engineers. With the sudden and resounding resignation of the director, who was an engineer, questions entered the minds of members of the profession. *The Engineering Journal* is not the medium through which the answers to these questions should be conveyed, but it should be safe ground to make unbiased comment on the work done by the director and these engineers on his staff who supported him.

Few people, not themselves a part of the service, will have any idea of the size and complexities of the setting up and operating of a national service for manpower control. Starting with only a director, and an assistant, and unsuitable legislation, about which selective service itself had absolutely no say, and almost no knowledge up to the day it was announced, it struggled valiantly and intelligently through months and months of days and nights, to gather information and make plans without which it could not possibly succeed, and without which it should never have been inaugurated.

At the time of the director's resignation, much had been accomplished. New and more suitable legislation had been obtained; a greatly augmented field force had been established; divisions that had to do with statistics, planning, allocation, public information, enforcement and so on were working efficiently, public support was being received from all sides, both labour and management were cooperating and supporting the service excellently, and the controls were working.

The director's resignation was so well publicized that everyone must be familiar with it. He stated simply that in view of the needs, the work was not being done sufficiently well, and that without the addition of some clarifying legislation and necessary cooperation, he could not hope to accomplish the task which he had assumed when accepting office.

All this is reviewed here, not to unduly eulogize or embarrass anyone, but to indicate clearly that as engineers, the readers of the *Journal* may be well satisfied with the contribution to public service made under unusual and adverse conditions, by a member of their own profession. Canada is much better off for having had Elliott Little inaugurate and establish National Selective Service, and fellow engineers have good reason to be proud of his contribution to the solution of one of the nation's greatest problems.

### THE GENERAL SECRETARY RETURNS

The resignation of the director of National Selective Service, and the subsequent reorganization of that service, have made it possible for the assistant director—our general secretary—to withdraw from that activity and again devote his full time to the affairs of the Institute. While the Institute was pleased to perform a national service by lending him to the federal Department of Labour, it has felt that increasing activities within our organization have made his return to headquarters very desirable.

Mr. Wright's original purpose in going to Ottawa was to aid in establishing a system of controls for technical manpower. He was made assistant director of the Wartime Bureau of Technical Personnel, and remained in that office for over a year. Upon the appointment of E. M. Little, then director of the Bureau, as director of National Selective Service, Mr. Wright, with Council's consent, transferred with him, as assistant.

For almost two years, Mr. Wright has been working strenuously in the interests of the engineering profession and of labour. His main achievement, perhaps, was the establishment of the Wartime Bureau of Technical Personnel. He was a member of the delegation that interviewed Dr. Bryce M. Stewart, then deputy Minister of Labour, to arrange for the establishment of the Bureau. It was he who recommended E. M. Little to the other societies as a "possible" for the post of director, and it was he who persuaded the officers of Mr. Little's companies to permit him to undertake this work. Mr. Wright's ability to appraise people was shown not only by his recommendation of Mr. Little as director, but also by his selection for the Bureau of such persons as H. W. Lea, J. M. Dymond and I. S. Patterson, the three principals of the Bureau today. The Bureau, still carrying on its important work under the guidance of these gentlemen, must be a source of much satisfaction to Mr. Wright.

Mr. Little's transfer to National Selective Service took Mr. Wright into that field also. In the first hectic months of that new activity, he had to play many parts aiding the director in fields of administration, organization, planning, and enforcement. Ultimately, in the clarification that came with time, he became head of the division of enforcement.

Notwithstanding the many other calls upon him during the past two years, Mr. Wright has found time for frequent consultations with the officers of the Institute and with headquarters, and has managed to attend all meetings of Council.

Officers and members of the Institute, and the headquarters staff, will certainly welcome his return to full-time duty with the Institute. We appreciate his work at Ottawa, which has made the Institute's good name known in so many new directions, but his return to our ranks will fill a long-felt want and we shall be glad to have him back at Mansfield Street.

R.J.D.

## POST-WAR RECONSTRUCTION

During the month of November, members of a sub-committee named by the Dominion Government held a series of informal conferences in western Canada to discuss the development of Canada's water and power resources in relation to post-war problems. This committee was headed by Dr. J. B. Challies, M.E.I.C., vice-president, The Shawinigan Water and Power Company, and formerly director of the Dominion Water and Power Bureau, and included Dr. J. J. O'Neill, M.E.I.C., dean of engineering, McGill University, Dr. L. C. Marsh, formerly director of social research at McGill University, and Mr. Victor Meek, M.E.I.C., Controller of the Dominion Water and Power Bureau, who acted as technical consultant.

Dr. Marsh is research adviser to the Committee on Reconstruction set up under the chairmanship of Dr. F. Cyril James, principal of McGill University, as an advisory body to report to a Dominion Committee of the Cabinet on reconstruction policies and activities in Canada and abroad following the war. Under this main committee, a sub-committee under the chairmanship of Dr. R. C. Wallace, HON.M.E.I.C., principal of Queens University, has been working on the relationship of post-war problems to the conservation and development of Canada's natural resources. Dr. Challies and Dr. O'Neill, as members of the latter committee, have been concerned particularly with the post-war development of Canada's water and power resources.

Since these water resources are largely administered by the provincial governments it was considered advisable to hold a series of regional conferences. Accordingly, four western Canada meetings with provincial officials and others directly interested in the development of water resources were held at Winnipeg, Regina, Calgary, and Vancouver. The purpose was to obtain a wide view of the present situation with respect to water and power resources and the overall planning necessary for further development of these resources in the post-war period as an aid to rehabilitation. Several of the provinces have already been studying the problem and it was felt that the exchange of views and informal discussions at these conferences were of real value in co-ordinating the Dominion and provincial viewpoint with respect to the utilization of water resources in post-war planning.

The discussions at Vancouver indicated that the province of British Columbia possesses immense reserves of undeveloped water power but the extent to which these water resources could be used to advantage is dependent on finding suitable industries to use the energy produced. It was suggested that the possibility of locating industries in British Columbia to produce aluminum, magnesium, iron, steel and other products requiring large blocks of power be investigated in relation to probable markets after the war.

In the prairie provinces the water supply is mainly interprovincial and international. The prairie region, with its comparatively low precipitation, is in itself not conducive to a reasonably dependable surface water supply and is dependent on water originating in the Rocky Mountains on the West and in the innumerable natural lake reservoirs of the Canadian Shield draining into Manitoba from the East. The entire settlement and further development of the prairies in the post-war period is dependent on the conservation and utilization to the fullest extent to the available water resources for irrigation, water power, domestic, municipal and industrial purposes. It was emphasized at the conferences that overall planning on a watershed basis is essential to ensure that the limited water supplies available are used to the best advantage.

It was suggested that the construction of further irrigation projects within the drought area offered particular advantages for inclusion in post-war rehabilitation plans. Attention was directed to the St. Mary and Milk Rivers irrigation project as an example, and through the courtesy of Mr. P. M. Sauder, M.E.I.C., director of water resources for Alberta, members of the committee were given an opportunity of spending several days looking over the present irrigation development in southern Alberta. The committee were favourably impressed with the possibilities of the St. Mary and Milk Rivers project to provide employment and land settlement opportunities during the immediate post-war period.

The St. Mary and Milk Rivers are international streams which are apportioned between Canada and the United States by treaty. The project is designed to provide the necessary storage reservoirs and diversion canals for the full use of Canada's share of these waters to irrigate an additional 345,000 acres at a cost of about $43.00 per acre. The Engineering Institute Committee on Western Water Problems, under the chairmanship of Mr. G. A. Gaherty, M.E.I.C., president of the Montreal Engineering Company, Limited, Montreal, Que., in a report dated June 15, 1941, strongly recommended that an agency be constituted by the Dominion and provincial governments to undertake the development and that funds be made available for an early start on construction.

More recently a committee representing the interested departments of the Dominion Government and the Province of Alberta was established by Order in Council under the chairmanship of Mr. Victor Meek, M.E.I.C., controller, Dominion Water and Power Bureau, to make a thorough study and comprehensive report on all aspects of the proposed St. Mary and Milk Rivers irrigation development. The final report of this committee, dated February 16, 1942, recommended the development as a post-war measure under the terms of a suggested co-operative agreement between the Dominion and the Province of Alberta, providing for a division of the cost and a programme of development extending over a period of 15 years. Members of the Institute who are interested in this report may obtain copies from the Dominion Water and Power Bureau Department of Mines and Resources, Ottawa, Ont.

## FRIENDLY CRITICISMS

From time to time, the General Secretary's mail contains letters calling attention to some matter which, in a member's opinion, deserves consideration. Such letters are welcome, because they may give an opportunity for Council, or for the appropriate committee, to make desirable changes in procedure, or to do something which otherwise might be overlooked. In any case they are valuable as indicating the views of at least a part of the membership on the way in which the Institute's activities should be conducted.

One of our members who joined the Institute soon after his recent arrival in Canada, has noted some features in our branch meetings which, he thinks, could be improved. As a comparatively new member, he feels somewhat diffident in expressing his views, but he asks the Council to take such action as they may consider advisable in the matter.

His courteous letter makes certain suggestions which are timely, and his very proper action is appreciated.

The course he has followed is much more helpful than that of persons who merely grumble about such sins of omission or commission as in their opinion mar the record of a governing body or a committee of the Institute, but who do nothing about it.

Our correspondent is grateful for the welcome he has received in Canada since he has benefited by the meetings he has attended, he desires to add to the usefulness of the Institute, particularly as regards its branch meetings, by suggesting certain changes in the way they are handled. He thinks that on many occasions our technical meetings would be more satisfactory (a) if they began more punctually; (b) if the time taken by the author for his presentation were more strictly limited, or indeed, when advance copies are available, if the author would present his paper in abstract only, taking say 20 minutes; and (c) if at least 45 minutes were retained for the discussion, the author being allowed a further 15 minutes for his closure. In short, our kindly critic thinks that some lack of system is apparent at our meetings.

We can assure him that none of the points he raises are now brought up for the first time. In fact, they involve a number of old familiar difficulties which have so far resisted all efforts to cope with them effectively. Time and again, they have been scotched but not killed. But the struggle is not yet over.

Take the starting problem first. Here we think there is usually little cause for complaint. But what is a chairman to do when the author is late or the slides are not at hand, or the audience insists on staying and talking outside the hall? These are only a few of the possible causes of delay. Obviously, punctual commencement depends on the co-operation of a considerable number of people, and can only be secured if they all do their part.

As regards the author, his paper and the manner of its presentation, it must be remembered that our technical papers—particularly those presented at branch meetings—are prepared, often at considerable personal inconvenience, by people who have many other and more pressing duties. It is not surprising, therefore, that it is seldom possible for the author to send in his manuscript (and illustrations) so long ahead of the meeting date that it can be printed in time for distribution then. And authors have a way of wanting to revise their papers as soon as they see them in print, also their original illustrations are not always suitable for reproduction. If there can be no advance copies of a paper it is hard to arrange for adequate discussion, because the speakers have had no opportunities to consider the author's views.

The plea for brevity in the author's presentation has real appeal, as also has the idea of having the paper read in abstract. But at our Institute and branch meetings, the audience generally and rightly includes many whose detailed engineering knowledge does not cover the precise subject of the paper. Thus a somewhat fuller presentation is desirable than would be needed if all were specialists with the same specialty. The author has to bear his audience and readers in mind when he is writing. The abstract system has been tried and has been found possible to only a very limited extent. Although all authors are asked to prepare abstracts, not all of them do so.

Reams might be written about the organization and conduct of technical meetings, but enough has been said to indicate the kinds of difficulties which have to be met by the paper committees of the Institute and its branches, by our branch secretaries, by the annual meeting committees, and by the headquarters staff. It seems fair to add, that when one considers the large number of technical sessions held annually by the Institute and the great variety of local conditions under which the meetings take place, it is gratifying to find that cases of friction or dissatisfaction are so rare. Our speakers, chairmen, and branch secretaries are in fact to be congratulated on the effective manner in which their duties are performed. It is only on exceptional occasions when some unexpected difficulty arises that real cause for criticism appears.

## COMING MEETINGS

**Canadian Construction Association.**—Annual Convention, Log Chateau, Seigniory Club, Que., January 20-22, 1943. General Manager, J. Clark Reilly, Ottawa Building, Ottawa, Ont.

**Canadian Pulp & Paper Association.**—30th Annual Meeting, January 27th, 28th, 29th, Mount Royal Hotel, Montreal. Secretary, A. E. Cadman, 3420 University St., Montreal, Que.

**The Engineering Institute of Canada.**—57th Annual General Professional Meeting, Royal York Hotel, Toronto, Ont., February 11-12, 1943. General Secretary, L. Austin Wright, 2050 Mansfield St., Montreal, Que.

## WASHINGTON LETTER

Several months ago this letter commented on the Canadian war effort as seen from Washington. I recently returned from a week's hasty visit to Montreal, Ottawa, and Toronto, to take a closer look at certain aspects of Canada's war production. I visited a number of plants covering a representative cross-section of Canadian production and, while in Ottawa, talked to a number of key people. My visit certainly sustained the impression that Canada is doing a marvelous job. True, the closer view revealed one or two "stresses and strains". For instance, the manpower affair was a little unfortunate. A few words of comparison on several scores may be of interest.

Part of my work in Washington has involved finding my way around the various scientific and semi-scientific bodies in the United States. Much of the research work on the instrumentalities of war is conducted at the instigation of the Army or Navy by the Office of Scientific Research and Development which was set up not long ago and which draws its authority directly from the President. Under the O.S.R.D., which is under the direction of Dr. Vannevar Bush, is the National Defense Research Council and also the Committee on Medical Research. In addition, of course, both the Army and the Navy have research facilities of their own. For instance, the Quartermaster Corps carries out a considerable research programme and, of course, the Ordnance Department does a great deal of work in its own field and issues a number of reports. To carry out research in the actual production field, the Office of Production Research and Development was recently set up under the direction of Dr. H. N. Davis. This Office will function in cooperation with the War Production Board. There is also the National Research Council and the National Academy of Science. The National Academy of Science, founded by President Lincoln in Civil War days, is in the nature of a Scientific Senate. In addition to these scientific bodies, there are also the permanent bodies such as the Bureau of Mines, the Bureau of Standards and the various scientific offices of the Department of Agriculture. Most of these scientific organizations "farm out" a considerable amount of their work to Research Departments of major universities, such as Massachusetts Institute of Technology or the Stevens Institute. If we consider a specific problem such as synthetic rubber, we find that nearly all these bodies are doing work of some sort in connection with the problem and that there is also a Technical and Research Division under the Rubber Controller. The above résumé only scratches the surface of the vast network of scientific bodies in the United States. The various branches of the War Production Board such as the paper section, or chemical or rubber or metals section, have really excellent scientific bureaux attached to them; the Board of Economic Warfare has a well staffed industrial and technical section. While the end result of all this activity is very commendable, there is a great deal of duplication and considerable possibilities of confusion.

By comparison, the Canadian situation is very much simpler. As in all other phases of Canadian war organization, a considerable degree of unification has been achieved. All scientific research and development is under control or supervision of the National Research Council. The National Research Council, in turn, maintains a complete liaison with all of the various scientific bodies in the United States and the United Kingdom. Through this one body, Canada is kept fully abreast of scientific developments throughout the world, and is at the same time in a position to make a very real contribution by virtue of being able to bring to bear the fully coordinated scientific resources of the Dominion. The National Research Council is headed by Dean J. C. Mackenzie, who, of course, is well known to all members of the Engineering Institute of Canada. The various war technical bodies are closely related to the National Research Council. For instance, the Inventions Board, and the War Technical and Scientific Development Committee are both chaired by Dean Mackenzie, and the Army Technical Development Board includes Dean Mackenzie as a member. In discussing the scientific set-up with Dean Mackenzie recently, he admitted that the unity of control which had been achieved by the National Research Council would probably not be possible in a country much larger than Canada.

One of the most interesting and important lines of endeavour in connection with war production is in the field of conservation. The Conservation Division of the War Production Board is a very large and well organized unit. The Canadians are represented on this Board by Mr. Hilton Wilby, and, as a result, it is my understanding that the liaison between Canada and the United States is very much more complete than for any other part of the Empire. The new Conservation Committee recently set up in Canada by direction of Mr. H. J. Carmichael, under the chairmanship of Mr. C. B. Stenning, has already accomplished much useful work. The meeting in Toronto of munitions manufacturers and the conservation exhibit was a brilliant and (insofar as I am aware) a new venture in conservation technique. It was my privilege to discuss this work with Mr. Carmichael and to attend the Conservation Committee Exhibit at Toronto, and one cannot fail to be impressed by the importance of the work which is being accomplished.

Another point for the record as far as Canada's war effort is concerned is her appointment as a full fledged member of the Joint Production and Resources Board in full partnership with the United States and United Kingdom. This move was made in recognition of the fact that Canada is now the third largest producer in the United States-British Commonwealth group.

One cannot emphasize too often the splendid job which is being done by Canadian shipbuilding yards. Statistical studies indicate that, in the main, Canadian shipbuilders are holding their own against the Kaiser records, and, in some cases, even doing better. During my visit to Canada, I was invited to witness the launching of one of the 10,000 ton freighters. Canada's projected part in the merchant ship programme for 1943 is very far in excess of her per capita share. The difficulties of the shipping situation are taxing the creative genius of the engineering profession in many ways. Far reaching experiments are being conducted with all types of cargo carrying vessels. A large programme of concrete ships is at present underway in the United States, although little is being said about this programme until the ships have been fully tested. Many novel methods of construction, forming, concrete placing, reinforcing, etc., are being tried out in this programme. When the story can be told, the art of reinforced concrete construction will be considerably further advanced. Then, of course, there was the Sea-Otter and its successor the Sea-mobile which is now being built for full scale tests. Some publicity has also been given recently to the so-called Phantom ship which travels in a convoy and is operated by remote control. One of my most interesting experiences recently was a visit to the U.S. Navy Yard gun factory. Here again, advances made in recent years will make very interesting reading when they can be told. One gets a tremendously favourable impression as well as a vast sense of the complication of modern war from a visit such as this. It is a real experience to stand next to the breech mechanism of a 16-inch gun!

E. R. Jacobsen, m.e.i.c.

## CORRESPONDENCE

Hamilton, Ont.,
December 13th, 1942

L. Austin Wright, Esq., m.e.i.c.
General Secretary,
The Engineering Institute of Canada, Montreal, Que.

Dear Mr. Wright,

As I approach my last chapter as secretary of the Hamilton Branch, I am mindful that it has been only a very insignificant portion of the great history the Institute is writing for Canada.

It has been a great honour and a greater pleasure to serve with those like you and Louis Trudel and if I may be permitted to say that if my term has been one of success to the branch it is because of your help and that of the various chairmen and every member.

Engineers have often been looked on as a little slow in the battle of life, but it seems to me that, perhaps, instead of being slow the true engineer has a little of the happy and contented philosophy of the Chinese. In all the six years of my duties I have never seen one hand grasping for personal aggrandizement or delivering a dirty blow.

I have tendered my resignation because there are some other matters I hope to be able to give useful attention to and also because it seems only fair that another member should have an opportunity to enjoy the many pleasures that present themselves to the secretary-treasurer of a Branch.

Bill Brown is a true gentleman and my help will always be at his disposal.

I know that at the Annual Meeting they will thank me for what I have been able to do, however small it may have been, but I am very sincere when I tell you that my own feeling is one that calls for my thanks to every officer and member that it has been my privilege to do business with.

Wishing you a very Happy Christmas,

I remain, yours sincerely,

(*Signed*) A. R. Hannaford, m.e.i.c.

9 Waterloo Place, London, S.W.1., July 25th, 1942.

Dear Mr. Wright,

It was indeed a pleasure to receive your letter of June 1st informing me that the Council had again remitted the fees to the Institute of members in this country. I am sure that my fellow members over here will agree that it is an honour largely undeserved, though much appreciated, because we read and hear many reports of the great expansion of Canadian industry to take care of the ever-rising output of warlike stores. This is, of necessity, largely due to our fellow members who have stayed behind and without whom it would not have been possible.

I personally, have left active soldiering for the time being, to take up an appointment with the Armaments Inspection Department on the inspection and proof of gun carriages and mountings. It is most interesting work and is giving me very valuable experience in British manufacturing methods and conditions.

The *Journal* is arriving regularly and I find it most interesting as do English friends to whom I pass it on.

Thanking you for your kind thoughts, I am,

Yours sincerely,

(*Signed*) R. B. Wotherspoon, jr.e.i.c

# HENRY HAGUE VAUGHAN

On the afternoon of December sixteenth the many friends of Henry Hague Vaughan assembled at Christ Church Cathedral, Montreal, to take part in his funeral service. Six past presidents of the Engineering Institute of Canada, representatives of other technical societies of which he was an honoured member, railway officials, business associates and fellow engineers joined in paying respect to the memory of one of Canada's foremost mechanical engineers and administrators. He died on December eleventh. Had he lived a few days longer, he would have passed his seventy-fourth birthday.

Born in England, at Forest Hill, Kent, he was educated at Forest House School and at King's College, London. He then served his time as a special apprentice at Patricroft, Lancashire, in the shops and drawing office of Nasmyth, Wilson & Company, the works originally established by James Nasmyth, inventor of the steam-hammer. The training received there, together with extensive later shop experience elsewhere, gave him that thorough grasp of mechanical details and engineering processes which was afterwards to serve him in such good stead.

In 1891, after some months of work in the locomotive shops of two English main line railways, he went to the United States, entering railway service there first as machinist, later as draftsman, and then as assistant engineer of tests at St. Paul, for the St. Paul Minneapolis and Manitoba Railroad.

In 1898, he became mechanical engineer of the Philadelphia & Reading Railroad, and then of the Q. & C. Company, Chicago. After two years as Assistant Superintendent (and later as Superintendent) of Motive Power at Cleveland for the Lake Shore and Michigan Southern, he came to Montreal, in February, 1904, in the same capacity for the Canadian Pacific Railway. In December, 1905, he was appointed assistant to the vice-president, a position in which he had general charge of the design and construction of locomotives and car equipment, the maintenance of equipment east of Fort William, and the operation of the well-known Angus shops. At that time the road was at the beginning of a ten year period of rapid growth and the responsibility of obtaining and maintaining the necessary equipment was no light one.

H. H. Vaughan, M.E.I.C.

His first task was the standardization of the many types of locomotive then in service on the Canadian Pacific Railway, this resulted in greatly simplified maintenance. He undertook a great deal of experimental work on new types of equipment. Considerable saving followed his adoption of thermostatically controlled feed water heaters. Later he was a pioneer in the successful application of superheated steam to locomotives, a course which he first advocated in 1905. This required extensive investigation of problems regarding valve design, new types of piston packing, and cylinder lubrication. The Canadian Pacific Railway adopted superheating some years before the United States roads recognized the advantages of the practice. The many other developments in which Mr. Vaughan was interested included improvements in the balancing of locomotives to avoid rail breakages, and the design of what were at that time the most powerful rotary snow ploughs in North America. They were needed to deal with the huge snow slides which occur from time to time in the mountain divisions of the road. Mr. Vaughan was in fact an inventor, and always had tests and experiments under way. Many of these resulted in notable economies in operation.

He remained in the service of the Canadian Pacific Railway until 1915, his last achievement before his resignation being the adaptation of the Angus shops and equipment to various forms of necessary war work. In this way he became one of the leaders in improvising and designing machinery for the mass production of shells and cartridge cases, the manufacture of which was one of Canada's main contributions to the war effort in 1915-1918. An example of the way in which the Angus shops, under his direction, met urgent needs, was the design of four 250-ton and one 300-ton presses for making shell forgings followed by their successful construction and delivery in twenty and thirty days respectively from the time the order was first discussed. Similarly, prompt action was taken in respect to the 800-ton hydraulic presses needed for the production of 18 ft. brass cartridge cases. In these and other instances the manufacturing processes were of a kind which had not been carried out previously in Canadian workshops, except on a very small scale in the Dominion Arsenal at Quebec. The Arsenal's information and experience, however, were freely placed at the service of munitions contractors, and proved of very great value in the early stages of their work.

After resigning his executive position with the Canadian Pacific, Mr. Vaughan was retained by the railroad as a consulting engineer. His activity continued, however, as regards the production of munitions, for he became president of the Montreal Ammunition Company and subsequently vice-president of the Dominion Copper Products Company. In 1916 he became vice-president of the Dominion Bridge Company. All these firms were then engaged in war work.

After the war his consulting work developed along administrative and financial rather than strictly technical lines. He became president of the Canadian Foreign Investment Corporation, and held directorships in a number of other concerns. In recent years he took a leading interest in the establishment and operation of the Portland cement industry in Brazil.

In 1906 he joined the Engineering Institute of Canada (then the Canadian Society of Civil Engineers), holding office as a member of Council in 1910-1911, as vice-president in 1912, 1913 and 1914, and as president in 1918. He was largely instrumental in the work of reorganization which culminated in the change of the Society's name in 1918 and he was in fact the first president of the Engineering Institute of Canada. He was concerned not only with the active functioning of the Institute as regards the dissemination of professional knowledge but also as regards the recognition and legal establishment of the engineer's professional status in Canada, and the regulation of professional practice. In his presidential message he pointed out that "the change in name implies the attempt to unite all engineers in Canada, to whatever branch of the profession they may belong, into one society." He followed with interest the discussions which took place on these matters between 1920 and 1930 and in that year succeeded past president S. G. Porter as chairman of the Institute Committee on Relations of the Institute with the Professional Associations. That committee's work terminated in the formation of the "Committee of Four" (all representatives of the Associations), a body which gave rise to the present Dominion Council of the Engineering Profession. Mr. Vaughan lived to see the conclusion of formal agreements between the Institute and several of the Professional associations.

Mr. Vaughan was active also on other professional societies. He was a member of the Institution of Civil Engineers, Great Britain, serving as a member of its council for 1925-26. He was also a member of the Institution's advisory committee in Canada.

In 1940 the American Society of Mechanical Engineers conferred an Honorary Membership upon him. He joined that Society in 1899, serving as vice-president in 1910 and again in 1923. He was a member of the A.S.M.E. Boiler Code Committee (Locomotive Sub-Committee) and represented the Society on the American Engineering Standards Committee. He was also a member of the American Society for Testing Materials. Mr. Vaughan was president of the American Railway Master Mechanics Association in 1908 and of the Canadian Railway Club in 1909.

He took an active part in the work of the Canadian Engineering Standards Association, of which he was chairman for some years. His work was recognized in 1939 by the award of Honorary Life Membership in that Association.

This outline of Henry Vaughan's career can give but little idea of his personality and character. Those who were privileged to work with or for him soon learned to appreciate his ability, his helpful co-operation or supervision, his professional competence, and his great store of technical knowledge. As the presiding officer of a council or committee his immediate grasp of the essential features of a proposal and his promptness in decision were characteristic. Widely read, interested in a great variety of topics, his views on questions of the day were always worthy of consideration. It would indeed be hard to fill the gap in the engineering fraternity which is left by his passing.

## MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, December 19th, 1942, at ten o'clock a.m.

*Present:* President C. R. Young in the chair; Vice-Presidents deGaspé Beaubien and K. M. Cameron; Councillors J. E. Armstrong, J. H. Fregeau, J. G. Hall, R. E. Heartz, W. G. Hunt, C. K. McLeod and G. M. Pitts; Secretary-Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

Council noted with deep regret the death of Past-President H. H. Vaughan which had taken place suddenly in Philadelphia on December 11th, 1942. On the motion of Mr. Armstrong, seconded by Mr. Heartz, the following resolution was passed unanimously, and the general secretary was directed to send a copy ot his family:

"The Council of the Engineering Institute learned with profound regret of the death of Past-President H. H. Vaughan, a distinguished member of long standing, who rendered signal service to the Institute and to the profession.

"During his long service as Councillor, Vice-President and President of the Institute, he always had the interests of the Institute at heart. His ability, integrity and professional experience made him outstanding in his chosen profession. Few members of the Institute contributed more constructively to the upbuilding of the profession of engineering.

"Council desires to express to the members of his family its deep sympathy in their irreparable loss."

Mr. Trudel submitted a copy of the programme of the Annual Meeting as it will appear in the December number of the Journal. He commented briefly on the various items, and pointed out that the Association of Professional Engineers of Ontario was meeting on the Saturday following the Institute meeting. A joint luncheon was being arranged on that day to which are invited any members of the Institute who are still in Toronto. President Young reported that Principal James of McGill would open the discussion at the Friday afternoon session on "Post-War Planning and Reconstruction."

The general secretary read a letter from Mr. Cameron, expressing appreciation of the report which he had received from the Institute's Committee on Post War Problems on the form "Considerations for Evaluating Projects". The great care which had been taken by Mr. Miller's committee in considering this matter, and the representative nature of the report, covering, as it does, such a large cross-section of the engineering profession in Canada, made it of very definite and constructive value. The letter was noted, and the general secretary was directed to send a copy to Mr. Miller.

Mr. Hall and Mr. Hunt were appointed scrutineers to open the ballot for Honorary Membership for Professor Frederick Webster. Their report showed that a favourable ballot had been returned by every member of Council.

Professor Webster was declared elected an Honorary Member of the Institute, and the general secretary was directed to notify him by wire, and request his formal acceptance of this distinction in accordance with the by-laws.

In presenting the report of the Membership Committee, Mr. Hall expressed appreciation of the very constructive comments which had been received from members of Council and branch executives, some of which had been of great assistance to his committee in preparing its final report. His committee now submitted a proposed "Memorandum to Branch Executives—re Qualifications for Membership", together with a suggested form for the use of branch executive committees in tabulating all the information available regarding an applicant.

Mr. Hall pointed out that as one or two of the branches had strongly objected to the use of the form, his committee was recommending that it be left to the individual branches to decide whether or not they returned the completed form to Council with their recommendation. The use of the form was recommended so that all branches would have some uniform system of evaluating the qualifications of an applicant.

Councillor F. W. Gray of Sydney had brought up the question of engineers from the Old Country, who, although not holding a degree, had had special apprenticeship training, including extensive night study at the local university or technical school. Such cases were not covered by the form, and in his opinion should receive special consideration.

A prolonged discussion followed, in which all councillors took part. There was some difference of opinion as to the interpretation which should be given to the various items on the proposed form. Many important points were raised, and it was felt that the report should not be adopted until all members of Council had had an opportunity of studying it. It was suggested that copies be circulated and the report discussed at a later meeting of Council. This resolution was carried unanimously.

During the discussion it had been suggested that it might be desirable to appoint an Admissions Committee to consider all applications before they are presented to Council. It was decided to leave this suggestion with the Membership Committee, which could make a recommendation to the new Council if considered advisable.

Mr. Armstrong presented a brief progress report from his Committee on the Engineering Features of Civil Defence, giving the complete membership of the committee to date.

President Young reported that up to the present time no positive action had been taken by the government on the joint submission which had been sent to the Prime Minister on November 3rd, concerning the setting up of an organization to look after the repairing of engineering structures damaged by enemy action. The communication had been acknowledged by the Prime Minister's secretary, but no further word had been received. Recently President Young had heard that steps were being taken in Ottawa to organize a similar set-up under military control. It seemed desirable to take some action, and he had drafted a follow-up letter to the Prime Minister, which, with the approval of Mr. Pitts and Mr. Stirling, the presidents of the Royal Architectural Institute of Canada and the Canadian Construction Association respectively, he would like to send out immediately. The approval of both these gentlemen having been secured, the president undertook to prepare a final letter for submission to the Prime Minister.

It was noted that after consultation with the chairman of the Committee on Industrial Relations, President Young had nominated Mr. E. G. Hewson, M.E.I.C., Office Engineer, Central Region, C.N.R., Toronto, as the Institute's representative on the new Committee on Unionism as Related to Engineers and Technologists to be established by the Engineers' Council for Professional Development.

The financial statement to the end of November had been examined, and it was noted that in spite of the remission of fees to those resident in combatant areas and to members overseas, the Institute's position was somewhat better than at the same time last year.

The following resolution was presented from the Toronto Branch Executive Committee:

"Whereas engineers form an important part of our modern army and whereas in general we have civil and mining engineers commissioned in the R.C.E., and mechanical and electrical engineers commissioned in the R.C.O.C., as O.M.E.'s, and

"Whereas there may be a movement on foot to follow in the Canadian army the newly formed "Royal Electrical and Mechanical Engineers" of Great Britain, and

"Whereas there may be some advantage in having all army engineering activities grouped in one organization under the title "Royal Canadian Engineers", be it resolved

"That Council be asked to nominate a Committee to study the above matter and bring in a report to Council."

Mr. Wright commented briefly on the newly formed organization in England, which is reported to be working out very satisfactorily. It is a strictly professional group, receiving professional allowances, and it is hoped that a similar set-up in the Canadian Army would solve the problem of professional recognition for engineers, a matter which has been before the Council of the Institute over a long period of time.

On the motion of Mr. Pitts, seconded by Mr. Beaubien, it was unanimously resolved that the president and the general secretary be asked to name a special committee to investigate this matter and report to Council.

The following resolution was presented regarding a paper entitled "Industrial Democracy and Its Survival" by Paul Ackerman, M.E.I.C., which had been presented at a recent meeting of the Montreal Branch:

"A resolution was passed at the branch meeting held on November 5th, as follows: "That, considering the importance and magnitude of the subject and the need for its study, it is resolved that this meeting request our branch executive to ask the Council of the Institute to appoint a committee to examine the value of this paper, in respect of post-war reconstruction, and give it such publicity as it merits."

On the motion of Mr. McLeod, seconded by Mr. Pitts, it was unanimously resolved that this resolution be referred to the Committee on Post-War Problems for study and recommendation.

Mr. Pitts suggested that this would be an appropriate time to tell Mr. Wright how glad Council was to know that he will be back at the Institute on a full-time basis, and to tell him how much his work in Ottawa and his efforts on behalf of the Institute have been appreciated. President Young stated that he was very glad that Mr. Wright had been able to do this work. While in some respects the Institute may have had to contract its efforts because of his absence, he felt that on the whole it had been a very fine gesture on the part of the Institute to allow the general secretary to carry on the work in Ottawa.

A number of applications were considered and the following elections and transfers were effected:

| Admissions | |
|---|---|
| Members | 12 |
| Juniors | 4 |
| Students | 64 |
| **Transfers** | |
| Junior to Member | 18 |
| Student to Member | 4 |
| Student to Junior | 23 |

It was noted that the next meeting of Council would be held in Montreal on Saturday, January 16th, 1943, following the annual meeting of the Montreal Branch on Friday evening, January 15th, at which the president would be the guest of honour.

The Council rose at twelve-thirty p.m.

## ELECTIONS AND TRANSFERS

At a meeting of Council held on December 19th, 1942, the following elections and transfers were effected:

*Members*

**Cranswick,** Jack Edwin Boyd, B.Sc. (Elec.), (Univ. of Man.), sales engr., Canadian Westinghouse Co. Ltd., Edmonton, Alta.

**deGuise,** Paul Ernest, B.A.Sc., C.E. (Ecole Polytechnique), consltg. engr., deGuise & Desaulniers, Montreal, Que.

**Graydon,** Edgar Ross, B.A.Sc. (Univ. of Toronto), structural engr., Dominion Bridge Co. Ltd., Toronto, Ont.

**Heyland,** Kenneth Vaughan, B.A.Sc. (Univ. of Toronto), asst. mgr., Construction Equipment Co. Ltd., Montreal, Que.

**Lovell,** John (Plymouth Tech. Coll.), engr. Hamilton Bridge Co. Ltd., Hamilton, Ont.

**Richardson,** John Maxwell, B.Sc. (McGill Univ.), elect'l engr., Southern Canada Power Co. Ltd., Montreal, Que.

**Scrivener,** Robert Massey, B.Sc. (McGill Univ.), gen. mgr., Toronto Shipbuilding Co. Ltd., Toronto, Ont.

**Wyllie,** James Murdoch, contracting engr., engrg. dept., Canadian Bridge Co. Ltd., Walkerville, Ont.

*Juniors*

**Brunskill,** Harry Talmadge, B.Sc. (Mech.), (Univ. of Sask.), engr., Plant engrg. dept., Ford Motor Co. of Canada, Windsor, Ont.

**Lindsay,** Donald Lorne, B.Eng. (Mech.), (McGill Univ.), sub-lieut. (E), R.C.N.V.R., Halifax, N.S.

**Rounthwaite,** Cyril Frederic Thomas, B.Arch. (Univ. of Toronto), structural designer, 69 Howland Ave., Toronto, Ont.

***Upton,** Franklin Howard, production planner, John Inglis Co. Ltd., Toronto, Ont.

*Has passed the Institute's examinations.

*Transferred from the class of Junior to that of Member*

**Backler,** Irving Saul, B.Eng. (McGill Univ.), consulting engineer, Montreal, Que.

**Bates** Harold Carey, B.Sc. (Civil), Queen's Univ., county engr., Stratford, Ont.

**Cowie,** Norman Claude, B.A.SC. (Univ. of Toronto), engr., Great Lakes Power Co. Ltd., Sault Ste. Marie, Ont.

**Craig,** James William, B.ENG. (Ceramic Engrg.), B.SC. (Chemistry), (Univ. of Sask.), mgr., development and research, Canadian Refractories Ltd., Montreal.

**Dyer,** John Henry, B.SC. (E.E.), (N.S. Tech. Coll.), elect'l switchgear dftsmn., English Electric Co. of Canada, Ltd., St. Catharines, Ont.

**Gislason,** Stefan Ingvar, B.SC. (E.E.), (Univ. of Man.), asst. design engr., Defence Industries, Ltd., Jean Brilliant, Que.

**Hinton,** Eric, hydro-electric engr. and asst. mgr., H.E. Dept., Bowater's Newfoundland Pulp & Paper Mills, Ltd., Deer Lake, Nfld.

**Lynch,** John Franklin, B.SC. (E.E.), B.SC. (C.E.), (Univ. of N.B.), res. engr., Defence Industries Ltd., Brownsburg, Que.

**Lyons,** Gerald S., B.SC. (Elec.), (Queen's Univ.), engr., Bell Telephone Co. of Canada, Ltd., Montreal, Que.

**Matheson,** Murray Alexander, B.SC. (Mech.), (Univ. of Sask.), asst. chief engr., Talara Refinery, International Petroleum Co. Ltd., Talara, Peru.

**Smith,** Maurice Howie, B.SC. (E.E.), (Univ. of Man.), inspecting officer (E.E.), Inspection Board of United Kingdom and Canada, Peterborough district, Peterborough, Ont.

**Timm,** Charles Ritchie, B.SC. (E.E.), (McGill Univ.), elect'l engr., Central engineering dept., Dominion Rubber Co. Ltd., Montreal, Que.

**Watier,** Arthur H., B.ENG. (McGill Univ.), asst. to asst. supt. of generating stations, Shawinigan Water & Power Co., Shawinigan Falls, Que.

**Weselake,** Edward Joseph, B.SC. (E.E.), (Univ. of Man.), reinforced concrete designer, Cowin & Co., Winnipeg, Man.

**Willows,** Fred, B.SC. (C.E.), (Univ. of Man.), field engr., Beauharnois Light, Heat & Power Co., Ltd., Beauharnois, Que.

*Transferred from the class of Student to that of Member*

**Evans,** Edward Norton, B.SC. (McGill Univ.), sales representative, Champion Spark Plug Co. of Canada, Ltd., Windsor, Ont.

**Hayes,** Ronald Abram Hughson, B.SC. (McGill Univ.), asst. chief engr., Aluminum Laboratories, Ltd., Montreal, Que.

**Hubbard,** Sewell Fortescue, B.ENG. (Chem.), (McGill Univ.), Chemicals & Explosives Prodn. Branch, Dept. of Munitions & Supply, Montreal, Que.

**Lacombe,** Jean Louis, B.ENG. (McGill Univ.), dftsmn., mtce., mech. designer, Quebec North Shore Paper Co., Baie Comeau, Que.

**Nichols,** Judson Timmis, B.ENG. (Mech.), (McGill Univ.), mtce. engr., Aluminum Company of Canada, Ltd., Arvida, Que.

**Reinhardt,** Gerard Victor, B.SC. (Mech.), (N.S. Tech. Coll.), dftsmn. engrg. office, Aluminum Company of Canada, Ltd., Arvida, Que.

*Transferred from the class of Student to that of Junior*

**Bélanger,** Lucien, B.A.SC., C.E. (Ecole Polytechnique), engr., and dftsmn., Royal Canadian Naval Service, Deep Brook, N.S.

**Bourgeois,** Claude, B.A.SC., C.E. (Ecole Polytechnique), asst. engr., Plessisville Foundry, Plessisville, Que.

**Carey,** Leslie Clement, B.E. (Civil), (N.S. Tech. Coll.), junior engr., Hydraulic Dept., Hydro-Electric Power Commission of Ontario, Toronto, Ont.

**Clark,** Alvin Ira, B.SC. (M.E.), (Univ. of Sask.), mech. engr., Aluminum Company of Canada, Ltd., Arvida, Que.

**Cousineau,** Emile, B.A.SC., C.E. (Ecole Polytechnique), surveying and gen'l engrg., Quebec Streams Commission, Montreal, Que.

**Decarie,** Yves Stanley, B.A.SC., C.E. (Ecole Polytechnique), foundry division, Canadian Car & Foundry Ltd., Longue Pointe Works, Montreal, Que.

**deTonnancour,** L. Charles G., B.ENG. (Chem.), (McGill Univ.), asst. to Development engr., Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

**Forest,** Clement, B.A.SC., C.E. (Ecole Polytechnique), inspector for Dept. of Transport (Civil Aviation Divn.), Montreal, Que.

**Grout,** Raymond Edward, B.SC. (Elec.), (Univ. of Alta.), elect'l designing engr., Shawinigan Engineering Co. Ltd., Montreal, Que.

**Hoba,** Joseph G., B.SC. (Queen's Univ.), asst. engr., Aircraft Division, Kelsey Wheel Co., Windsor, Ont.

**Hunter,** Lawrence McLean, B.SC. (Queen's Univ.), mgr., production dept., Coca Cola Co. of Canada, Ltd., Toronto, Ont.

**Kirkpatrick,** Robert Evans, Capt., R.C.A. B.ENG., (McGill Univ.), inspecting officer, Propellants and Cartridges, Inspection Board of United Kingdom and Canada, Ottawa, Ont.

**Laquerre,** Maurice L., B.A.SC., C.E. (Ecole Polytechnique), field engr., Angus Robertson Co. Ltd., Villeray plant of D.I.L., Montreal, Que.

**Larose,** Gérard, B.A.SC. (Ecole Polytechnique), special products dept., Northern Electric Co. Ltd., Montreal, Que.

**Lemieux,** Henri Julien, B.A.SC., C.E. (Ecole Polytechnique), office engr., engrg. dept., Foundation Company of Canada, Shipshaw, Que.

**Madill,** Floyd Alexander, B.SC. (Civil), (Univ. of Alta.), asst. party chief, gravity meter surveys, producing dept., Imperial Oil Ltd., Calgary, Alta.

**McColeman,** Hugh Alexander, B.SC. (Univ. of Alta.), elect'l dftsmn., Aluminum Co. of Canada, Ltd., Montreal, Que.

**Oatway,** Harold Callaghan, B.ENG. (McGill Univ.), Flight-Lieutenant, R.C.A.F., aeronautical engr., Aircraft Development Officer (Design & Production), Ottawa, Ont.

**Papineau,** Marcel L., B.A.SC., C.E. (Ecole Polytechnique), Flying Officer, R.C.A.F., aeronautical engr. officer, No. 3 I.T.S., Victoriaville, Que.

**Pearce,** Eldridge Burton, B.SC. (Queen's Univ.), dftsmn., tool design, Canadian Car & Foundry Co. Ltd., Amherst, N.S.

**Phemister,** William Ian, B.SC. (Mech.), (Queen's Univ.), photoreproduction supervisor, National Steel Car Corp., Niagara Falls, Ont.

**Smith,** Allan Garfield, B.ENG. (Elec.), (McGill Univ.), sales engr., Illumination Divn., Northern Electric Co. Ltd., Toronto, Ont.

**Taylor,** Dudley Robert, B.ENG. (McGill Univ.), radio engr., Trans-Canada Airlines, Winnipeg, Man.

*Students Admitted*

**Beaton,** William Henry (McGill Univ.), 3484 Westmore Ave., Montreal, Que.

**Charton,** Herman (McGill Univ.), 336 Woodland Ave., Verdun, Que.

**de la Chevrotière,** Jean-Marie (McGill Univ.), 6588 St. Denis St., Montreal, Que.

**Mackenzie,** Arthur Drury (Univ. of Toronto), 506 Huron St., Toronto, Ont.

**Maclure,** James Hubert Crocker (McGill Univ.), 602 Victoria Ave., Westmount, Que.

**Morison,** George Alfred (Univ. of Man.), 54 Maryland St., Winnipeg, Man.

**McKinney,** Charles Donald (Univ. of N.B.), 44 Ludlow St. West, Saint John N.B.

**Reid, Robert Arthur,** B.ENG. (Mech.), (McGill Univ.), 944 Davaar Ave., Outremont, Que.

**Ritchie,** Ross A. (McGill Univ.), 3592 University St., Montreal, Que.

**Tivy,** Robert Harrison (Univ. of Man.), 54 Maryland St., Winnipeg, Man.

**Waldron,** John Ross (Univ. of Man.), 54 Maryland St., Winnipeg, Man.

**Weber,** Thomas Eugene (Univ. of Man.), 409 Sherbrook St., Winnipeg, Man.

**Weller,** Robert Charles (Univ. of Toronto), 588 Huron St., Toronto, Ont.

*Students at the Ecole Polytechnique, Montreal, Que.*

**Baillargeon,** Robert A., 12,200 Valmont St., Montreal, Que.

**Baril,** Roland Gérard, St. Hilaire, Que.

**Beaudoin,** Bernard, 3783 Botrel St., Montreal, Que.

**Beaupré,** Louis, 34 Hazelwood Ave., Outremont, Que.

**Beland,** Jean Armand, 807 Wilder Ave., Outremont, Que.

**Bisaillon,** Gérard Albert, 1956 Rachel St. East, Montreal, Que.

**Boucher,** Jean-Paul, 1305 Panet St., Montreal, Que.

**Boulva,** Francis, 824 Cherrier St., Montreal, Que.

**Bourassa,** Jean, 1615 Bernard Ave., Outremont, Que.

**Bouthillette,** Roland, 1899 Leclaire St., Montreal, Que.

**Brais,** Pierre, 127 Chambly Road, Longueuil, Que.

**Brissette,** Jacques L., 788 Jean-Talon St. W., Montreal, Que.

**Brissette,** Paul, 2549 Chapleau St., Montreal, Que.

**Clément,** Albert, 2501 Orleans St., Montreal, Que.

**Cormier,** André, 837 Dunlop Ave., Outremont, Que.

**Courchesne,** Armand, 5621 Côte des Neiges Road, Montreal, Que.

**Dagenais,** Camille, 3876 Harvard Ave., N.D.G., Montreal, Que.

**Deniger,** Jean, 2500 Sheppard St., Montreal, Que.

**Dion,** Louis Armand, 4323 Western Ave., Montreal, Que.

**Dugas,** Jean, 454 Outremont Ave., Outremont, Que.

**Farand,** Henri-Paul, 2612 Ste. Catherine Road, Outremont, Que.

**Faubert,** Guy-Albert, 369 Ville de Léry, Chateauguay Co., Que.

**Ferraro,** Silvio, 7166 Casgrain St. Montreal, Que.

**Gagnon,** Adrien, 1957 Kent St., Montreal, Que.

**Gendron,** Lucien, 800 Gilford St., Montreal, Que.

**Giroux,** Léopold, 217 Aqueduc St., Quebec, Que.

**Grenier,** Guy, 4251 DeLorimier Ave., Montreal, Que.

**Houde,** Raymond, 308 Baldwin St., Montreal, Que.

**Laganière,** René, 4702 Lafontaine St., Montreal, Que.

**L'Anglais,** François, 3493 DeLorimier Ave., Montreal, Que.

**LeBlanc,** René, 194-A Querbes Ave., Outremont, Que.

**Lemieux,** Philias, Lauzon, Que.

**Leroux,** Jean-Jacques, 696 St. Joseph St., Lachine, Que.

**Marier,** Jean Jacques, 187 Blainville St., Ste. Thérèse, Que.

**Matte,** Gilbert, 36-2nd Ave., Ville St. Pierre, Montreal, Que.
**Murray,** Hubert, 1851 Theodore St., Montreal, Que.
**Parent,** Albert, 8041 St. Michel Blvd., Montreal, Que.
**Partous,** Georges Jean, 1638 Bennett Ave., Montreal, Que.
**Pontbriand,** Joseph Edmond, Sorel, Que.
**Pouliot,** Georges Aimé, 4270 St. Hubert St., Montreal, Que.
**Renaud,** Robert, 6869 Fabre St., Montreal, Que.
**Ricard,** Julien, 1653 Ontario Street East, Montreal, Que.
**Rolland,** Paul-André, 5470 Notre Dame de Grâce Ave., Montreal, Que.
**Roy,** Jacques, 1847 Theodore St., Maisonneuve, Montreal, Que.
**Ste-Marie,** Jean E., 5314 Brodeur St., Montreal, Que.
**St-Pierre,** Fernand O., 8271 Henri-Julien St., Montreal, Que.
**Scharry,** Leo, 4743 Berri St., Montreal, Que.
**Tessier,** Laurent, 6253 deLaroche St., Montreal, Que.
**Thomas,** Jean-Marie, 386 de Lasalle Ave., Montreal, Que.
**Tourigny,** Paul, 456 Sherbrooke St. East, Montreal, Que.
**Vincent,** Jacques, 837 Hartland Ave., Outremont, Que.

By virtue of the co-operative agreement between the Institute and the Association of Professional Engineers of Nova Scotia, the following elections and transfers have become effective:

*Members*

**Cameron,** Clyde Fraser, (Grad. R.M.C.), M.Sc. (Mass. Inst. Tech.), Major, D.A.Q.M.G. (E), Atlantic Command H.Q., Halifax, N.S.

**Coy,** Vincent Michael, B.Sc. (Elec.), (N.S. Tech. Coll.), distribution engr., Nova Scotia Light & Power Co. Ltd., Halifax, N.S.

**Reid,** George Gideon, B.Sc. (Mech.), (N.S. Tech. Coll.), 34 Regina Terrace, Halifax, N.S.

**Ward,** William Albert, engrg. dftsman., Dept. of Public Works, Halifax, N.S.

*Transferred from the class of Junior to that of Member*

**Duff,** Duncan Clemens Verr, B.Sc. (Civil), (N.S. Tech. Coll.), senior asst. engr., Works & Bldgs. Br., Dept. of National Defence, Halifax, N.S.

*Transferred from the class of Student to that of Member*

**MacKinnon,** Archibald Hugh, B.Eng. (Mech.), (N.S. Tech. Coll.), designing engr., I. Matheson & Co. Ltd., New Glawgow, N.S.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**William N. Kelly,** M.E.I.C., is the newly elected chairman of the Vancouver Branch of the Institute. Born at Douglas, Isle of Man, he was educated at Belfast Technical College and at Liverpool University. He served an apprenticeship as engineer with Combe, Barbour and Combe Ltd., Belfast. From 1903 to 1908 he was employed with various firms of engineers at Liverpool. He came to Canada in 1909 and was engaged in various engineering projects in British Columbia. Later, he was appointed superintending engineer with Consolidated Whaling Corporation and North Pacific Sea Products Co. In 1925, he joined the staff of Yarrows Limited at Vancouver. In 1926, he entered private practice as a consulting engineer at Vancouver and has since been carrying on successfully as mechanical engineer and marine surveyor. Mr. Kelly is surveyor to the British Corporation for the Register of Shipping and Aircraft.

William N. Kelly, M.E.I.C.

**R. H. Parsons,** M.E.I.C., city engineer at Peterborough, Ont., has been elected vice-president of the Canadian Institute on Sewage and Sanitation.

**Dr. A. E. Berry,** M.E.I.C., director, Sanitary Engineering Division of Ontario, was re-elected secretary-treasurer of the Canadian Institute on Sewage and Sanitation at the convention held in Toronto, last October.

**Squadron-Leader Wilfrid E. Hobbs,** M.E.I.C., has recently been promoted from the rank of Flight-Lieutenant and has been transferred from R.C.A.F. headquarters in Ottawa to No. 2 Training Command at Winnipeg, Man. Before his enlistment in the R.C.A.F., he was employed as assistant to the manager in the Land Department of Hudson's Bay Company at Winnipeg.

**Gordon McL. Pitts,** M.E.I.C., is a new member of the City Council of Montreal, having been appointed as one of the representatives from McGill University. Mr. Pitts is a member of the firm of Maxwell & Pitts, architects.

**Flying Officer John W. Lucas,** M.E.I.C., is now back in the R.C.A.F. after having been recalled by the Department of Public Works at Ottawa, for three months, early last year, and he is at present stationed in Halifax, N.S., at Eastern Air Command Headquarters.

**T. A. S. Munford,** M.E.I.C., has been appointed division engineer at London, Ont., with Canadian Pacific Railway Company. He was previously assistant engineer, Bruce Division, at Toronto.

**David Hutchison,** M.E.I.C., has been elected chairman of the Edmonton Branch of the Institute. Born at Owen Sound, Ont., he was educated at Queen's University where he graduated with honours in 1924. Upon graduation, he joined the staff of Foundation Company of Canada and was employed on bridge underwater inspection for two years. In 1926 he went with Power Corporation of Canada Limited at Montreal and became construction superintendent. In 1938 he joined the Hudson's Bay Company as manager of Mackenzie River Transport, at Edmonton.

**Roland Saint-Pierre,** M.E.I.C., has obtained leave of absence from the Quebec Department of Highways and has joined Bombardier Snowmobile Limited at Valcourt, Que. After a certain period of time spent at Valcourt, Mr. Saint-Pierre will come to Montreal where he is expected to take charge of engineering in the assembly plant. A graduate of Ecole Polytechnique, in 1935, he has been connected with the Department of Highways of Quebec since graduation, his last position being that of division engineer at Beauceville, Que.

**Commander B. R. Spencer, R.C.N.,** M.E.I.C., has been transferred from Esquimalt, B.C., where he was in charge of the Mechanical Training Establishment, to Halifax, N.S., where he occupies the same position.

**H. O. Brown,** M.E.I.C., has recently accepted a position with Massey-Harris Limited at Toronto. He was previously with Ste. Anne Paper Company at Beaupré, Que.

**H. C. Anderson,** M.E.I.C., who was lately district engineer for the Department of Public Works of British Columbia at New Westminster, B.C., is now assistant chief engineer of the Department at Victoria, B.C.

**C. K. McLeod,** M.E.I.C., has recently been elected managing director and appointed chief engineer of Walter Kidde & Company of Canada Limited. He has been associated with the company since 1925 in charge of engineering and sales in Canada. He was instrumental in the establishment, in June, 1941, of the Company's factory in Montreal, where fire protection products are manufactured for the aircraft and allied industries.

Mr. McLeod retains his connection with Permutit Company of Canada Limited, having been their engineering representative in the provinces of Ontario, Quebec and the Maritimes for a number of years.

where his work brought him into relation with Quebec Power Company engineers. In 1930 he was invited to go to Quebec as assistant superintendent of that division. In 1937 he was appointed superintendent of that division and in 1939 he became assistant general superintendent of the company.

Last year he resigned his position with Quebec Power Company upon his appointment as Director of the new department of electrical engineering which was being established at Laval University. He had been lecturing at Laval University, in the Mining and Metallurgical Department, for the two years previous.

Rodolphe Dubuc, M.E.I.C.

C. K. McLeod, M.E.I.C.

René Dupuis, M.E.I.C.

**Rodolphe Dubuc,** Affil.E.I.C., has been appointed to the City Council of Montreal, representing the Canadian Manufacturers' Association. Mr. Dubuc is assistant tax agent in the property and tax department of Shawinigan Water & Power Company which he joined in 1926 as a draughtsman. He is a graduate of McGill University and University of Montreal.

**R. A. Campbell,** M.E.I.C., is assistant superintendent and production engineer with R. Melville Smith Company Limited, project managers, Canadian-Alaska Highway, at Fort Saint John, B.C. He was previously supervisor of forest operations with the Government of Ontario at Toronto.

**D. M. Dunlop,** M.E.I.C., has been transferred to Kenora, Ont., as assistant superintendent of the Canadian Pacific Railway Company. A graduate in civil and electrical engineering from the University of Manitoba, he joined the Canadian Pacific Railway in 1936 as an instrument man. Lately he had been stationed at Ignace, Ont.

**W. E. S. Dyer,** M.E.I.C., consulting and designing engineer, has opened an office in Buffalo, N.Y., besides carrying on practice in his Canadian office, at Toronto. Since 1902, Mr. Dyer has been engaged in the designing, construction and installation of power plants and factory equipment in Canada, the United States and Europe. One of his recent projects was the design of the new power plant of the Algoma Steel Company at Sault Ste. Marie, Ont.

**René Dupuis,** M.E.I.C., is the new elected Chairman of the Quebec Branch of the Institute. He is Director of the Department of Electrical Engineering at Laval University.

Mr. Dupuis began his engineering education at McGill University, Montreal, and completed his course at Nancy, France, where he obtained his diplomas in Mechanics and Physics. He also studied Political Economy. Returning to Canada, Mr. Dupuis was employed for two years by the Canadian Westinghouse Company, Hamilton, Ont. From 1928 to 1930, he was employed in the repair shop of the Shawinigan Water & Power Company at Trois-Rivières,

**J. E. Goodman,** M.E.I.C., has recently joined the McNamara Construction Company Limited of Toronto as a construction engineer. He was previously a county road engineer at Kingston, Ont.

**C. V. Dunne,** Jr.E.I.C., is now resident engineer with the Naval Service of the Department of National Defence at Sydney, N.S. He was previously construction engineer with E. B. Eddy Company, Hull, Que.

**R. C. Robson,** Jr.E.I.C., has left the staff of Bloedel, Stewart & Welch Limited, at Trail, B.C., to join the British Columbia Electric Railway Co. Ltd., at Vancouver, B.C.

**Sydney M. S. Dunne,** Jr.E.I.C., is on the staff of Defence Industries Limited at Jean Brillant, Que. He is a graduate of the University of Toronto, in the class of 1940.

**P. R. Martin,** S.E.I.C., has left the St. Maurice Power Corporation Limited, LaTuque, Que., to join Electric Steels Limited at Cap de la Madeleine, Que.

## VISITORS TO HEADQUARTERS

**Léon Dancose,** S.E.I.C., Division Engineer, Office, Canadian National Railway, Levis, Que., on December 12th.

**S. W. Gray,** M.E.I.C., Wartime Bureau of Technical Personnel, Halifax, N.S., on December 15th.

**T. A. McElhanney,** M.E.I.C., Forest Products Laboratories, Department of Mines, Ottawa, Ont., on December 22nd.

**Capt. V. R. Davies,** M.E.I.C., Royal Military College, Kingston, Ont., on December 23rd.

**Lieutenant J. P. Leroux,** Montreal, on December 23rd.

**Lucien Allaire,** Jr.E.I.C., Provincial Highways Department, Metabetchouan, Lake St. Jean, on December 23rd.

**J-Ovide Couillard,** Affi.E.I.C., field engineer, Bell Telephone Co. of Canada Limited, Quebec, on December 28th.

# Obituaries

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

### FRANK DAWSON ADAMS, Hon.M.E.I.C.

Among the eminent persons who have been elected Honorary Members of the Engineering Institute of Canada, Dr. F. D. Adams was notable as a man of science, educator, philanthropist, and churchman. He died at his home, in Montreal, on December 26th, 1942. Much of his geological work—especially that done for the Geological Survey of Canada and his later research work on the flow of rocks—had direct bearing on the work of the engineer. His term of office as Dean of the Faculty of Applied Science at McGill showed his grasp of the many problems of engineering education. He gave active support to organizations for social and religious service, particularly in connection with unemployment, the Boy Scouts, and the Y.M.C.A.; he was the author of a History of Christ Church Cathedral, in

**Frank Dawson Adams, Hon.M.E.I.C.**

Montreal, the church to which he was so devoted and where his funeral service was held.

Frank Dawson Adams, PH.D. (Heidelberg), D.SC. (McGill), F.R.S., Emeritus Professor of Geology at McGill University, was born in Montreal in 1859. He was educated at Montreal High School and at McGill University, studying also at Yale, Heidelberg and Zurich.

He joined the staff of the Geological Survey of Canada in 1880, and returned to McGill nine years later as lecturer in Geology. In 1893 he was made Logan Professor of Geology on the retirement of Sir William Dawson. He became Dean of the Faculty of Applied Science (Engineering) in 1908, vice-principal in 1921 (when Sir Arthur Currie became principal) and Dean of the Faculty of Graduate Studies in 1922, holding the two posts concurrently. He retired from active University work in 1924.

A complete list of his degrees, honours and appointments would be a very long one. Among them may be mentioned: Fellow of the Geological Society (London, 1895), Fellow of the Royal Society (London, 1907), president Canadian Institute of Mining and Metallurgy (1910-12), president Royal Society of Canada (1913), president Geological Society of America (1918). He was an honorary member of the Institution of Mining and Metallurgy (London), The American Institute of Mining and Metallurgy and of the Engineering Institute of Canada; six universities conferred doctorates upon him.

During 1918-19 he was deputy director of the Educational Department of the Canadian Expeditionary Force, with the rank of lieutenant-colonel and rendered enthusiastic service in the rehabilitation of Canadian soldiers.

A geologist of world-wide reputation, his long career at McGill University brought him into contact with six principals of the university and many generations of students. In the words of Principal Cyril James, "many of those he met during six decades of university life have been privileged to know him as a friend whose wisdom of counsel was equalled by his personal charm."

The community in which he lived, and the country of his birth, will not soon forget his many contributions to their welfare, and the quiet unobtrusive way in which these services were rendered.

Dr. Adams was elected Honorary Member of the Institute on October 23rd, 1917.

**Rex Elmer Buckley,** M.E.I.C., died at Glen Ferris, West Virginia, on October 1st, 1942, after an illness of two months. He was born at Niagara Falls, Ont., on November 17, 1889, and received his engineering education at Valparaiso University, Indiana. In the first years of his career, he was engaged in municipal engineering and hydroelectric power development at Niagara Falls. From 1914 to 1916 he worked on the construction of the Welland ship canal. In 1916 he joined the staff of the Canadian Niagara Power Company of Niagara Falls and remained with the firm for several years.

Later he went to the United States where he was engaged in the construction of power developments. In 1928 he was in charge of construction for the New Power Company at Glen Ferris, West Virginia, where he was still located at the time of his death.

Mr. Buckley joined the Institute as an Associate Member in 1919 and he became a Member in 1940.

**John Herbert Jackson,** M.E.I.C., died at his home in Toronto on September 25, 1942. He was born at Windsor, Ont., on January 30, 1878, and was educated at Windsor Collegiate Institute, and at the School of Practical Science, University of Toronto. He served an apprenticeship, for three years, in the office of the city engineer, at Windsor, Ont. In the early years of his career, he was employed in the office of the late Brigadier-General C. H. Mitchell, at Niagara Falls, Ont., on municipal work and hydraulic investigations. From 1903 to 1908 he held the position of city engineer at Niagara Falls. In 1908 he became superintendent, and later chief engineer and general manager, of what is now the Niagara Parks Commission. Under his guidance this park project grew and expanded until it embraced a series of parks from Lake Erie to Lake Ontario, joined by a Government-owned highway along the whole length of the Niagara River, and known as the Niagara River Parkway. Following his retirement in 1934, he took up residence in Toronto.

Mr. Jackson joined the Institute in 1899 as a Student, transferring to Associated Member in 1905. He became a Member in 1932.

**John George MacKinnon,** M.E.I.C., died in the hospital at Montreal on October 19, 1942. Born at Underwood, Ont., on October 19, 1884, he received his engineering education at the University of Toronto where he graduated in 1909. During the early years of his career he was employed on railway location in the Canadian West, and from 1912 to 1914 was resident engineer for the Canadian Northern on construction of the line through the Yellow Head Pass. In 1915 he engaged in private practice and was also retained by the Department of Public Works, Government of Alberta, as roadway engineer for the constituencies of Stettler and Coronation. From 1916 to 1919 he served overseas as a lieutenant in the 3rd Battalion, Canadian Railway Troops. After his return to Canada he was associated with the firm of Parsons-Ed, Limited, on the construction of the hydroelectric power installation at Grand Falls, N.B. Later, he returned to private practice. A few months before his death he was appointed chief engineer at No. 31 Personnel Depot, R.C.A.F., Moncton.

Mr. MacKinnon took an active interest in public affairs.

John George MacKinnon, M.E.I.C.

He was secretary of the local Board of Trade and a past chairman of the Moncton Branch of the Institute.

He joined the Institute as an Associate Member on March 25, 1925. In 1940 he became a Member.

**William Henry Souba,** M.E.I.C., died at Minneapolis, Minn., on September 23, 1942. He was born at Hopkins, Minn., on June 6, 1884, and received his education at the University of Minnesota where he graduated as a mechanical engineer in 1909. From 1910 to 1912 he was engaged on grain elevator construction as mechanical draftsman and designer with Barnett & Record Company at Minneapolis. In 1912 he came to Canada at Fort William, Ont., in a similar capacity with Barnett, McQueen Company Limited. In 1914 and 1915 he worked as an assistant engineer for the Board of Grain Commissioners of Canada at Saskatoon, Sask., Calgary, Alta., and Vancouver, B.C. In 1916 he joined the staff of Mr. C. D. Howe at Port Arthur, Ont. The following year he became a partner in the firm of C. D. Howe & Company, consulting engineers. In 1933 he returned to Minneapolis, Minn., where he resided at the time of his death.

Mr. Souba joined the Institute as a Member in 1922.

**Frederick Stanley Walton,** M.E.I.C., died suddenly at Prince Rupert, B.C., on October 18, 1942. He was born at Hull, Eng., on June 12, 1888, and received his education in the local schools.

He began his engineering career with the Grand Trunk Pacific Railway in Saskatoon, in 1911, and was there until August, 1914, when he enlisted at the outbreak of the Great War. He was made prisoner of war in April, 1915, and made several unsuccessful attempts to escape until the Armistice.

In May, 1920, he resumed service with the railway as an instrumentman on the Smithers Division. In 1925, he was promoted to be a roadmaster at Smithers and in October, 1926, he was transferred to the same position at Prince Rupert, B.C.

In the past year Mr. Walton had been particularly active owing to developments resulting from the war and at the time of his sudden death he was directing operations on the clearing of an obstruction on the line.

Mr. Walton joined the Institute as a Junior in 1911, transferring to an Associate Member in 1926. He became a Member in 1940.

# News of the Branches

## Activities of the Twenty-five Branches of the Institute and abstracts of papers presented

### BORDER CITIES BRANCH

J. B. Dowler, M.E.I.C. - *Secretary-treasurer*

The monthly dinner meeting of the Border Cities Branch was held at Windsor on November 27th 1941, at 6.30 p.m. Thirty-three members and guests were present.

After dinner, the chairman, H. L. Johnston, introduced P. E. Adams, the chairman of the branch committee on "Structural Defence Against Bombing." Mr. Adams reported on the activities of the committee both in the branch and at headquarters and announced that he would be available for consultation with anyone who wished to review the notes of the Professor Webster lectures. He also exhibited copies of the Institute booklet "Structural Defence Against Bombing" and reviewed the contents. He announced that the booklets were for sale to the public and also that T. H. Jenkins of Windsor had been very active in the preparation of the material.

G. G. Henderson then introduced the speaker of the evening, W. R. Stickney, welding engineer of the Canadian Bridge Company.

The subject of Mr. Stickney's address was **Electric Arc Welding**—a general review of the metal arc industry to-day. The address was illustrated by sound and colour films entitled "The Inside of Arc Welding" shown by Mr. Wilson of the Canadian General Electric Co.

Mr. Stickney introduced his subject by saying that at the time of the last war, arc welding was merely a convenient or makeshift method of making repairs or fastening small parts to structures, whereas to-day welding is one of the major production method for vital war materials.

There are three major types of fusion welding, that is welding which does not require pressure, namely, electric arc welding, thermite welding and oxy-acetylene welding. The former only was discussed in the paper.

Originally, all arc welding was done with bare electrodes but it is only because of the development of electrode coating that a.c. welding and the welding of high tensile alloy steels are made possible. The speed of modern welding would be impossible without this development.

In the choice of arc welding equipment for any installation, we must consider the following alternatives; either direct or alternating current; manual or automotive equipment, single or multiple operator outfits power from a transformer or motor-generator set, and many other factors.

The training of the welding operator must be very carefully conducted. Most welding schools try to instruct in the fundamentals but the operator must be further trained on the job in the particular methods of welding to be used. The great number of variables which enter into every job must all be considered and mastered. Usually an operator will become reasonably efficient after 4 to 6 months time.

Mr. Stickney concluded his address with a short résumé of the recent developments in this field.

After the discussion period, J. F. Blowey moved a vote of thanks to the speaker.

The meeting adjourned at about 10.30 p.m. on motion of W. P. Augustine.

### HALIFAX BRANCH

S. W. Gray, M.E.I.C. - *Secretary-Treasurer*
G. V. Ross, M.E.I.C. - *Branch News Editor*

The annual meeting of the Halifax Branch was held on December 17, at the Halifax Hotel. Percy Lovett, retiring chairman, reviewed the activities of the past year and S. W. Gray, secretary-treasurer, gave the financial report. The Halifax Branch has grown in recent years until it is now the fourth largest in Canada, having 191 resident and 90 non-resident members.

The new executive officers elected were Prof. A. E. Flynn, chairman; K. L. Dawson, L. E. Mitchell, and C. V. Duff, resident; and R. B. Stewart, New Glasgow, and John Clarke, Bridgewater, non-resident.

When Prof. Flynn had taken over the chair, he introduced the speaker, Mr. R. L. Dunsmore, of the Imperial Oil Co. Mr. Dunsmore showed a film and gave a talk on the three new pre-load concrete oil storage tanks recently constructed here. These tanks are 130 feet in diameter, 42 feet high with a dome roof and have 100,000 barrel capacity. Last November, Mr. Walsh, chief engineer of the Gunite and Waterproofing Co. Ltd., spoke to the branch on the design and construction of the tanks they then proposed to build, and Mr. Dunsmore's folk and film provided an interesting follow up now that construction has been completed. Several changes were made during the construction period, as these are the first tanks of this type to be used for petroleum products, and the designers and builders had to feel their way along.

Sixty-three members and guests were present.

## KINGSTON BRANCH

R. A. Low, M.E.I.C. - *Secretary-Treasurer*

The Kingston Branch opened its winter programme on November 10th, at which the guest speaker was Professor J. C. Cameron, Head of the Industrial Relations Section, Queen's University. Professor R. A. Low acted as chairman for the meeting, and introduced the speaker.

Professor Cameron made it quite clear that any study of the problems of industrial relations must proceed primarily from the standpoint of management. This is because problems of procedure in handling human relations are essentially problems of managerial technique. To be complete the analysis must attempt to the worker the difficulties of management, and to management the difficulties of the worker. It must, moreover take cognizance of the larger social interests which impinge at various points on equitable relations in industry and business.

In an interesting discussion period, the speaker emphasized that the economic organization of a country is a means to an end rather than an end in itself. That end is dominantly social: the enrichment of human life through the satisfaction of natural wants and desires. From a social point of view, the achievement of that end through the exploitation of the workers is undesirable and unjustifiable.

Following the meeting the election of officers took place.

Officers for 1943

| | |
|---|---|
| *Chairman* | K. M. Winslow, M.E.I.C. |
| *Vice-Chairman* | S. D. Lash, M.E.I.C. |
| *Executive* | W. F. Noonan, M.E.I.C. |
| | R. W. Carter, M.E.I.C. |
| | J. D. Lee, Jr., M.E.I.C. |
| *Ex-officio* | T. A. McGinnis |
| | D. S. Ellis. |
| *Secretary-Treasurer* | R. A. Low, Dept. of Civil Engineering, Queen's University, Kingston, Ontario. |

## LONDON BRANCH

H. G. Stead, Jr.E.I.C. - - - *Secretary-Treasurer*
A. L. Furanna, Jr.E.I.C. - - *Branch News Editor*

The last regular meeting of the year, held on Monday, December 7th, was occasioned by President C. R. Young's visit to the branch. Prior to the meeting the president was entertained by the branch members at a private dinner in the Hotel London.

After being introduced to the meeting by Mr. J. A. Vance, the president spoke on the Institute's activities during the past year. The first problem facing the Institute was to determine whether or not it should remain active during the war. However, it was decided that the Institute would carry on as usual and it may now be seen that the achievements of the past year alone have justified that decision.

President Young outlined the purpose of the Institute under three headings, namely the preparation of scientific papers, the encouragement of interest in engineering activities and the promotion of the engineer's welfare. Under Mr. H. F. Bennett's Committee on the Young Engineer a book was published for the guidance of prospective engineer students. This book has been distributed to the high schools and technical schools. Besides, the branches have selected a committee who will make themselves available to students seeking advice as to their desire of a career in engineering. Also a manual was published for the guidance of these counselling committees.

The war has given rise to several special activities. The Institute has published an abridgment of the lectures given by Prof. Webster, Deputy Chief Engineer for the Ministry of Home Security in England. This book is now being distributed throughout the Civilian Defence Committees. Members of the branches have also become local technical advisers to the C.D.C. on engineering problems. Another committee deals with the problems of structural defence against bombing, the repair of engineering works and the protection of existing and future plants against bombing.

The Institute is very much concerned with the reconstruction programme after the war. Mr. W. C. Miller is chairman of a committee on Post-War Problems. It will be the duty of this committee to help evaluate engineering projects put forth for government consideration. Another committee is studying the problems of Industrial Relations.

The president expressed his confidence for the future. He said that great reserves were being created by the war and that great quantities of material would be required. As shining examples of this he pointed out the tremendous requirements of the railways and city water and sewage systems. Besides this, he predicted that many new lines would be developed out of war research efforts and that great new industries would be carried on in Canada after the war.

Finally, Dean Young declared a fear that the vast numbers of technologists developed by the war would create a severe problem. He advised that there is a need for a professional outlook rather than that of the technologist, the basic difference between them being that the engineering profession as such has a knowledge of the art with a firm realization of its professional trusteeship.

President Young was thanked for his address and visit by Mr. E. V. Buchanan. A number of his former students also took the opportunity of expressing their pleasure in being able to see and hear him again.

## MONCTON BRANCH

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

On November 11th a combined meeting of the Moncton Branch and the Engineering Society of Mount Allison was held in the Science Building of the University at Sackville. James Fraser, president of the Engineering Society, was in the chair. A series of Canadian General Electric technicolour sound films, entitled "The Inside of Arc Welding", were shown. The following evening, November 12th, the films were screened at a branch meeting in Moncton. H. J. Crudge, chairman of the branch, presided. The meeting was open to the public, and, in addition to Institute members, a number of railway welders and vocational school pupils were in attendance.

## MONTREAL BRANCH

L. A. Duchastel, M.E.I.C. - *Secretary-Treasurer*
Willis P. Malone, M.E.I.C. - } *Branch News Editors*
W. W. Ingram, S.E.I.C. - - }

Through the courtesy of the Dominion Bridge Company Limited, a visit was made to their Lachine plant on October 29th, by about 350 members.

The trip was particularly interesting in view of the work that is being carried on in the plant at the present time.

Operations such as forging, union melt welding, heavy forming of heads for Scotch marine boilers, frame bending and prefabrication for ship construction, were in progress. The mold loft, where templates are made for the fabrication of ships' plate, and the various furnaces used in bending and forming work proved of special interest.

After the tour through the plant, refreshments were served.

Transportation to and from the plant was provided through the kindness of the Montreal Tramways Company.

---

**Industrial Democracy and Its Survival** was the topic of an address given by P. Ackerman, on November 5th.

The industrial age in which we live, where machine power has gone so far to replace manpower, has introduced social and economic problems that must be solved if industrial democracy is to survive. A plan was presented to solve these problems by assuring equity in "duties of all" and in "benefits for all" which would lead to ever-growing maximum security, comfort and freedom to all. The alternative is "industrial anarchy," with outcast and privileged classes, resulting in discontent, unrest, class war and leading to perpetual insecurity, want and human slavery.

The goods that are required by man can be produced by a fraction of the population. Therefore, some means must be used to avoid having superfluous labour, or as we usually call it—unemployment. The proposed plan would take care of the situation by the retirement of everyone at an early age, with their future secured by means of a national mutual retirement insurance. All workers would be taxed for the purpose during their working years and all would receive at least an adequate pension for life on retirement. Workers would not be compelled to retire on attaining the normal retirement age, but there would be no advantage in their working beyond it.

Provision is made for sickness, accident and disability insurance, for rehabilitation after the war, for retirement of the national debt, for a revised monetary system, for foreign trade, and for economic and social needs.

The plan promises economic freedom and social security by means of a "healthy national reorganization of industrial society."

The discussion lasted about an hour and showed a keen interest in the subject. It culminated in the voting of a resolution that the Montreal Branch ask Council to create a committee to study the subject further. Mr. Duchastel pointed out that there already is a committee on post-war reconstruction to which the matter might be referred. The question was left for Council to decide.

---

Mr. H. E. Ziel, head of the ventilating and air conditioning staff of Albert Kahn, Associated Architects and Engineers, Inc., Detroit, gave a lecture on November 12th, his subject being **Ventilating Buildings Manufacturing War Equipment.**

The aircraft factory of to-day is a vast building of one storey and basement. One such building covers 47 acres. For purposes of fire protection these plants are divided into sections of 350,000 square feet with fire walls between.

Air-conditioning is designed to provide cleanliness, controlled temperature and humidity, and the movement of air, and is a necessity in these plants where the use of various metals with different co-efficients of expansion demands a maximum temperature of 85 deg. F.

The fans are placed on the roof; wooden ducts six feet square are used with branches running down. In aircraft plants the discharge is usually made at floor level, the air being delivered at high temperature and high velocity. The work centres around the fuselage and the workers are far enough away from the duct outlets that they suffer no discomfort. In other plants, the conditioned air is discharged at an angle just below the roof, with enough velocity to cause circulation. Practically all heat loss of these buildings occurs through the roof.

The entrances of the buildings lead to the basement and the employers reach their work by nearby staircases, without disturbing operators of the previous shift by parading along the ground floor. The basements are also used for locker and wash rooms, cafeterias and kitchens, and recreation rooms.

---

The meeting of November 26th was devoted to the subject of **Manpower Control and Employer-Employee Relations.** L. Austin Wright spoke on the manpower control features of National Selective Service and Mr. Douglas B. Chant described the work that is being done with respect to employer-employee relations.

Mr. Wright outlined the restrictions on seeking employment and on hiring employees under the Selective Service programme. The restrictions are designed to keep selective service officers informed as to available labour, and as to the requirements for labour, so that workers can be placed where they are needed most. A great effort is made to provide men with employment in the district in which they live and thus eliminate unnecessary movement of workers about the country. At times, however, it is necessary to transport labour to locations where the demand is expanding rapidly and the local supply is exhausted.

Speaking of the expansion in personnel since the Unemployment Insurance offices were taken over by the Selective Service last spring, Mr. Wright stated that the number of offices had increased from 115 to 210 and the Selective Service staff from 2,500 to 4,000. Great care is exercised in the choosing of Selective Service officers because of the responsibility and authority vested in them. Each Selective Service officer has full responsibility for the operation of the programme in his area.

With reference to employer-employee relations, Mr. Chant said that the troubles between management and labour are usually the result of misunderstanding and that a lot of the difficulty can be avoided by establishing a definite company policy, preferably in writing, and by instituting a joint labour-management agreement committee. The tendency to-day is for labour to take the initiative and demand these committees.

Mr. Chant made certain recommendations regarding these committees, namely, that management and labour be equally represented, that labour representatives be below the grade of foreman, that democratic elections be held with representation by departments or other suitable divisions, that powers be advisory and recommendatory only, that a committee cover one plant only with separate committees for other plants of the same company, that there be no third party, that wages and hours of service not be dealt with, that if any machinery already exists for handling grievances the committee not enter that field.

In the discussion that followed, the questions of how to deal with absenteeism and loafing on the job were raised. It was suggested that these could be minimized by pointing out to the employee the importance of his work with relation to that of the other employees and the effects on production if he is not on the job. Persistent cases can be classed as "serious misconduct" and the employer may dismiss the employee in such cases without the usual seven day's notice.

On Thursday, Dec. 3rd a paper on **Design, Manufacture and Installation of 120 kv. Oil-Filled Cables in Canada,** was presented by Messrs. D. M. Farnham of the Montreal Light, Heat & Power Cons. and O. W. Titus of Canada Wire & Cable Company.

In the first section of the paper, Mr. Farnham spoke on the design of the system involved. Due to the load carried by the medium tension ring and the transformers installed, it was impossible to carry power for any interconnection work. It was therefore necessary to choose a high tension line to act as a tie between two large transmission systems. As an overhead line would be rather long and considerable right-of-way would be required, it was most economical to use an underground oil-filled cable system. The duct line was laid to give the straightest line possible and also the most suitable contour for the cable so as to reduce as much as possible, oil pressures within the cable.

In the second section of the paper, Mr. Titus spoke on the manufacture and installation of the cable. He outlined briefly the construction and theory of solid type cable which has no central oil channel and is impregnated with a viscous petroleum compound. Under load the cable sheath expands and upon cooling small voids are formed due to the contraction of the compound. Ionization takes place in these low pressure areas and may finally cause cable breakdown. In the oil-filled cable the impregnant is a fluid oil and the cable has a hollow core which allows the oil to flow in the cable core. Thus under load the oil expands as in a solid type cable and, on cooling, the oil which is under pressure flows along the cable core and prevents the formation of voids. The life of the cable is thus increased. If the oil pressure in the cable is kept above atmospheric pressure under all conditions, the cable is protected against electrical damage due to sheath punctures.

The cable lengths were kept under pressure from an oil supply even during the pulling of the cable into the ducts. All the joints were flushed with fresh degassed oil and vacuum treated to remove any contamination due to wiping operations and to remove all traces of gas. The potheads were made with connections for the oil supply as were also the stop-joints. Oil feed points were so spaced as to keep the pressure always above atmospheric pressure. The cables have been in service for some time now and data is being collected on their operation. Several slides were shown of construction and installation details of the cable.

## NIAGARA PENINSULA BRANCH

J. H. Ings, M.E.I.C. - *Secretary-Treasurer*
J. W. Brooks, Jr.E.I.C. - *Branch News Editor*

On November 26 the Branch held a dinner meeting at the Leonard Hotel, St. Catharines. Mr. J. M. Galilee, assistant advertising manager of the Canadian Westinghouse Company, was the speaker of the evening, choosing as his subject **Recent Advances in Electrical Research.** Mr. Galilee's talk was illustrated by considerable equipment, including sterilamps, ultra-violet light, luminous powders, and a rather remarkable comparison between the efficiencies of incandescent and fluorescent lighting.

At an executive meeting held immediately after, one of the main topics of discussion was the increasing prevalence of Category AA gasoline ration books among the local engineers. In a widely-scattered branch such as this, the matter assumes considerable importance as far as monthly meetings are concerned.

## OTTAWA BRANCH

A. A. Swinnerton, M.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

An informal discussion on P.R.P. (Production Requirements Plan) took place at a noon luncheon of the branch at the Chateau Laurier on December 17, 1942, led by G. L. Jennison of the Department of Munitions and Supply. The discussion, which was not open to the press, took the form of a few brief remarks by Mr. Jennison followed by questions from the audience, which he answered. The questions, for the most part, were based upon actual problems that had arisen amongst the members in the operation of the plan. Many of the members availed themselves of this opportunity for enlightenment on various aspects of the subject.

## PETERBOROUGH BRANCH

A. R. Jones, Jr.E.I.C. - - - *Secretary-Treasurer*
J. F. Osborn, S.E.I.C. - - - *Branch News Editor*

Branch activities for the 1942-3 season began on October 24th with a visit to the plant of Fiberglas Limited and Duplate Limited in Oshawa. About 35 persons inspected the facilities of the company and later enjoyed dinner as guests of Fiberglas and Duplate.

Mr. R. N. Fournier, industrial heating specialist, Canadian General Electric Company, Montreal, addressed the first regular evening meeting Thursday, November 5th. Mr. Fournier spoke on **Electric Heat in Industry,** a topic receiving particular attention at present in view of its importance in war industry. A full report of Mr. Fournier's paper has been made in connection with its presentation at other branches.

Nearly a hundred members and guests gathered for the 24th Annual Dinner of the Peterborough Branch on Thursday, November 26th. The meeting was addressed by Dean C. R. Young, president of the Institute and dean of the Faculty of Engineering, University of Toronto, and by Mr. K. M. Cameron, president elect of the Institute and chief engineer, Department of Public Works, Ottawa.

Branch Chairman D. J. Emery, presented a brief report on branch activities and introduced the guests. Among the latter was Louis Trudel, assistant general secretary of the Institute who commented favourably on the impression gained on his first visit to the local organization. Mayor Hamilton welcomed the guests on behalf of the city. His Worship took the opportunity to express the communities' gratitude for activities of Peterborough engineers, singling out Mr. Emery for special notice in connection with his A.R.P. duties.

Mr. A. L. Killaly introduced Mr. Cameron, tracing his outstanding career of public service.

Mr. Cameron, an ardent and effective exponent of planning for post war action, stated plainly that engineers are bearing an increasing responsibility in the war and must be prepared to carry an even greater burden in the peace to follow. He felt that Peterborough with a great engineering industry was an appropriate place for engineers to assume the lead.

Dean Young was introduced by Mr. Ross Dobbin, an early pupil of the president.

Dean Young began with general observations on the affairs of the Institute, mentioning specifically the Civil Defence Committee. He went on to define the place of the engineer in society, with attention to the training and employment of the young engineer. The president distinguished three different groups of technical men, namely, technicians, technologists and engineers. The technician possesses manual and other skills but with little, if any, theoretical background. The technologist is a person highly trained in theory and to some extent in application but in a very narrow field. The engineer on the other hand is concerned with organizational economic and managerial aspects as well as with the technical skill and knowledge of his work. He must be familiar with many sciences and must be able to relate his own ability and that of others to the problem at hand. The young man was advised to acquire a broad professional training, then specialize if the situation required it. Dean Young stressed the moral obligation the engineer owed society to serve it to the best of his ability. There is an element of trusteeship in engineering as a profession. He assured the meeting that there would be a tremendous backlog of engineering work to be done at the end of the war and that engineers will be busier than ever.

The speakers were thanked by the chairman on behalf of the meeting.

Mr. Jules Mercier assisted by Mr. Ross Dobbin led group singing. Entertainment was provided by Mr. N. Thomas of the Training Centre.

# PETERBOROUGH BRANCH ANNUAL DINNER

*Above:* Vice-president K. M. Cameron speaks in a light vein. On his right, Chairman D. J. Emery and President C. R. Young; on his left, Immediate Past-Chairman John Cameron.

*Top right:* G. R. Langley, Councillor W. H. Munro of Ottawa, President Young, Past-President J. M. R. Fairbairn, Chairman D. J. Emery. In the foreground, Past Vice-President R. L. Dobbin.

*Above:* R. A. Elliott of Deloro, president-elect of the Association of Professional Engineers of Ontario, A. L. Killaly and Past-President J. M. R. Fairbairn.

*Above:* A. L. Malby, former secretary-treasurer, discusses Branch affairs with President Young and Chairman Emery. In the background, John Barnes.

*Left:* Jules Mercier, "the life of the party," leads community singing.

The assistant general secretary, Louis Trudel, reports on Headquarters' activities.

A happy group. *From left to right:* R. L. Dobbin, Dr. M. H. Yelland, president of the Ontario Medical Association, John E. Keyes and D. Dotty.

## QUEBEC BRANCH

Paul Vincent, M.E.I.C. - *Secretary-Treasurer*

Samedi après-midi, le 12 décembre, les membres de la Section de Québec visitaient le nouvel Hôpital St-Michel Archange à Mastaï. Organisée par Yvon-R. Tassé, cette visite de l'institution qu'on prétend être la plus moderne du genre dans toute l'Amérique du Nord, a grandement intéressé les ingénieurs.

L'édifice central et ses trois pavillons abritent actuellement un personnel de 4,300 personnes. Il n'y a donc pas lieu de s'étonner d'y trouver réunies toutes les particularités d'une véritable petite ville.

La façade principale mesure 600 pieds de longueur et les huit étages représentent quelque 650,000 pieds carrés de plancher. Trois autres ailes de 600 pieds chacune s'édifieront avec le temps pour former un carré autour des centrales d'électricité et de chauffage. Les quatre bâtisses sont réunies par 48,000 pieds carrés de plancher souterrain s'étendant sur une longueur de plus d'un mille.

Tout a été construit et organisé en vue de l'expansion future et les autorités n'ont rien épargné pour que l'organisation soit la plus parfaite possible à tous points de vue. L'hôpital a son usine électrique en propre. L'électricité est produite par la vapeur provenant de l'usine de chauffage. Trois chaudières, dont deux fonctionnent régulièrement, brûlent chacune environ 3,000 lb., par heure, de charbon pulvérisé amené à la chambre de combustion par des stokers pulvérisateurs. Toutes les opérations et les pressions sont mesurées automatiquement sur un tableau d'instruments de toutes sortes. La ventilation et l'air climatisé offrent aussi beaucoup d'intérêt.

La construction de l'édifice central a été l'objet d'une étude particulière de la part des membres. La structure est de béton armé et tout est à l'épreuve du feu. La chapelle, une fois terminée, pourra recevoir 2,800 personnes. Le procédé par lequel le plafond est suspendu est très remarquable. Des fils d'acier attachés aux poutres d'acier soutiennent le plafond de plâtre et ce n'est qu'en l'examinant par dessus qu'on peut constater le mode de suspension qui élimine toutes les colonnes. En regardant de l'intérieur, il nous semble que de grosses poutres soutiennent le plafond, quand, en réalité, ce n'est que soufflage.

Le théâtre, que l'on est également à terminer, a les mêmes particularités et, comme dans la chapelle, tous les murs intérieurs sont isolés au liège pour amortir les bruits et éliminer la condensation qui pourrait être néfaste aux fils d'acier. Les matériaux acoustiques y sont amplement utilisés dans ces deux endroits.

L'éclairage se fait par le système fluorescent dans tout l'édifice.

L'installation des cuisines et des garde-manger, des plus moderne, est faite avec la même perfection du détail et de l'ensemble. Les repas sont servis dans un temps minimum par un système de cafeteria qui est, sans contredit, ce qu'il y a de plus moderne dans toute la ville de Québec.

Les communications entre les départements sont nombreuses et faciles, les ascenseurs, en particulier, étant complètement automatiques.

L'appareil électrique, pour les traitements aux malades de catégorie spéciale, a retenu l'attention des visiteurs. On traite depuis un an une foule de patients à l'électricité par des méthodes moins pratiques. Des statistiques ont démontré que, sur 1,160 patients traités, on avait obtenu une guérison complète pour 60 à 70 pour cent de ce nombre.

M. Emmanuel Fournier, chef-ingénieur diplômé de l'Université de Michigan et du Massachusetts Institute of Technology a guidé les quarante visiteurs en leur donnant les explications techniques.

Le 14 décembre 1942, la section de Québec tenait son assemblée annuelle générale dans l'amphithéâtre de l'Ecole des Mines, Faculté des Sciences de l'Université Laval, Boulevard de l'Entente.

En l'absence de Monsieur L.-C. Dupuis, président de notre section pour 1941 et 1942, Monsieur René Dupuis présidait la réunion.

Après lecture des procès-verbaux et des rapports financiers de l'année, l'on présenta à Monsieur Cyrille Dufresne un certificat pour le prix de $25.00 de l'Engineering Institute of Canada, qu'il avait gagné au mois de juin dernier, pour ses succès comme étudiant de troisième année en génie minier. Ce certificat lui fut remis par Monsieur A.-O. Dufresne, sous-ministre au Ministère des Mines de la Province de Québec.

En attendant le rapport des scrutateurs sur l'élection des officiers, les présidents des divers comités de la section ont présenté le rapport de leurs activités durant l'année.

Le rapport des scrutateurs fit connaître à l'assemblée que Monsieur René Dupuis était élu président de la section de Québec pour 1943. M. Dupuis est directeur de l'Ecole de Génie Electrique récemment créée à la Faculté des Sciences de l'Université Laval de Québec.

Monsieur E. D. Gray-Donald, assistant surintendant général de Quebec Power a été élu vice-président et Paul Vincent, ingénieur en chef au Ministère de la Colonisation, secrétaire pour un autre terme.

Les nouveaux conseillers, élus pour une période de deux ans, sont MM. Gustave St-Jacques, Euclide Paré et Yvon-R. Tassé.

Après l'allocution du nouveau président M. René Dupuis qui remercia les membres du témoignage de confiance qu'ils lui faisaient en l'élisant à ce poste, l'on procéda à la formation des comités de Bibliothèque, Législation, Recrutement, Nomination, Orientation des Etudiants, Programme et Engineering Features of Civil Defence.

M. Robert Sauvage nous donna ensuite une courte causerie sur **La Théorie et les Effets des Bombes.**

Pour terminer cette soirée, les membres prirent des rafraîchissements tout en discutant avec leurs confrères.

## SAULT STE. MARIE BRANCH

O. A. Evans, Jr.E.I.C. - - - *Secretary-Treasurer*
N. C. Cowie, Jr.E.I.C. - - - *Branch News Editor*

The sixth general meeting for the year 1942 was held in the Grill Room of the Windsor Hotel on Friday, November 27th, 1942, when 28 members and guests sat down to dinner at 6.45 p.m.

The business portion of the meeting began at 8.00 p.m., with Chairman L. R. Brown in charge. The minutes of the previous meeting were read and adopted. The chairman then called upon A. H. Russell to bring in the Nominating Committee's slate of officers for the year 1943. The chairman explained to the members that they were free to nominate any other member for the executive. After a lapse of some minutes and no further names being nominated the nominations were closed.

The chairman then called upon C. Stenbol to introduce the speaker of the evening, Professor A. E. MacDonald of Manitoba University, which he did in a few well chosen words.

Professor A. E. MacDonald in his opening remarks brought greetings from the Winnipeg Branch to the Sault Branch. In his address entitled **Foundation Problems in the Winnipeg Area,** the speaker advised the members to pay particular attention to the geological structure of the land when constructing any building or edifice. Winnipeg was built on the bed of old Lake Agassiz. Great masses of powdered rock were deposited in different layers between the soil on the surface and the limestone bed rock some 60 feet below. Some of these clays contain as much as 30 per cent water and in Winnipeg these clays have been drying up due to the almost 100 per cent run off of moisture from the city streets. This drying up is not general around the building and as a consequence the clay on one side of the building may dry up and let the building sag on one end. He also quoted incidences where this dried up clay had taken moisture in again and as a result raised the floor of the basement in humps, causing the centre beams to raise and the doors and windows jam in the household. He also informed the members that driving piles in the clay was worse than useless as the load was then distributed over a smaller area. This only aggravated the sag. There were a number of ways to overcome this problem among which were to drive pillars down to bed rock or to allow for a certain amount settlement. His address was well illustrated with slides.

A. E. Pickering in his vote of thanks said that every engineer encountered this problem in his career and that Professor MacDonald's address was full of useful information.

## TORONTO BRANCH

S. H. DeJong, m.e.i.c. - - - *Secretary-Treasurer*
G. L. Whyte, Affi.e.i.c. - - - *Branch News Editor*

The second meeting of the Toronto Branch for the 1942-1943 season was held in Hart House, Friday, November 20th. After the regular routine business was disposed of the Branch chairman, Col. W. S. Wilson, handed the meeting over to the chairmanship of Prof. R. W. Angus, particularly in view of the latter's long association with the speaker of the evening, Mr. O. Holden, chief hydraulic engineer, Hydro-Electric Power Commission of Ontario.

Mr. Holden's paper dealt with the design and construction of the DeCew Falls power development near St. Catharines, Ont. Beginning with the early development of the district by John DeCou and other prominent pioneers in the early part of the 19th century, Mr. Holden traced the growth of water power development at this site which culminated in the existing 50,000 hp, 66⅔-cycle generating plant of the old Dominion Power & Transmission Co. He then depicted the various features which comprise the new 65,000 hp, 25-cycle development at DeCew Falls now under construction. The work involved in this extends from the intake from No. 3 Welland Canal at Allanburg northwards to the control and outlet works at Port Dalhousie, a distance of approximately 10 miles. Between these points lie improvements to existing water channels and storage basins, the headworks structure and the 2,000 ft. long canal in solid rock leading to it, the penstock and power house structures, the improvement in alignment of Twelve Mile Creek which forms the tailrace channel, the removal at St. Catharines of No. 2 lock on the second Welland Canal with installation of a large weir structure in the deepened and widened channel there, together with sundry minor works. Design of the various structures was described by the speaker who also briefly indicated some of the construction problems encountered. The whole lecture was illustrated by lantern slides in both black and white and colour, and was listened to with considerable interest by an audience of about 70. After some interesting discussion the meeting was brought to a close with a vote of thanks proposed by Mr. W. E. Bonn.

**Surface Hardening by Induction** was discussed by Dr. H. B. Osborn, Jr., Tocco Division, Ohio Crankshaft Company, Cleveland, before a joint meeting of the American Institute of Electrical Engineers, Toronto Section, and the Engineering Institute of Canada, Toronto Branch, at the Mining Building, University of Toronto, Friday, November 27, 1942.

All arrangements for this meeting were made by the Toronto Section A.I.E.E., and the chairman, D. W. Callander, presided.

According to Dr. Osborn, induction hardening was first introduced in the production of crankshafts. This successful application led to further investigation of the possibilities of the process and it is now being applied for many purposes including important items of war material.

While the exact method of operation and the equipment varies with different applications, the general principle involved is the heating of the surface layer of the metal by placing the part in a high frequency alternating field. In practice the principal source of heat is from eddy currents which are confined largely to the surface layers of the metal when the frequency employed is high.

Induction hardening apparatus consists essentially of a source of high frequency current and a suitably designed water-cooled inductor coil. The inductor usually has holes through which water may be sprayed on the heated parts to quench it. The source of high frequency current may be a motor-generator set, a spark gap oscillator, or a vacuum tube oscillator. Good inductor design is an important factor in the successful operation of the process and in each case the inductor must be adapted to the particular parts to be treated and the area which it is desired to harden. In many cases where large numbers of similar parts are being hardened by induction, ingenious devices are incorporated to handle the parts and carry out the sequence of operation to accurate timing.

The speaker discussed the method of controlling the process according to the maximum temperature and depth of hardening desired, and the size of piece to be heat-treated. The factors varied are the electrical input, the frequency, and the length of time of heating.

Among the applications of induction hardening are the treating of gear teeth, bearing surfaces, and pins; the heating of tubes in shell production, and the brazing of nose-pieces for high explosive shells. Advantages of induction hardening are that distortion is minimized, the short heating time eliminates formation of scale and avoids grain coarsening, and mass production is possible.

The lecture was illustrated by slides showing sectional view of surface hardened materials and some of the surface hardening equipment now in use.

At the conclusion of a lively discussion, the vote of thanks was moved by W. S. Wilson, chairman of the Toronto Branch, Engineering Institute of Canada.

**Glass in National Defence** was discussed by C. J. Phillips, sales manager, Insulation Division, Corning Glass Works, Corning, N.Y., before the Toronto Branch, of the Institute, at Hart House, on Thursday evening, December 3rd.

After opening the meeting, Branch Chairman W. S. Wilson called upon W. H. M. Laughlin to act as chairman for the evening.

In order to provide a background for some of the newer developments in glass, the speaker pointed out that glass definitely dated back to 1500-2000 B.C. and was an early article of commerce. From 1300-1400 A.D. the secrets of glass-making were very zealously guarded in Venice but shortly after 1500 A.D. glass-making had spread through practically all the European countries. The glass industry has a long tradition of hand-working and until very recently many of the tools of glass-making were identical with those of the early Egyptians. However, within the last forty years some portions of the industry have been highly mechanized; a typical instance is a machine which will turn out 1,000 electric light bulbs a minute.

From various viewpoints glass may be defined as any one of a great variety of commercial objects (Corning makes 35,000 different glass articles), as an almost separate and distinct state of matter, or as the result of mixing, fusing and cooling of mixtures of chemicals in such a way that they do not crystallize.

Approximately 90 per cent of the glass manufactured is the basic soda-lime-silica type common in window glass, bottles, etc. Countless modifications may be made through the use of other oxides and in an average year at Corning Glass Works some 350 different kinds of glass are employed, while the company's files list tens of thousands of glass formulae.

Through such modifications, glass may be prepared in colours from clear to jet black, densities from 2.1 to 8.5, coefficients of expansion from $8 \times 10^7$ to $120 \times 10^7$ per deg. C., with a modulus of elasticity varying from 7-14 million, restivity from $10^{10}$ to $10^{18}$, and refraction from

1.4 minimum to over 2. Great variations in chemical resistance are also experienced.

The speaker referred to the difficulty of predicting the mechanical strength to glass. Under proper conditions, glass rods drawn from the furnace and not touched save at the ends (one-quarter inch in diameter) may have a tensile strength of 140-150,000 lb. per sq. in. If a little sand is drawn over the surface of the rod, the tensile strength may drop to 25,000 lb. and with a bit of rough handling down to 10,000 lb. Very fine glass fibres which have not been touched have given tensile strength as high as several million pounds per square inch.

The heat treatment of glass, setting up compression on the outside and tension on the inside, is used in the production of baking ware, armour plate glass, and gauge glasses.

The metallizing of glass is one of the interesting recent developments. By this process a metal coating is fused tightly to glass, permitting the subsequent soldering of metal bases or other metal parts to glass articles.

Wire is being wound in grooves on glass with the threads cut to a tolerance of plus or minus 2/1000 or better. Grooves are cut in a lathe in which a revolving disc and a screw mechanism grinds the thread.

Another interesting operation is the production of precision bore tubing with inside diameter held at plus or minus 5/10,000. In order to accomplish this a glass tube is placed over a specially designed mandrel of the proper diameter. The tube is heated and a vacuum applied through the mandrel making the glass conform exactly to the mandrel. Tubing of this type is used in level indicators in aeroplanes in which a glass ball moves in the tube.

Perhaps the outstanding accomplishment described by the speaker was the development and application of 96 per cent silica glass. This type of glass is ground, suspended with a few per cent of water and slip cast in plaster of Paris moulds. This material may also be extruded or dry pressed and provides an easy means for the production of glass articles with holes which were formerly difficult to place at right angles to the direction of formation. Articles of this 96 per cent glass which are relatively fragile after casting, are fired, shrinking 15-20 per cent in the process. This glass is playing an important part in replacing scarce steatite in certain phases of radio transmitter work.

Briefly reviewing the war uses of glass, the speaker referred to optical glass for instruments, binoculars, range finders, sights, periscopes, etc.—armour plate or bullet-proof glass for aeroplane and other uses—glass for lenses of searchlights, beacons, and signalling devices—glass for ship portholes, insulators for radio equipment, laboratory ware for industrial and medical purposes, and many other items.

---

Dr. T. H. Hogg, chairman of the Hydro-Electric Power Commission of Ontario, addressed a joint meeting of the Toronto Branch, Engineering Institute of Canada, and the Royal Canadian Institute, at Convocation Hall, on Saturday evening, December 5th, on the subject **Saving Hydro Power for Victory.** Prof. T. H. McIlwraith, president of the Royal Canadian Institute, presided.

In the introductory part of the lecture, Dr. Hogg pointed out that Canada entered the present war with supplies of hydroelectric power several times greater than those available at the close of the last conflict. This increase in hydroelectric power output may be traced largely to the expansion of manufacturing facilities to a point far in excess of domestic requirements, through Canada's position as the fifth exporter in the world.

The Hydro-Electric Power Commission of Ontario at the beginning of the war had a 35 per cent reserve over its primary peak load. In spite of the further extension of generating capacity, and improved co-ordination of generation and distribution, certain restrictive measures and voluntary reduction in the consumption of power are now necessary to meet this winter's heavy load.

Dr. Hogg proceeded to show pictures of two new hydro developments, the one on the Muskoka River and the other at Barrett Chute on the Madawaska River, as instances of what is being done to expand electrical output. Other slides and a motion picture served to demonstrate very clearly how important savings of electrical power could be made in the home.

Mr. W. S. Wilson, chairman of the Toronto Branch, Engineering Institute of Canada, moved the vote of thanks to the speaker.

# Library Notes

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## ADDITIONS TO THE LIBRARY

### NEW C.E.S.A. SPECIFICATIONS

The Canadian Engineering Standards Association has recently issued the following new standards.

**A56—1942 Round Timber Piles:**

*This specification covers the material requirements only, of round timber piles to be used untreated, or treated by standard preservatives. 50c.*

**C77—1942 Oil Circuit-breakers:**

*This specification applies to both indoor oil circuit-breakers for a.c. only, having interrupting capacities of 500,000 kva or less at rated voltage and having voltage ratings of 15,000 volts or less. 50c.*

**C83—1942 Pole Line Hardware:**

*Since the publication of this specification in June 1942, the following five sets of additional drawings have been published for insertion in the above-mentioned specification. Recipients of this specification are urged to secure copies of these drawings in order to keep their specification up-to-date. 25c. a set.*

*Set No. 2—*
- *G-1 Metal pole gain*
- *L-1 Reinforcing link*
- *S-2 Guy straps*
- *S-4 Pole bracket straps*
- *S-6 Storm guy strap*
- *S-7 Reinforcing straps*

*Set No. 3—*
- *A-1 Transformer kick arm*
- *B-9 Phantom transposition bracket*
- *G-3 U cable guards*
- *I-1 Break irons*
- *R-6 Span wire ring*
- *S-8 U cable guard straps*

*Set No. 4—*
- *B-3 Single point transposition bracket*
- *B-13 Diagonal braces*
- *B-14 Vertical braces*
- *S-9 Aerial cable support*
- *T-1 Guy thimbles*
- *T-4 Communication thread*

*Set No. 5—*
- *B-4 Extension back braces*
- *I-2 Pulling-in irons*
- *N-2 Eye nuts*
- *P-2 Wood thimble steel insulator pin*
- *P-3 Wood thimble steel insulator pins*
- *T-2 Wood thimble*

*Set No. 6—*
- *F-1 Crossarm pole top extension fixture*
- *G-5 Flat guage*
- *G-6 Ring guage*
- *P-4 Lead thimble steel insulator pin*
- *P-5 Lead thimble steel insulator pins*
- *T-5 Steel insulator pin lead thimble*

### CESA ELECTRICAL STANDARDS

The following six revised and new standards are Approved Specifications under Part 2 of the Canadian Electrical Code, the requirements of which must be met in order to obtain CESA approval of the electrical devices concerned. These standards were prepared in collaboration with interested manufacturers and industrial associations and are based on laboratory tests and record in service.

**C22.2 No. 3—1942 Electrical Equipment for Oil-burning Apparatus, 2nd ed.:**

*This specification applies to electrical equipment for use on supply circuits of 750 volts and less in conjunction with electrically operated or electrically controlled oil-burning apparatus intended to be employed and installed in accordance with the rules of Part 1 of the Canadian Electrical Code. It does not apply to (a) oil burners intended for use on industrial process:—(b) The construction of electrical components of* *oil burners (e.g. motors, controls, transformers). Due to the present restrictions on the manufacture of the type of equipment covered by this specification the "effective date of new production" will be set by the CESA Approvals Administrative Board when these restrictions have been withdrawn. 50c.*

**C22.2 No. 46—1942 Electric Air-heaters, 2nd ed.:**

*This specification applies to both portable and stationary air-heaters for potentials of 250 volts and less, designated to be employed in accordance with the rules of Part 1 of the Canadian Electrical Code. Effective as of December 31, 1942 for new production. 50c.*

**C22.2 No. 61—1942 Electric Ranges:**

*This specification which has just been issued applies to both stationary and portable electric ranges for potentials up to and including 250 volts between conductors, designed to be employed in accordance with the rules of Part 1 of the Canadian Electrical Code. The specification is applicable to general domestic and commercial purposes (e.g. in homes, restaurants and similar establishments). Effective as of October 31, 1942 for new production. 50c.*

**C22.2 No. 64—1942 Cooking and Liquid-heating Appliances (Domestic and Commercial Types):**

*This specification applies to both portable and stationary cooking and liquid-heating appliances for potentials of 250 volts and less, designed to be employed in accordance with the rules of Part 1 of the Canadian Electrical Code. It applies to toasters, waffle irons, hot-plates (table-stoves), sandwich toasters, grills, coffee makers, kettles, chafing dishes, water-heaters, doughnut cookers and similar devices. It does not apply to portable (rangettes) or stationary electric ranges, humidifiers, stills, sterilizers or industrial heating appliances. Effective as of February 15, 1943 for new production. 75c.*

**C22.2 No. 72—1942 Heating and Heater Elements—Replacement Types:**

*This specification applies to replacement (those which are intended for general sales to the public and as such will be used in various makes of heating appliances) heating elements and heater elements for domestic heating appliances, for potentials up to and including 250 volts between conductors and designed to be employed in accordance with the rules of Part 1 of the Canadian Electrical Code. Effective as of May 15, 1942 for new production. 50c.*

**C22.2 No. 77—1942 Inherent Overheating Protective Devices for Motors:**

*This specification applies to inherent overheating protective devices for mounting in or on motors (and affected therefore, to some extent by heat from the motor) for potentials up to and including 600 volts between conductors and for motors rated at 1 hp or less, designed to be employed in accordance with the rules of Part 1 of the Canadian Electrical Code. It includes inherent overheating protective devices for both the automatic-reset type and the manual-reset type. They may be actuated by the heat from the motor alone or by a combination of the heat from the motor and the motor current passing through the device. Effective as of December 31, 1942 for new production. 50c.*

Copies of these standards may be obtained from the Canadian Engineering Standards Association, National Research Building, Ottawa.

### TECHNICAL BOOKS

**Principles of Electronics:**

*Royce Gerald Kloeffler. N.Y., John Wiley and Sons, Inc., 1942. 6 x 9¼ in. $2.50.*

**Heat:**

*2nd ed. James M. Cork. N.Y., John Wiley and Sons, Inc., 1942. 6 x 9¼ in. $3.50.*

**American Diesel Engines:**

*Their operation and repair. E. F. Goad. N.Y., Harper and Brothers (c. 1942). $2.75.*

**Ferrous Production Metallurgy:**

*John L. Bray. N.Y., John Wiley and Sons, Inc., 1942. 6 x 9¼ in. $4.00.*

**Engineering Materials Machine Tools and Processes:**

*W. Steeds. Toronto, Longmans Green and Co., 1942. 5½ x 8¾ in. $4.75.*

### TRANSACTIONS, PROCEEDINGS

**The Royal Society of Canada:**

*Transactions. 3rd series, volume 36, Section 5—Biological Sciences. May, 1942.*

### REPORTS

**Ohio State University Studies—Engineering Series—Bulletin:**

*No. 112—Nepheline syenite in low temperature vitreous wares.*

**Purdue University—Engineering Experiment Station—Bulletin:**

*Research series No. 85—Report of the research and extension activities, engineering schools and departments for the session of 1941-42.*

**University of Missouri—Engineering Experiment Station—Bulletin:**

*No. 31—Cross-connection survey in Calhoun County, Michigan, by Edward Lee Stockton.*

**University of California—Department of Geological Sciences—Bulletin:**

*Volume 27, No. 1—A skull of bison latifrons from the pleistocene of northern California.*

**Cornell University—Engineering Experiment Station—Bulletin:**

*No. 30—The specific heats of certain gases over wide ranges of pressures and temperatures. Air CO, $CO_2$, $CH_4$, $C_2H_4$, $H_2$, $N_2$, and $O_2$.*

**Quebec—Department of Mines—Division of Mineral Deposits:**

*Special report on the iron deposits of the province of Quebec.*

**St. Mary and Milk Rivers Water Development Committee:**

*Report on further storage and irrigation works required to utilize fully Canada's share of international streams in southern Alberta. February, 1942.*

**U.S.—National Bureau of Standards—Building Materials and Structures Reports:**

*BMS88—Recommended building code requirements for new dwelling construction with special reference to war housing.*

**Edison Electric Institute:**

*Utilization voltage standardization recommendations. A joint report of the Electrical Equipment Committee and the Transmission and Distribution Committee. E.E.I. publication No. J8, October 1942.—Boilers and Combustion 1941. A report of the Boilers and Combustion Subcommittee of the Prime Movers Committee. E.E.I. publication No. J7, October 1942.*

**Electrochemical Society—Preprint:**

*No. 83-1—The electrode position of silver on magnesium.*

**McGill University:**

*Annual report 1941-42.*

**Illinois Institute of Technology:**

*Annual report of the President for the year ended August 1942.*

**American Institute of Consulting Engineers:**

*Lesson of the last world war by Dr. James T. Shotwell with discussions.*

**Canada—War Time Prices and Trade Board:**

*Quarterly summary, July to September, 1942.*

### AIR RAID PRECAUTION AND CIVIL DEFENCE

The following literature has been added to the Institute Library since the last published list in the December Journal.

**Office of Civilian Defence—Medical Division—Sanitary Engineering Bulletin:**

*No. 1—Protection and maintenance of public water supplies under war conditions. 34 pp.*

*No. 2—Municipal sanitation under war conditions. 26 pp.*

**Indiana State Defence Council—Emergency Water and Sewerage Committee:**

*Bulletin No. 4—Waterworks school for emergency wartime training and waterworks training course (proposed syllabus). 82 pp.*

## BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters or may be sent direct to the publishers.**

**ACCOUNTING FUNDAMENTALS**

*By R. E. Strahlem. Ronald Press Co., New York, 1942. 365 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

This textbook is intended for students in engineering and industrial schools who must acquire a knowledge of accounting fundamentals in a relatively short course. From the first, the emphasis is on accounting for manufacturing corporations, and the problems all relate to industrial companies.

**AERIAL NAVIGATION (Flight Lesson Text No. 41)**

*By W. E. Dyer. American Technical Society, Chicago, 1942. 64 pp., illus., diagrs., charts, tables, maps, 9 x 6 in., paper, 75c.*

The method of aerial navigation called dead reckoning is thoroughly explained in this practical text. Many diagrams and illustrations are used to depict just how the process works. Actual problems with solutions, and a set of review questions are included.

**Air Raid Precautions Training Manual No. 1, 1st ed. Amended reprint, August, 1942.**

**BASIC TRAINING IN AIR RAID PRECAUTIONS**

*His Majesty's Stationery Office, London, 1942. 57 pp., illus., diagrs., tables, 8½ x 5½ in., paper, 6d. (obtainable from British Library of Information, 30 Rockefeller Plaza, New York, 15c.)*

This is the first of a series prepared by the British government to further uniform practical training of air raid precautions personnel. The present manual sets out the basic principles of personal protection against air attack and is intended to cover the first stage of training for air raid precautions workers. Protection against incendiary bombs, high explosives and gas are explained, and the elements of first aid are set forth.

**AIRCRAFT SPOT AND SEAM WELDING**

*By G. Kuntz. Pitman Publishing Corp., New York, and Chicago 1942. 108 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $1.25.*

The theory and practical operation of spot and seam welding equipment are concisely presented in this small volume. The object is to enable the welder to understand his machine, and to provide the aircraft designer with information that will enable him to utilize these welding processes to the best advantage.

**ALTERNATING-CURRENT MACHINES**

*By A. F. Puchstein and T. C. Lloyd, 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 655 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.50.*

In dealing with the various types of alternating-current machines, each topic is treated approximately in the following order: construction; discussion of operating characteristics; calculation of operating characteristics from tests; discussions and analysis of various related phenomena. The revised edition has been brought up to date by the inclusion of new methods of analysis and recent standardization practices. As in the previous edition, only steady-state phenomena are covered with a few important exceptions.

**AUDELS ELECTRICAL POWER CALCULATIONS with Diagrams**

*By E. P. Anderson. Theo. Audel & Co., New York, 1941. 421 pp., illus., diagrs., charts, tables, 6½ x 5 in., fabrikoid, $2.00.*

This is a collection of practical electrical problems and their solutions. It puts special emphasis on the fundamental laws of electricity and includes the necessary mathematical formulae. Complete solutions are given for 275 electrical problems selected from the average practice of electrical men. The book is divided into two parts: direct current and alternating current, which includes the subjects of power transmission and radio circuits.

**FUNDAMENTALS OF ELECTRIC WAVES**

*By H. H. Skilling. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 186 pp., diagrs., charts, tables, 9 x 6 in., cloth, $2.75.*

In this introductory study of electric waves, the principles of wave action and, in particular, the basic ideas of Maxwell's equations are presented in a way that has proved to be understandable to students. These ideas are discussed and used in simple examples in order to increase the students' familiarity with them. Physical concepts are stressed without neglecting mathematical exactness or the requirements of engineering practice.

**Great Britain, Dept. of Scientific and Industrial Research.**

**INTERNAL COMBUSTION ENGINES**

*By J. A. Polson. 2 ed. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1942. 548 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

A textbook for junior or senior students of mechanical engineering "who have had a thorough course in fundamental thermodynamics and have a fair conception of the operation of internal combustion engines." This edition has been completely rewritten and considerable new material added on cams, air cooling and the performance of aircraft engines. A new chapter on gas turbines has been added.

**INTRODUCTION TO ENGINEERING ECONOMY**

*By B. M. Woods and E. P. De Carmo. The Macmillan Co., New York, 1942. 441 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth, $4.00.*

This textbook for engineering students is intended as an introduction to the subject, in which the relation of such subjects as economics, accounting, statistical methods, etc., to the economy of engineering enterprises is set forth.

**MERRIMAN'S STRENGTH OF MATERIALS, revised by E. K. Hankin, 8th ed.**

*John Wiley & Sons, New York; Chapman & Hall, London, 1942. 148 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $1.50.*

The new edition of this well-known textbook has undergone a thorough revision and rewriting. The reviser has designed it as a basic textbook for nontechnical students and mechanics, and has made it more practical than before.

**OIL PROPERTY VALUATION**

*By P. Paine. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 204 pp., charts, tables, 9½ x 6 in., cloth, $2.75.*

This book reviews the meaning and scope of valuation in the oil business, discusses the factors which enter a valuation and describes the methods of applying these factors. The object is to show the influences other than the mere amount of oil and gas available which affect the value of a property.

**(An) OUTLINE OF NAVAL ARCHITECTURE AND SHIP CONSTRUCTION, 2 Vols.**

*By C. L. Wright, Jr. 2 ed. rev. Graduate School, Dept. of Agriculture, Washington, D.C., 1942. Vol. 1, 145 pp.; Vol. 2, 130 pp. diagrs., charts, tables, 10½ x 8 in., paper, $2.00 each Vol.*

Presented entirely in outline form, this guide is intended for persons whose interests require a general knowledge of the design and construction of ships. The treatment is essentially practical, and numerical examples are fully worked out. For detailed information concerning any particular phase of the work, this outline must be supplemented by publications such as those listed on the reference page.

**PAPERMAKING ABSTRACTS**

*Compiled by TAPPI Committee on Abstracts and Bibliography, edited by R. G. Macdonald and V. F. Waters. Published by the Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York, 1942. 270 pp., 11½ x 9 in., paper, $2.00.*

This volume provides abstracts of articles and patents relating to the manufacture and technology of pulp, paper, paperboard and paper products which have appeared during recent years. Special attention is given to foreign publications, which are abstracted very fully. Author and subject indexes are included.

**PLASTICS FOR INDUSTRIAL USE, an Engineering Handbook of Materials and Methods**

*By J. Sasso. McGraw-Hill Book Co., New York and London, 1942. 229 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

This manual discusses the plastics which are particularly suitable for industrial use. The comparative properties of the various types, methods of molding, the design of molds and the machining and finishing of plastic parts are described. Separate chapters are devoted to specific plastics. A directory of trade names, suppliers and molders is appended.

**PRINCIPLES OF HEAT ENGINEERING**

*By N. P. Bailey. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 284 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $2.75.*

The principles of heat engineering covered in this book may be considered as the minimum requirement for any engineer. The theoretical material presented is expressed quantitatively for use in the solution of engineering problems, of which a large group is included at the end of the text. The early chapters deal with general concepts, while the later ones cover respectively such engineering topics as internal-combustion and steam engines, turbines, boilers and refrigeration.

**STRUCTURAL DEFENCE AGAINST BOMBING**

*Engineering Institute of Canada, 2050 Mansfield St., Montreal, Canada. Oct., 1942. 56 pp., illus., diagrs., charts, tables, 11 x 8½ in., paper, $1.00.*

This booklet, prepared by a committee of the Engineering Institute of Canada, presents an excellent outline of methods of protection that will give citizens sufficient protection against aerial attack and will prevent undue dislocation of industrial plants and public services. The methods are based upon British experience and practices. Air raid shelters, bomb resisting structures, shelter ventilation, the protection of glass, structural protection against fire, the protection of industry and vital plant, and building design in relation to air attack are considered. There is a bibliography.

**STRUCTURE AND PROPERTIES OF ALLOYS**

*By R. M. Brick and A. Phillips. McGraw-Hill Book Co., New York, 1942. 227 pp., illus., diagrs., charts, maps, tables, 9½ x 6 in., cloth, $2.50.*

This text seeks to establish the correlation among alloy phase diagrams, microstructures and properties. Special attention has been directed to the effect of industrial practices in casting, working and heat treating alloys on the application of, or departure from, theoretical principles. One hundred and thirty-six photomicrographs, with full descriptions of their origins, illustrate normal and abnormal structures of most standard alloys.

**(A) SYMPOSIUM ON PETROLEUM DISCOVERY METHODS**

*Conducted by the Research Committee of the American Association of Petroleum Geologists, P.O. Box 979, Tulsa, Okla., 1942. 164 pp., tables, 11 x 8½ in., paper, $1.00.*

This symposium brings together the views of a large number of petroleum geologists as to the best approach to the problem of oil and gas discovery, both now and in the future.

**THE STEAM LOCOMOTIVE**

*By R. P. Johnson. Simmons-Boardman Publishing Corp., New York, 1942. 502 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

In this book, the first on the locomotive to be published in many years, the Chief Engineer of the Baldwin Locomotive Works has set down certain fundamentals of locomotive theory and operation. In addition, attention is paid to the economics of the steam locomotive and to comparison with the Diesel-electric variety. The book contains much of interest to designers and those concerned with railroad motive power.

**(The) VANDERBILT RUBBER HANDBOOK, 8th ed., 1942, edited by J. M. Ball**

*R. T. Vanderbilt Co., 230 Park Ave., New York, 1942. 464 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $5.00.*

This work brings together a large amount of technical information upon rubber, especially upon compounding for various purposes and upon testing methods. Both dry rubber and latex are discussed.

**WHAT THE CITIZEN SHOULD KNOW ABOUT SUBMARINE WARFARE**

*By D. O. Woodbury. W. W. Norton & Co., New York, 1942. 231 pp., woodcuts, charts, 8½ x 5½ in., cloth, $2.50.*

A nontechnical account of the development of the submarine and its uses, and of the measures developed against it. The author tells something of the history of the submarine and the torpedo, describes the life and training of submarine crews, and analyses submarine warfare from 1914 to date.

*(Continued on page 53)*

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

December 30th, 1942.

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the February meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

## FOR ADMISSION

BJARNASON—BARNEY SVEINN, of 177 Davisville Ave., Toronto, Ont. Born at Cold Springs, Man., July 25th, 1906; Educ.: B.Sc. (E.E.), Univ. of Man., 1931; Summers: 1927, '28, '30, and 1931-32, Dept. of Highways, Prov. of Man.; Surveying and gen. engrg., 1933-35, Vanson Manitoba Gold Mines Ltd., and 1936 (May-Dec.), Ardeen Gold Mines Ltd., Kashaboinie, Ont.; 1937-42, with Hans Lundberg Ltd., Toronto, geophysicists and geologists. I/c of laboratory, directing development and constrn. of various geophysical instruments for field exploration work; at present, test engr. radio inspn. and test dept., Research Enterprises Ltd., Leaside, Ont.

References: A. E. Macdonald, R. W. Moffatt, G. H. Herriott, E. P. Fetherstonhaugh, W. F. Riddell, S. H. deJong.

BREESE—RUPERT WALTER, of 245 Elm Ave., Westmount, Que. Born at, Walsall, Staffs., England, Sept. 18th, 1890; Educ.: 1906-09, articled pupil, Messrs. Goddard & Shrimpton, Architects and Land Surveyors, Wolverhampton, England; 1901-16, with Joseph Rielle, Q.L.S., Montreal, surveys and plans; 1916-18, with Malcolm D. Barclay, Q.L.S., successor to Joseph Rielle, city and country surveys and plans; 1918-21, with Laurentide Co. Ltd., Grand Mère, and St. Maurice Paper Co., surveys, constrn. and i/c real estate; 1921-36, technical service dept., City of Montreal; 1936-39, Granvill & Co.; 1939, Dept. of Transport, St. Hubert Airport, asst. to res. engr. and inspr.; 1939 to date, Works and Bldgs. Divn., R.C.A.F., No. 3 Training Command, Montreal, senior dftsman., asst. estimating engr., chief in charge of bldg. siting for aerodromes and relief landing fields, also instructing and supervising recruited junior dftsman.

References: G. R. MacLeod, W. G. Hunt, H. W. Lea, A. A. Wickenden, L. Laferme W. E. Seeley.

CHRISTIE—KENNETH JOHN, of 62 Chelsea Road, Hull, Que. Born at Esterhazy, Sask., May 24th, 1913; Educ.: B.Sc. (Mining), Montana School of Mines, 1941; Summers: 1937, 1939, 1941, Hudson Bay Mining & Smelting Co. Ltd., Flin Flon, engr's. helper and junior engr.; Summer 1938, Geol. Survey of Canada; 1940, engr., sampler, and shift boss, Shamrock Mine, Bernice, Montana; 1941-42, asst. mining engr., Jerome Gold Mines, Ramsey, Ont.; 1942 (Apr.-Sept.), engr. i/c of tunnels, Shipshaw, Que.; at present, 2nd Lieut., Engineer Officer, Advanced Training Centre, R.C.E., Petawawa, Ont.

References: C. Miller, P. C. Kirkpatrick.

FINCH—GORDON HOLBROOK, of Ottawa, Ont. Born at Cookshire, Que., April 24th, 1898; Educ.: B.Sc. (E.E.), Univ. of Man., 1924; with Canadian Westinghouse Company as follows: 1922-24, ap'ticeship course, 1924-25, correspondent, Winnipeg, 1926-28, correspondent, Calgary, 1928-42, engrg. sales, Calgary, and at present, sales engr., at Ottawa.

References: H. J. McEwen, J. McMillan, W. Anderson, H. A. Cooch, W. H. Munro, P. F. Peele, A. B. Geddes, H. B. LeBouvreau.

FROST—JOHN GEORGE, of 3680 St. Urbain St., Montreal, Que. Born at Hornsey, London, England, July 24th, 1902; Educ.: Private study. R.P.E. of Que. (by exam.), 1918-20, ap'tice dftsman., Canadian Allis-Chalmers Ltd., Rockfield, Que.; 1921, turbine fitter, 1922-24, dftsman., Dominion Engrg. Works, Lachine; 1924-26, dftsman., Southern Canada Power Co. Ltd., Montreal; 1926-30, dftsman., 1930-40, leading dftsman., and 1940 to date, chief dftsman., Power Corporation of Canada Ltd., Montreal.

References: J. S. H. Wurtele, H. S. Grove, G. E. Booker, G. L. Wiggs, H. S. Van Patter.

LABREQUE—HENRI, of Montreal, Que. Born at Montreal, Jan. 27th, 1890; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1912. 1923-24, post-graduate course, Ecole Spéciale des Travaux Publics, Paris; R.P.E. Que.; 1908-11 (summers), chainman and rodman, F. C. Laberge, C.E., Q.L.S., and Sask. River surveys, 1911, levelman and topogr.; 1912 (summer), dftsman., Dominion Bridge Co. Ltd.; Fall 1912, asst. engr., City of Montreal, and dftsman., Phoenix Bridge Co. Ltd.; 1918 (summer), asst. engr., Health Dept., Quebec Govt.; 1919 (summer), asst. engr., City of Outremont; 1920-26 (summers), asst. and res. engr., Quebec Dept. of Highways; 1913-29, professor of maths., and 1928-43, professor of static graphics, Ecole Polytechnique, Montreal. 1924-43, professor of static graphics and strength of materials, and 1932-43, of reinforced concrete, Ecole des Beaux-Arts, Montreal. Also 1928 to date, consltg. engr., Associated Engineers Limited, Montreal, Que.

References: O. O. Lefebvre, A. Circé, E. Gohier, H. Massue, J. G. Chênevert, J. A. Beauchemin.

MacDONALD—CHARLES DONALD, of Sackville, N.B. Born at Amherst, N.S., Feb. 5th, 1909; Educ.: B. Eng. (Civil), N.S. Tech. Coll., 1935; 1935, chemist on tar analysis, etc., for Milton Hersey Co. Ltd.; 1935-36, research, and 1936-39, res. engr., Dept. of Highways of Nova Scotia; 1939-40, lecturer, engrg. dept., 1940 to date, asst. professor of engrg., and from Feb., 1942, plant supt., Mount Allison University, Sackville, N.B.

References: H. W. McKiel, S. Ball, R. W. McColough, G. T. Medforth, V. C. Blackett, H. J. Crudge.

PARRISH—VERNON McLEOD, of Winnipeg, Man. Born at Medicine Hat, Alta., Feb. 16th, 1915; Educ.: B.A.Sc. (Mech.), Univ. of Toronto, 1938; 1933 and 1935 (summers), dfting., surveying, field work, gas dept., City of Medicine Hat; 1936-37 (summers), gen. dfting. and struct'l design, Dominion Glass Co., Redcliffe, Alta.; 1938-39, shop assembly and calibration of metering and control equipment, etc., Bailey Meter Company, Cleveland, Ohio; 1939 to date, sales-service engr., Bailey Meter Co. Ltd., Montreal, Que.

References: R. W. Angus, E. W. R. Butler, A. L. Cole, H. J. Muir, J. T. Watson.

ROBERT—RENE ANTONIO, of Ste-Thérèse, Que. Born at Lachute, Que., May 1st, 1908; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1935; R.P.E. Que.; 1935-36, asst. divn. engr., Quebec Roads Dept.; 1936 to date, assistant, physics laboratory, Ecole Polytechnique, Montreal, Que.

References—H. Gaudefroy, L. Trudel, A. Gratton, J. A. Lalonde, A. Circé.

THOMSON—CHRISTIAN ALDROM, of 3491 Belmore Ave., Montreal, Que. Born at Troy, N.Y., March 31st, 1895; Educ.: 1915-17, civil engrg., Tri-State College, Indiana (did not graduate—enlisted in U.S. Army Engrs.); 1913-15, chief operator, Canadian Light & Power Co.; 1917-19, Sgt. and Acting Master Engineer, U.S. Army, 6th Engineers; 1919-24, field engr., elec. and sprinkler depts., Can. Underwriters Assn.; 1924-34, fire protection engr., ins. dept., Canadian National Railways; 1935-42, gen. sales mgr., Dominion Electric Protection Company; 1942 to date, technical supt., R. Campbell Brown & Co. Ltd., Insurance Brokers, at present on fire protection and security survey of all properties, for Cons. Mining & Smelting Co. Ltd., Trail, B.C.

References: C. K. McLeod, R. W. Hamilton, J. Morse, H. A. Dixon, M. Eaton, S. W. Fairweather, D. Anderson, S. Walsh, W. A. Duff, H. F. Finnemore, J. Schofield, H. G. O'Leary, F. L. C. Bond, C. B. Brown, R. O. Stewart.

WHITEHOUSE—FRANK ALEXANDER, of Port Alberni, B.C. Born at Bournemouth, England, Oct. 24th, 1897; Educ.: Private tuition. I.C.S. Civil Engrg. Course; 1920-21, rodman and topogr., C.N.R. surveys and constrn.; 1921-25, logging engr., in full charge of surveys and constrn. of logging rlys.; 1925-26, dftsman., Los Angeles Gas & Electric Corpn.; 1927-32, dftsman., instr'man., inspr., on concrete pavements, etc., engrg. dept., City of Vancouver; 1940-41, manager, small lode gold mine; 1940-41, asst. engr. on constrn. of Nanaimo Military Camp; 1942 to date, engr. in charge of constrn., Alberni Brigade Camp, Port Alberni, B.C.

References: H. D. Lambert, A. G. Graham, F. P. V. Cowley, G. L. Tooker.

MacKAY—ERNEST, of 255 Outremont Ave., Outremont, Que. Born at Montreal, Feb. 1st, 1890; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1912. R.P.E. Que.; 1912-13, articled as surveyor, F. C. Laberge, C.E., Q.L.S., Montreal; 1913-16, surveys, City of Montreal; 1916-17, munitions inspr., Lymburner & Co., Montreal; 1917-21, design of boilers and special machy., mech. dept., Dominion Bridge Co. Ltd.; 1921-29, constrn. of sidewalks, sewers and paving, tech. dept., City of Montreal; 1929 to date, professor of mathematics, Ecole Polytechnique, Montreal.

References: J. A. Lalonde, F. Newell, J. G. Caron, A. Circé, L. Trudel.

WINTERBURN—FRED, of 317 Augustus St., Cornwall, Ont. Born at Preston, England, Dec. 27th, 1899; Educ.: I.C.S. LaSalle Extension Course. Mass. State Univ. Extension Course; 1921-24, load dispatcher, New Bedford Gas & Edison Light Co., New Bedford, Mass.; 1925-27, elec. locomotive electrn., Montreal Harbour Commission; 1927-34, elec. supt., Dominion Engrg. Works Ltd., Lachine, Que.; 1937 to date, elec. supt., Howard Smith Paper Mills Ltd., Cornwall, Ont.

References: D. Ross-Ross, H. E. Meadd, A. L. Farnsworth, R. M. Prendergast, W. R. Bunting, W. R. Fricker.

### FOR TRANSFER FROM JUNIOR

BLACK—WILLIAM STEELE, of Pointe-à-Pierre, Trinidad, B.W.I. Born at Weyburn, Sask., June 19, 1909; Educ.: B.Eng. (Civil), Univ. of Sask., 1933; 1935, (summer), Geological Survey, Dept. of Mines, Ottawa; 1936-40, engrg. dept. Imperial Oil Ltd., Regina; 1940-42, asst. engr., building constrn. dept., Trinidad Leaseholds, Pointe-à-Pierre, Trinidad, supervising constrn. work in the field. (Jr. 1939.)

References: R. A. Spencer, I. M. Fraser, W. E. Weatherbie, W. O. Longworthy, T. S. McKechnie.

ESDAILE—HECTOR MILTON, of Montreal, Que. Born at Montreal, Feb. 6th, 1914; Educ.: B. Eng., McGill Univ., 1936; R.P.E. Quebec; 1935, track layout and constrn., Cornwall Street Rly., Cornwall, Ont.; 1936-40, service and erection, and 1940 to date, supt. of service and erection, Combustion Engrg. Corp., Montreal, entailing the management of all erection and operation of all their steam power plant work in Canada. (St. 1934, Jr. 1939.)

References: J. G. Hall, J. D. Fraser, M. G. Saunders, F. A. Combe, H. C. Karn.

HAYES—HERMAN RUTHERFORD, of 1302 Frontenac Ave., Calgary, Alta. Born at Gleichen, Alta., Dec. 23rd, 1908; Educ.: B.Sc. (Civil), Univ. of Alta., 1934; 1929, rodman, 1931-37, transitman, C.P.R.; 1937 to date, with Burns & Co. Ltd., —1937, time study engr., 1937-40, supervisor of standards, 1940 to date, general supervisor of standards, Calgary, Alta. (St. 1933, Jr. 1938.)

References: R. S. L. Wilson, A. Brownie, J. L. Pidoux, R. M. Hardy, W. D. Suitor, K. Mitchell.

McKENZIE—ROLPH BOYNTON, of Lethbridge, Alta. Born at Lethbridge, Apr. 23rd, 1908; Educ.: B.Sc. (Chem.), Univ. of Alta., 1932; 1929-30 (summers), leveler, Lethbridge Nor. Irrigation Project; 1931 (summer) and 1933-35, asst. chemist, Maple Leaf Oil & Refining Co.; 1935-39, electl. contracting, estimating, salesman, and 1939 to date, manager, McKenzie Electric Ltd., Lethbridge, Alta. (St. 1932, Jr. 1937.)

References: J. T. Watson, J. Haines, W. Meldrum, G. S. Brown, A. G. Donaldson.

STANFIELD—JOHN YORSTON, of Ste. Genevieve, Que. Born at Truro, N.S., Aug. 17th, 1908; Educ.: B.Sc. (Civil) 1932, and B.Sc. (Mech.) 1933, N.S. Tech. Coll.; 1930-31, steel inspr. and instr'mn., Montreal Terminals development, C.N.R.; 1933-34, i/c lumbering operations, Moirs Ltd.; 1934-37, dftsmn. and asst. master mechanic, Consolidated Paper Corp.; 1937-39, sales engr., Anti Hydro of Canada, Ltd.; 1939 to date, Major, 15th H.A.A. Battery, R.C.A., Canadian Army, Labrador. (St. 1932, Jr. 1937.)

References: C. A. D. Fowler, H. G. Mosley, R. Yuill, J. R. Kaye, H. F. Sexton.

STIRLING—L. BRODIE, of Shawinigan Falls, Que. Born at Montreal, Que. Jan. 29th, 1902; Educ.: B.Sc. (Elec.) McGill Univ., 1924; 1920 (summer), Canadian Marconi Co.; 1921 (summer), Can. Steel Foundry; 1924 (6 mos.), electric boiler research: with Shawinigan Water & Power Co. as follows: 1923 (6 mos.), powerhouse mtce.; 1924-29, experimental hydraulic turbine testing; 1929-38, electl. and hydraulic testing and minor design; 1938-42, asst. engr., testing and mtce., and at present, asst. supt. of generating stations. (St. 1921, Jr. 1929.)

References: E. Brown, J. A. McCrory, C. R. Reid, H. J. Ward, M. B. Atkinson.

STRATTON—LESLIE ROBERTSON, of 335 Metcalfe St., Ottawa, Ont. Born at Saint John, N.B., Sept. 26th, 1908; Educ.: B.Sc. (Civil), Univ. of N.B., 1930; 1930-32, designer and asst. field engr., Monsarrat & Pratley, Montreal; 1935-38, designer, National Harbours Board, Saint John; 1938-41, designer and res. engr., National Harbours Board, Ottawa; 1941-42, liaison engr., St. Lawrence Waterways Development; at present res. engr., National Harbours Board, Ottawa. (St. 1930, Jr. 1936.)

References: P. L. Pratley, J. W. Roland, E. G. Cameron, A. Gray, V. S. Chesnut, G. A. Lindsay.

### FOR TRANSFER FROM STUDENT

BROWN—GORDON JAMES, of Niagara Falls, Ont. Born at Bancroft, Ont., May 27th, 1913; Montreal Tech. Inst., and Montreal Tech. School, 1930-1939; 1936-39, dftsmn., Dominion Bridge; 1939-41, dftsmn. and 1941 to date, chief dftsmn. and designer, Herbert Morris Crane & Hoist Co., Niagara Falls, Ont. (St. 1936.)

References: F. McHugh, D. Tenant, J. L. Miller, F. Newell, J. H. Maude, P. Brault, H. Buzzell.

CARMICHAEL—JAMES I., of Port Arthur, Ont. Born at Fort William, Ont., Aug. 11th, 1914; Educ.: B.Sc. (Mech.), Queen's Univ., 1936; 1936, office asst., master mechanic, Copper Cliff smelter, International Nickel Co.; 1936-38, meterman, Thunder Bay Paper Co., Port Arthur; with Canadian Car & Foundry Co., Fort William, as follows: 1938-40, shop engr., production engr. and asst. production supervisor; 1940-41, i/c subcontract programme for machined parts on Hurricane Aircraft; 1941 to date, asst. chief inspr. (St., 1935.)

References: L. T. Rutledge, R. J. Askin, D. Boyd, H. G. O'Leary, E. G. MacGill, E. J. Davies.

DUQUETTE—ROLAND CHARLES, of 753 St. Catherine Rd., Outremont. Born at Montreal, Jan. 18th, 1915; Educ.: B.Eng., McGill Univ., 1940; R.P.E. Quebec; 1937 (summer), Empire Foods Corp.; 1939 (summer), Montreal Ligth, Heat & Power Cons.; 1940-42, asst. electl. engr., Hull Distribution Divn., Gatineau Power Co., Hull, Ont. (St. 1940.)

References: C. V. Christie, A. V. Gale.

EXTENCE—ALAN BARR, of Toronto, Ont. Born at Toronto, Feb. 24th, 1921; Educ.: B.A.Sc., Univ. of Toronto, 1942; 1939 (summer) fitter's helper, A. S. Leitch Co. Ltd., Toronto; 1939-40 (summers), fitter's helper, machinist, dftsmn., United Steel Corp. Ltd.; 1941 (summer), machinist, fitter, Toronto Shipbuilding Co. Ltd.; 1942 (summer), junior research engr., Aircraft Engine Lab., National Research Council; Sept., 1942, to date, demonstrator in mechanical engrg., Univ. of Toronto. (St. 1941.)

References: C. R. Young, R. W. Angus, E. A. Allcut, G. R. Lord, C. F. Morrison, S. H. deJong, G. H. Crase.

GRAY—LAURENCE FREDERICK, of Montreal, Que. Born at Victoria, B.C., Dec. 15th, 1915; Educ.: B.A.Sc. (Elec.), Univ. of B.C., 1938; 1935-36 (summers), radio operator, Hydrographic Service; 1937 (summer), radio operator, C.N. Steamships; 1938 to date, radio engr., transmitter development dept., Canadian Marconi Co., Montreal. (St. 1939.)

References: H. J. MacLeod, E. W. Farmer, J. J. H. Miller, A. B. Hunt, W. H. Moore.

KINGHORN—WILLIAM WALLACE, of Amherst, N.S. Born at Montreal, Que., Jan. 31st, 1915; Educ.: B.Sc. (Civil), Univ. of N.B., 1941; 1934-35, and 1937 (summers), highway constrn.; 1941 to date, aircraft inspr. for Dept. of National Defence at Canada Car & Foundry Co. Ltd., Amherst, N.S. (St. 1941.)

References: J. Stephens, E. O. Turner, J. H. Moore, J. T. Turnbull, W. Lawson.

KOBYLNYK—DEMETRIUS FREDERICK, of 327A-23 Ave. W., Calgary, Alta. Born at Daysland, Alta., Oct. 4th, 1911; Educ.: B.Sc. (Elec.), Univ. of Alta., 1938; junior engr. with Calgary Power Co. Ltd. as follows: 1938-39, hydro plants, mtce., 1939-40, power distribution in towns; 1940 to date, substation mtce. and constrn., relay protection. (St. 1938.)

References: G. H. Thompson, H. Randle, F. K. Beach, H. B. LeBourveau, D. A. Hansen.

MACNAB—THOMAS CREIGHTON, Jr., of Rothesay, N.B. Born at Winnipeg, Man., Apr. 14th, 1913; Educ.: B.Sc. (Civil), Univ. of Man., 1940; Summers with C.P.R. as follows: 1929, axeman on constrn.; 1930, topographer, Peace River; 1931-32, labourer on constrn., Debden-Meadow Lake; 1933-34, gas locomotive helper on constrn., Coronation; 1935-36 (summers), inspr. on reconstrn. berths 1, 2, 3, 4, Saint John Harbour; 1938-39 (summers), inspr. on Highway constrn., Alberta Govt.; 1940-41, transitman Bruce Divn., Toronto, and 1941-42, transitman Laurentian Divn., Montreal, Canadian Pacific Railway. (St. 1940.)

References: E. A. Macdonald, G. H. Herriot, B. Ripley, J. A. MacKenzie, A. Gray.

MARCHAND—FERNAND, of 10 Hamilton Ave., Hamilton, Ont. Born at Montreal, April 2, 1915; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1940; 1940-42, misc. elect'l engrg., Canadian Westinghouse Co., Hamilton, Ont. (St. 1937.)

References: A. Circé, J. T. Thwaites, J. C. Nash, J. R. Dunbar, G. W. Arnold.

MARSHALL—WELSFORD ALLEN, of 567 Island Park Dr., Ottawa. Born at Ottawa, Ont., Jan. 29th, 1913; Educ.: B.Sc. (Civil), Queen's Univ., 1937; R.P.E. Ontario; 1930 to date, Dominion Structural Steel Ltd., Ottawa, from 1936 designing and detailing engr. and estimator; at present Lieutenant, R.C.O.C., 7th Division, O.M.E. Workshops, Debert, N.S. (St. 1937.)

References: A. E. MacRae, J. H. Irvine, L. B. McCurdy, N. B. MacRostie, W. H. G. Flay.

MELLOR—ALFRED GEOFFREY, of 619 Belmont Ave., Westmount. Born at Richelieu, Que., Oct. 18th, 1914; Educ.: B.Eng., McGill Univ., 1934; 1932 (summer), Nichols Chemical Co., Sulphide, Ont.; 1934-35, General Chemical Co., Marcus Hook, Pa.; 1935-37, inspr. wire mill, Steel Co. of Canada, Montreal; 1937-41, asst. to relay engr., and designer on substation work, Niagara Hudson Power Co., Buffalo, N.Y.; 1941-42, genl. asst. to genl. manager on operating problems of public utility companies in Canada, Newfoundland and South America, Montreal Engineering Co. Ltd., Montreal; at present Engineer Officer, R.C.A.F., mtce. of aircraft, with rank of Pilot Officer, Vulcan, Alta. (St. 1932.)

References: C. V. Christie, E. Brown, N. R. Gibson, J. T. Farmer, J. K. Sexton, A. A. Mellor.

PEACH—WILLIAM HERBERT, of 218 Cameron St., Port Arthur. Born at Gopsall, Leicestershire, England, Feb. 1st, 1903; Educ.: I.C.S. Diploma, Civil Engrg., 1935; 1917-20, with Messrs. Logan & Hemingway, Rly. Contractors, Doncaster, England, on dock, rly., reservoir, canal and mine constrn., also on iron ore development; with C. D. Howe Co. as follows: 1923-35, design and supervision of constrn. of grain elevators and allied structures, also design, dfting. and checking of plans and details; 1935 to date, vice-pres., on design and supervision of constrn. of grain elevators and other projects, including sheet pile revetments and industrial structures. (St. 1925.)

References: C. D. Howe, J. M. Fleming, A. E. Macdonald, R. J. Askin, M. W. Jennings, H. M. Olsson, J. C. Antonisen, F. C. Graham.

PRITCHARD—GEOFFREY ROWLAND, of Winnipeg, Man. Born at Winnipeg, July 28th, 1915; Educ.: B.Sc. (Elec.), Univ. of Man., 1937; 1937-40, dfting. and shop, Montreal and Toronto, and 1940 to date, manager Western Ontario and Winnipeg district, Canadian Allis Chalmers; also 1942 to date, lighting service engr., Canadian General Electric Co. Ltd. (St. 1937.)

References: N. M. Hall, A. E. MacDonald, F. V. Seibert, D. M. Stephens, W. A Trott.

SILVERBERG—DAVID M., of 291 Manitoba Ave., Winnipeg. Born at Winnipeg, Apr. 21st, 1913; Educ.: B.Sc. (Elec.), Univ. of Man., 1936; 1936-40, radio electrical servicing under own name; 1940 to date, engrg. dftsmn., Dept. of Transport, Winnipeg. (St. 1938.)

References: E. P. Fetherstonhaugh, D. N. Sharpe, G. H. Herriot, A. E. MacDonald, F. G. Haven.

/ TOWLE—HAROLD MARTIN, of the Town of Mount Royal, Que. Born at Fournier, Ont., June 29th, 1912; Educ.: working towards B.Sc. at Sir George Williams College; 1929 (summer), survey, C.N.R.; 1930-31, Shawinigan Engrg. Co.; 1932-35 (summers), Sutcliffe Co. Ltd., New Liskeard, i/c field party, mining claim survey; 1936-38 (summers), Labrador Mining & Exploration Co., i/c field party, mapping and surveying; 1936-42 (except periods specified), indentured to and working with D. M. Towle, Q.L.S.; 1940 to date, instr'man on Montreal Terminal development, Constrn. Dept., Canadian National Railways. (St. 1937.)

References: J. B. Walcot, A. E. Oulton, W. H. Abbott, R. O. Stewart, J. Gilchrist.

TRUDEAU—MARC R., of 6388 deLorimier Ave., Montreal. Born at Montreal, Nov. 7th, 1915; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1940; R.P.E. Quebec; with Lalonde & Valois as follows: 1937-39 (summers), supervising constrn. of viaduct at Bromptonville and tunnel at Ste. Thérèse, and designing of concrete structures; 1940-41, supervision of constrn. of engine testing labs., National Research Council, Ottawa; 1941 (3 mos.), supervision of constrn. of filtration plant, Huntingdon, Que.; Sept., 1941, to Jan., 1942, designing of concrete structures; Jan., 1942, to Oct., 1942, engr. i/c minesweeper dept., Canadian Fairbanks Morse Co.; at present, asst., hydraulic lab., Ecole Polytechnique, Montreal. (St. 1939.)

References: R. Boucher, A. Frigon, J. P. Lalonde, M. Gérin.

TUCKER—ROBERT NORMAN, of 268 Lake Shore Ave., Toronto. Born at Hamilton, Ont., Nov. 10th, 1912; Educ.: B.A. (Math. & Physics), McMaster Univ., 1937, and 4 yr. practical elect'l instlln. course at Hamilton Tech. Inst.; 1937-38 (7 mos.), elect'l mtce., Steel Car Corp and Steel Co. of Canada; 1939-41, elect'l engrg. dept., transmission section, and 1941 to date planning section, Hydro Electric Power Commission of Ontario, Toronto. (St. 1934.)

References: W. J. W. Reid, E. G. MacKay, D. W. Callander, E. D. W. Courtice, J. Hole.

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

CONCRETE DETAILER for Arvida, Quebec. Apply to Box 2597-V.

MINING, METALLURGICAL OR CHEMICAL ENGINEER for aluminum plant at Arvida. Industrial smelting or mining experience for experimental and technical work and supervision in remelt and shipping departments. Apply to Box 2599-V.

MECHANICAL ENGINEER for Arvida, Que., to take charge of repair and maintenance of equipment, ordering spare parts, etc. Apply to Box No. 2605-V.

CHEMICAL, MECHANICAL OR CIVIL ENGINEER for Arvida, Que. Supervision of operations and labour in alumina plant. Apply to Box No. 2606-V.

CHEMICAL ENGINEER for Arvida, Que., to assist in the supervision of operations and labour in the aluminum fluoride plant. Apply to Box No. 2607-V.

DRAUGHTSMAN for La Tuque, Que., experienced in equipment installation to take charge of engineering work. Apply to Box No. 2608-V.

CHEMICAL ENGINEER for Arvida, Que. Assist in supervision of process control of precipitation department. Apply to Box No. 2610-V.

JUNIOR ELECTRICAL ENGINEER OR DRAUGHTSMAN for Arvida, Que. Two or three years experience, for work on draughting or design combined with usual engineering office work. Apply to Box No. 2612-V.

RESEARCH ANALYST for Kingston, Ont. Analytical work in conjunction with research work carried on at aluminum laboratory. Apply to Box No. 2613-V.

### SITUATIONS WANTED

ENGINEER, M.E.I.C., A.M.I.Mech.E. Available for essential responsible position. Apply to Box No. 704-W.

ENGINEERING MANAGER, B.A.Sc., M.E.I.C., Registered Professional Engineer, Canadian, married, 20 years' thorough experience in industrial management; mechanical and electrical construction and development, production planning, precision manufacturing, very well versed in organization methods. At present in complete charge of an extensive programme now nearing completion by a large company of designers formed in Toronto about a year ago. Really responsible position with well-established company desired. Available immediately. Will go anywhere. Apply to Box No. 2437-W.

## LIBRARY NOTES

(*Continued from page 50*)

### POSTWAR PLANNING IN THE UNITED STATES

*By G. B. Galloway. Twentieth Century Fund, New York, 1942. 158 pp., tables, 9 x 6 in., paper, 60c.*

This report summarizes the activities, personnel and publications of the various agencies engaged in research upon the economic and social problems that will face us when the war ends. A considerable bibliography is appended.

### PRINCIPLES OF EMPLOYMENT PSYCHOLOGY

*By H. E. Burtt. Harper & Brothers, rev. ed. New York and London, 1942. 568 pp., diagrs., charts, tables, 9 x 6 in., cloth, $4.50 trade ed.; $3.75 school ed.*

An interesting, readable presentation of the principles of psychology and of their application in the selection and training of business and industrial personnel. Mental and trade tests are described. The book can be used as a textbook or by business men for reference. The new edition has been completely rewritten.

### PRIVATE PILOT'S HANDBOOK

*By A. G. Norwood. Pitman Publishing Corp., New York and Chicago, 1942. 258 pp., illus., diagrs., charts, maps, tables, 9 x 5½ in., cloth, $2.50.*

This book aims to provide in a single volume the information necessary to prepare for the examination for a certificate as a private pilot of aircraft. The elements of flight theory, meteorology, aerial navigation, the use of radio, the civil air regulations and the test flight are considered. Typical examination questions are appended.

### ROADWAY AND RUNWAY SOIL MECHANICS DATA, Permanency of Clay Soil Densification. (Engineering Experiment Station Series No. 67, School of Engineering)

*By H. C. Porter. Texas Agricultural and Mechanical College, College Station, Texas, 1942. 121 pp., illus., charts, tables, 9 x 6 in., paper, gratis.*

This bulletin on the permanency of clay soil densification is the first of a series of eleven which are to deal with soil mechanics. The experimental procedures used in determining the data are described, the results are discussed, and a synopsis of the conclusions reached is given. Both tables and graphs are used in presenting the numerical results.

### READING ENGINEERING DRAWINGS

*By G. F. Bush. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 60 pp., illus., diagrs., charts, blueprints, 11½ x 9 in., linen, $2.00.*

This book has for its object the teaching of the reading of engineering drawings and of their reproductions in a clear, brief and systematic manner. Only those basic ideas common to all branches of the subject are introduced, and the important branches of airplane drawing, machine drawing and structural drawing are treated in detail. Actual working drawings are provided as examples.

### REPORT OF THE RESULT OF THE INVESTIGATION INTO THE WORKING OF THE FINANCIAL PROVISIONS OF THE AIR RAID PRECAUTIONS ACT, 1937, under Section 10 of that Act, presented by the Secretary of State for the Home Department and Minister of Home Security to Parliament by Command of His Majesty, May, 1942.

*His Majesty's Stationery Office, London. 4 pp., 9½ x 6 in., paper (obtainable from British Library of Information, 30 Rockefeller Plaza, New York, 05c.).*

The Air Raid Precautions Act, 1937, provided that a percentage of the approved expenditure of any local authority would be paid by the British National Exchequer. Certain revisions in these payments are indicated in this report.

### SHORT COURSE IN SURVEYING

*By R. E. Davis and J. W. Kelly. McGraw-Hill Book Co., New York and London, 1942. 330 pp., illus., diagrs., charts, tables, maps, 7½ x 5 in., lea., $2.50.*

This small book presents the essential principles and practice of elementary plane surveyings, in a form useful for rapidly training rodmen, chainmen, instrumentmen and draftsmen during the present emergency. Numerous field problems are included, as well as the necessary tables.

### SKILLED WORKERS FOR DEFENSE INDUSTRIES

*By C. S. Slocombe. Personnel Research Federation, Lincoln Bldg., 60 East 42nd St., New York. 79 pp., charts, tables, 12 x 9 in., paper, $2.00.*

This pamphlet reports the results of a survey of the experience of various companies obtaining skilled labor during boom periods. Methods of hiring, upgrading and training are discussed, as well as such questions as the use of central placement offices, surveying anticipated requirements, estimating the employees capable of upgrading, selection of those to be trained and the results of training. A wide variety of methods and results is described.

### SMOKE PREVENTION ASSOCIATION OF AMERICA, PROCEEDINGS, 36th Annual Convention, Hotel Statler, Cleveland, Ohio, June 2-5, 1942

*Smoke Prevention Association of America, 139 N. Clark St., Chicago, Ill. 136 pp., illus., diagrs., maps, charts, tables, 11 x 8½ in., paper, $1.00.*

The major part of this volume consists of the technical papers presented at the convention. The topics treated include atmospheric pollution, chimney performance, fuel conservation and smoke abatement practices. Several papers contain discussions of the relation of the subject to the war effort.

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### ACID-PROOF CEMENT

An 8-page booklet recently issued by G. F. Sterne & Sons Ltd., Brantford, Ont., features "Penchlor," the trade name of a new acid proof cement developed to combat acid corrosion common in chemical plants, pulp and paper mills, oil refineries, smelting plants, steel mills and other industries. Its characteristics are clearly set forth and it contains a number of illustrations showing methods of application.

### ELECTRICAL INSULATION

"What Keeps the Wheels Turning" is the title of a 20-page bulletin published by Fiberglas Canada Ltd., Oshawa, Ont. This bulletin illustrates the applications of "Fiberglas" to the insulation of electrical machinery and its importance in maintaining production. It shows many conditions of extreme heat and corrosiveness, where the use of "Fiberglas" has prevented consistent outages. These include steel mills, textile and dyeing mills, dry kilns, coal mines and street cars. The different forms in which "Fiberglas" may be obtained are described.

### BLOWERS AND FORGES

Canadian Blower & Forge Co. Ltd., Kitchener, Ont., have for distribution catalogue No. 811-C, 24 pages, which presents the company's line of portable and stationary forges, hand and electric blowers, tuyeres, and anvils. Specifications and illustrations accompany the description of each item, and compressed air and oil-burning forges are also featured.

### TOOL STEEL

"Jessop R. T. Water-Hardening Tool Steel" is the title of an 8-page bulletin, No. 642, issued by Jessop Steel Co. Ltd., Toronto, Ont. This bulletin features the characteristics of R. T. tool steel which is extremely tough and strong. In addition to the general description there are also included a typical analysis, a list of applications, details of heat treatment with a temperature range chart, details of hardness tests and a chart of physical properties.

### THE WELD-IT

Issue No. 16 of "The Weld-It," published by Commonwealth Electric Corp. Ltd., Welland, Ont., features the Taylor-Winfield "Hi-Wave" welder and control panel, with a full and well illustrated article on the new "Hi-Wave" welder control panel.

### OFFICE EQUIPMENT

A 12-page catalogue recently issued by The Steel Equipment Co. Ltd., Ottawa, Ont., features the "Strongarm" line of tempered pressed wood office equipment, including both letter and cap size filing cabinets with three or four drawers; stationery cupboards; lockers, transfer cases, etc. These units are supplied in two standard colours, olive-green and grey-green, and in two standard finishes, smooth and krinkle.

### TIN-FREE GEAR BRONZE

The Hamilton Gear & Machine Co., Toronto, Ont., have prepared a report dealing with the results of a series of researches to find a tin-free bronze to take the place of the conventional metal used in the production of gears. After trying many combinations, a copper-nickel-antimony bronze was tried, and, to quote the report—"this is really good—better for our purpose than the peace time bronze." Details of proportions and physical properties are given. The report concludes with, "We are not applying for patent nor imposing restrictions. This is a free gift for the Allied Nations." This alloy is obtainable in ingot form from Canada Metal Co., Toronto, Ont.

### ELECTED PRESIDENT

Mr. W. T. Randall was elected President of Neptune Meters Limited at the annual directors meeting held recently. Earlier this year Neptune Meters Limited opened a large new plant in Long Branch, Ont., which is engaged 100% in the manufacture of precision instruments for war purposes. The Neptune line of Trident and Red Seal liquid meters is still being manufactured at the Neptune factory in Toronto.

### RECESSED HEAD SCREWS

Different types of "Stelco Phillips" recessed head screws and bolts and drivers are shown in a 6-page bulletin just issued by The Steel Co. of Canada Ltd., Hamilton, Ont. A few of the many uses of these products are featured and illustrated and the advantages they offer are demonstrated.

### TOOLMAKERS' GUIDE

Atlas Steels Ltd., Welland, Ont., have issued a revised edition of their "Toolmakers' Guide", which is in the form of a wall hanger, measuring 17 x 24 inches, attractively printed in colour and shows at a glance the characteristics of their various tool steels and which should be used on any given job.

### WOOD TANKS

A 6-page bulletin prepared by Ajax Engineers Ltd., Toronto, Ont., describes the construction of wood tanks, and illustrates different forms, round and rectangular, horizontal and vertical; also tanks fitted with agitators and other mechanisms used in process work. It contains a ready reference giving capacities of various shapes and dimensions.

### PAINTS, VARNISHES AND ENAMELS

A 28-page catalogue recently issued by The Northern Paint & Varnish Co. Ltd., Owen Sound, Ont., features in the layman's language the description, uses and application of the company's paints, varnishes, and enamels for mining, pulp and paper, power, marine, architectural, engineering and general industries. The catalogue is divided into three sections designating the general class of surface to be covered, i.e., metal, wood and plaster; and porous surfaces, concrete, and for slip prevention. A simplified index indicates the particular product required for specified industries. The company's products are manufactured for industries and institutions only and are distributed by direct representatives.



### DRESSING AND TRUING GRINDING WHEELS

Canadian Koebel Diamond Tools Ltd., Windsor, Ont., have prepared a booklet entitled "For Grinder Men Only—Ladies Night," which is offered by this company, singly or in quantity, without cost to employers for distribution to employees. Recognizing the need for specialized training of women new to industry who may be called on to dress and true grinding wheels, the booklet clearly and simply explains how a wheel should be dressed, the necessity for care in the handling of diamond tools, the importance of taking light cuts, the use of a "drag" angle, correct speed, and other factors bearing on the economical and efficient utilization of diamond tools and grinding wheels.

### INSULATING MATERIAL

A series of bulletins prepared by Webster & Sons Ltd., Montreal, Que., feature "Tartan Vermiculite Insulation" which is fabricated in various forms in combination with building material to provide heat and sound insulation. "Tartan" insulation is fire-proof, rot-proof, vermin-proof, odorless and a non-conductor of electricity. It does not dissolve, disintegrate or give off odors when wet, and melts at about 2500° F.

### OVERHEAD ELECTRIC CRANES

Systematic maintenance and care in operation of "Morris" overhead electric cranes are stressed in an 8-page bulletin, Section 10-M, prepared by The Herbert Morris Crane & Hoist Co. Ltd., Niagara Falls, Ont. The bulletin also contains descriptive cross-sectional drawings, with each detail of the crane designated by a number and tabulated for reference.

### VARNISHED INSULATION

Irvington Varnish & Insulator Co. of Canada, Ltd., Hamilton, Ont., have published a 20-page book designed to enable the user to become better acquainted with this company's products and its laboratory and manufacturing facilities. This book describes and deals with the uses of varnished cambric, canvas, paper, silk, fiberglas and tubing. It also includes technical data and details regarded as necessary to select and specify the product required.

### NORTHERN CIRCUIT

The December 1942 issue of "Northern Circuit," published by Northern Electric Co. Ltd., Montreal, Que., contains a message from the president, Mr. Paul F. Sise, to the company's employees stressing three direct contributions every citizen of Canada should make to the general cause. A visit by employees to a minesweeper; a most interesting item on "Uncle Tom's Cabin" at Chatham, Ont.; the proposal of a "National Electrical Federation" in a speech by Mr. Arnold L. Brown; and many items of special interest to the employees form the contents of this issue.

### DECEASED

McKenzie James Morgan, district sales manager of the Canadian Ohio Brass Co. Ltd. died suddenly on December 12th, in Niagara Falls, Ont. Born in Wales, Ont., in 1895, Mr. Morgan had been with Canadian Ohio Brass since August 1920; first at the Chicago office and the past twenty years with the Canadian Office. (*Continued on page 24*)

## *When Engineers Figure Costs*

# VITRIFIED CLAY PIPE

## is always specified

The best is never expensive when a competent engineer is figuring costs. This is particularly true of sewers—where true costs are not so much a matter of installation but of maintenance and amortization over a period of years.

Judged by sound standards and proved engineering practice, the record of Vitrified Sewer Pipe stands high. It meets the tests of the Canadian Engineering Standards Association and the American Society for Testing Materials with a wide margin. In the vital acid, crush and capacity tests, it stands pre-eminent. Truly the ideal and everlasting material for the sewage-disposal systems of today's industrial communities.

***Buy Victory Bonds and War Savings Certificates Regularly***

*Associated for Publicity Purposes*

NATIONAL SEWER PIPE CO. LTD.
HAMILTON — TORONTO
Sales Offices: 320 Bay Street TORONTO

STANDARD CLAY PRODUCTS LTD.
ST. JOHNS, QUE. — NEW GLASGOW, N.S.
Sales Offices: University Tower, MONTREAL

CLAYBURN COMPANY LTD.
VANCOUVER — BRITISH COLUMBIA

ALBERTA CLAY PRODUCTS CO. LTD.
MEDICINE HAT — ALBERTA

# VITRIFIED CLAY PIPE

## PERMANENT AS THE PYRAMIDS


*Powered by a Chrysler Industrial Engine, this Westinghouse 300-Ampere Flex Arc Welder is used to weld tools and casings in oil fields.*

## Chrysler Industrial Engines serve the Empire's Armed Forces, Industry, Agriculture and Construction in Hundreds of Different Ways

Powering generators for electric arc welding is just one of the hundreds of uses to which Chrysler Industrial Engines are daily being applied in industry, agriculture and other fields.

Three sizes of Chrysler Industrial Engines meet a wide variety of power needs with maximum efficiency at minimum cost.

Famous *Chrysler Fluid Drive* is also available to reduce shock loads on the driving mechanism, and greatly prolong the life of valuable equipment.

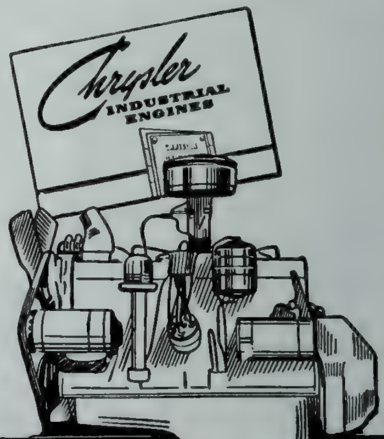
Have you a power problem? Chrysler engineers would like to consider your needs and submit proposals. Write us today.

*Nation-wide Service and Parts Facilities*

**Hundreds of Chrysler Corporation of Canada dealers handle parts for Chrysler Industrial Engines and are equipped to give prompt, efficient service.**

**Write for FREE Booklet**

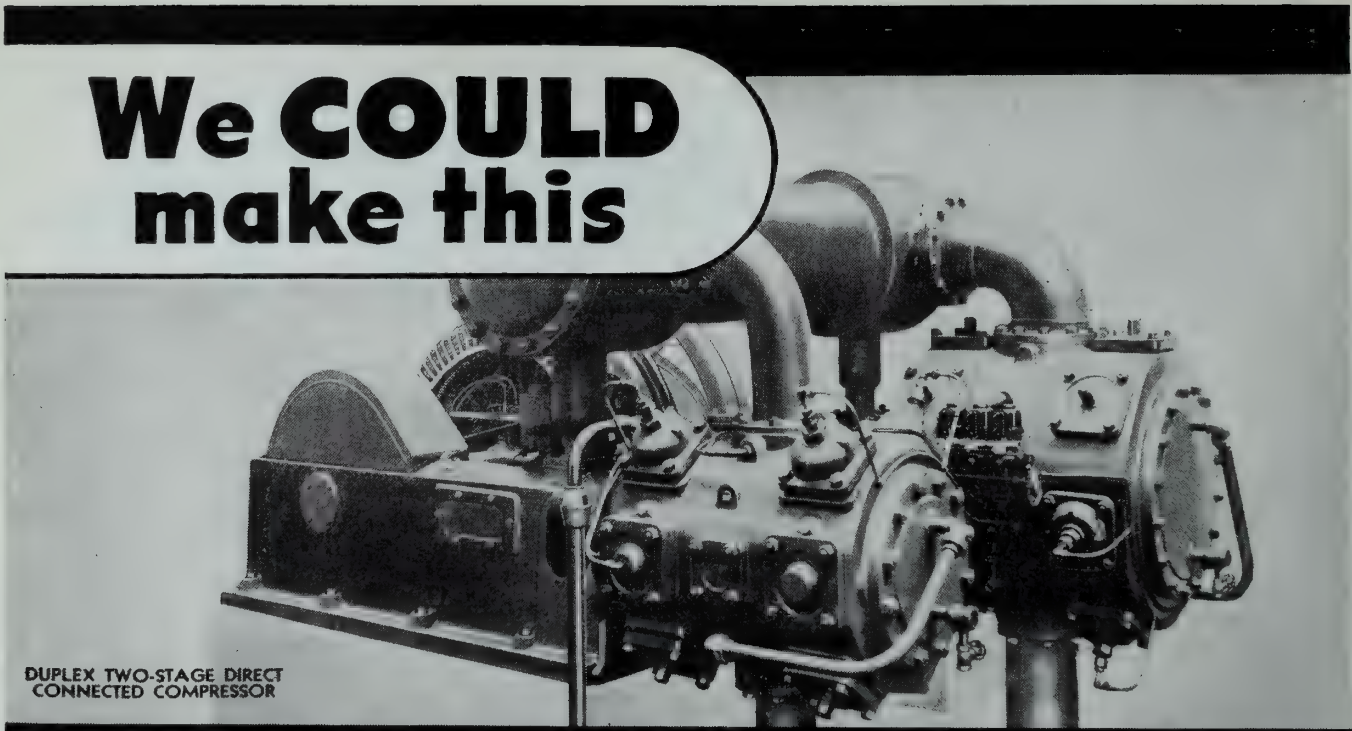
We will be glad to mail you a free booklet showing Chrysler Industrial Engines in action in a wide variety of cases. Complete description, specifications and net horsepower and torque charts. Address Industrial Engine Division, Chrysler Corporation of Canada, Limited, Windsor, Ontario.

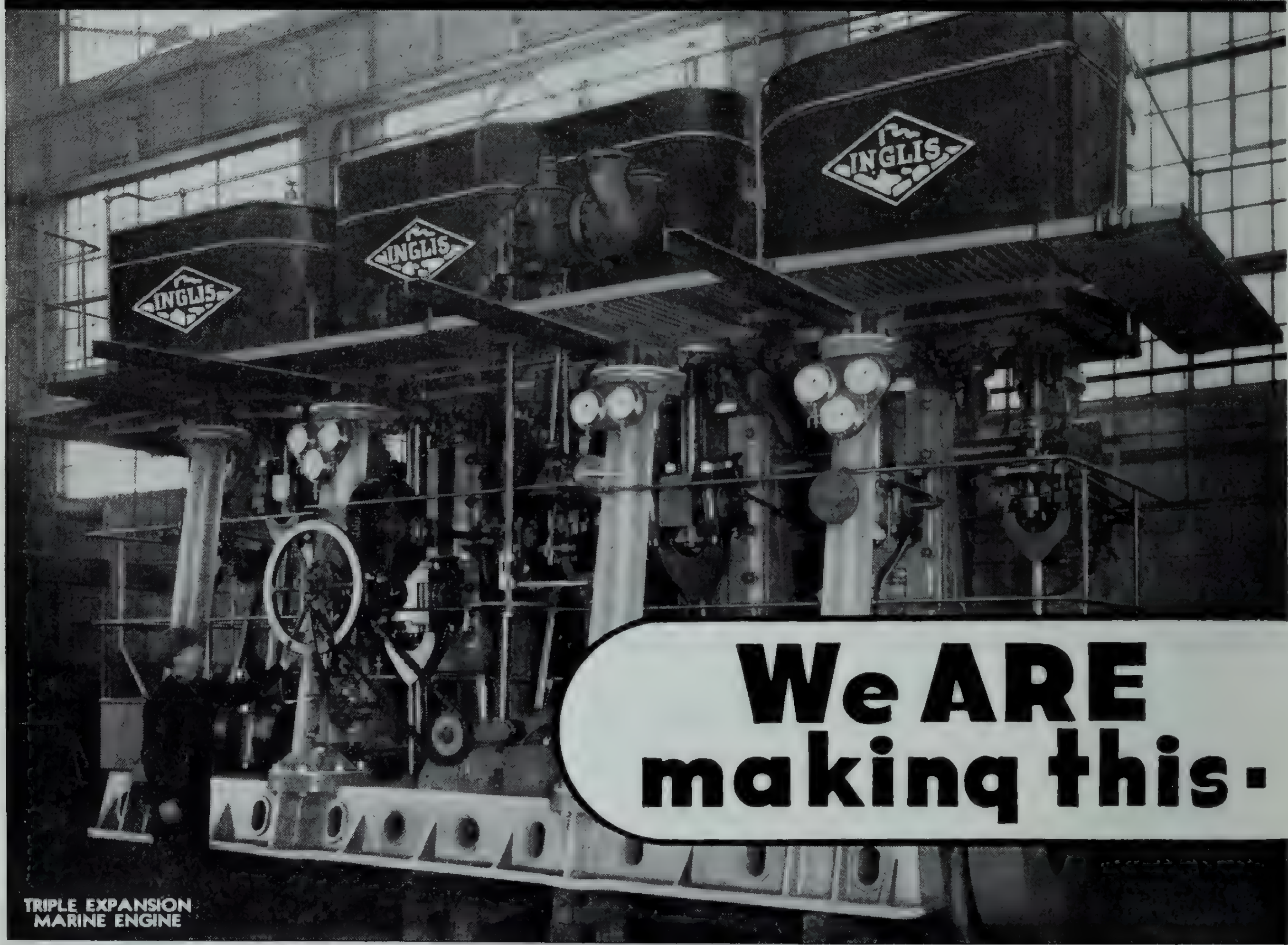



CHRYSLER CORPORATION OF CANADA, LIMITED, WINDSOR, ONTARIO

# Chrysler Industrial Engines

*Built in Canada by Chrysler*


We COULD
make this
DUPLEX TWO-STAGE DIRECT
CONNECTED COMPRESSOR


INGLIS
INGLIS
INGLIS
We ARE
making this ·
TRIPLE EXPANSION
MARINE ENGINE


BATTLESHIP
35,000 Tons
NELSON
A SELECTION OF SHIPS' BADGES of HIS MAJESTY'S Royal Navies
AIRCRAFT CARRIER
23,000 Tons
FREE
As a tribute to the men who "go down to the sea in ships", Gutta Percha have issued a
16 PAGE BOOKLET IN 7 COLOURS ILLUSTRATING 121 BADGES OF THE FIGHTING SHIPS OF HIS MAJESTY'S ROYAL NAVIES.
Also shown are the sleeve markings and shoulder straps indicating the rank of Naval Officers and silhouettes of British Naval Vessels.
We will gladly send you a copy of this booklet. Just drop us a note or fill in and mail the coupon below.
GUTTA PERCHA & RUBBER, LIMITED
THE LARGEST ALL-CANADIAN RUBBER COMPANY
FOUNDED IN 1883
'PERKY' SAYS: "IT'S YOURS FOR THE ASKING"
GUTTA PERCHA & RUBBER, LTD.,
E.J.
160 West Lodge Avenue, Toronto, Canada.
Please send me a free copy of your booklet "Ships' Badges of His Majesty's Royal Navies".
NAME..........
(TO MAKE SURE COPY ARRIVES — PRINT CLEARLY)
STREET..........
TOWN..........
137R-G-42
USE THIS COUPON OR WRITE US ON YOUR LETTERHEAD

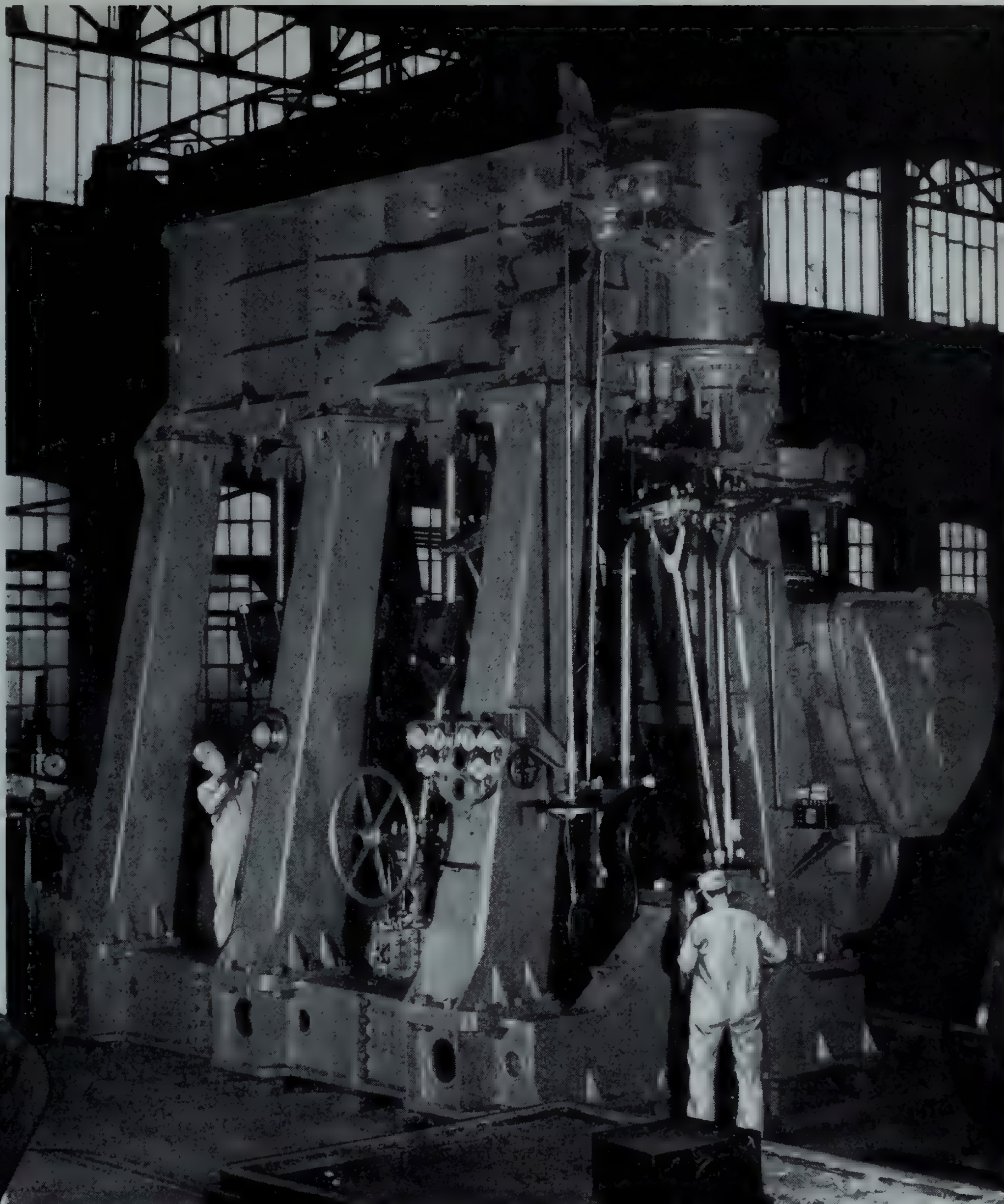
WE BUILD THE

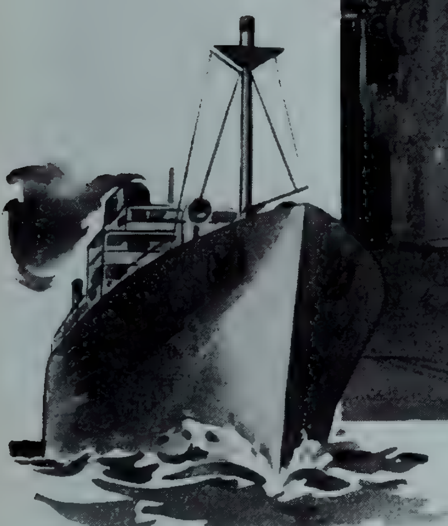
*Ships*

WE BUILD THE

*Engines*

TOO





The heart of any ship is its engine. And every Vickers ship—swift Corvette or sturdy Cargo carrier—has one or more of these Triple Expansion Engines, designed and built by Vickers. These are the pulsing giants that give our Cargo Vessels and Corvettes their tremendous power.

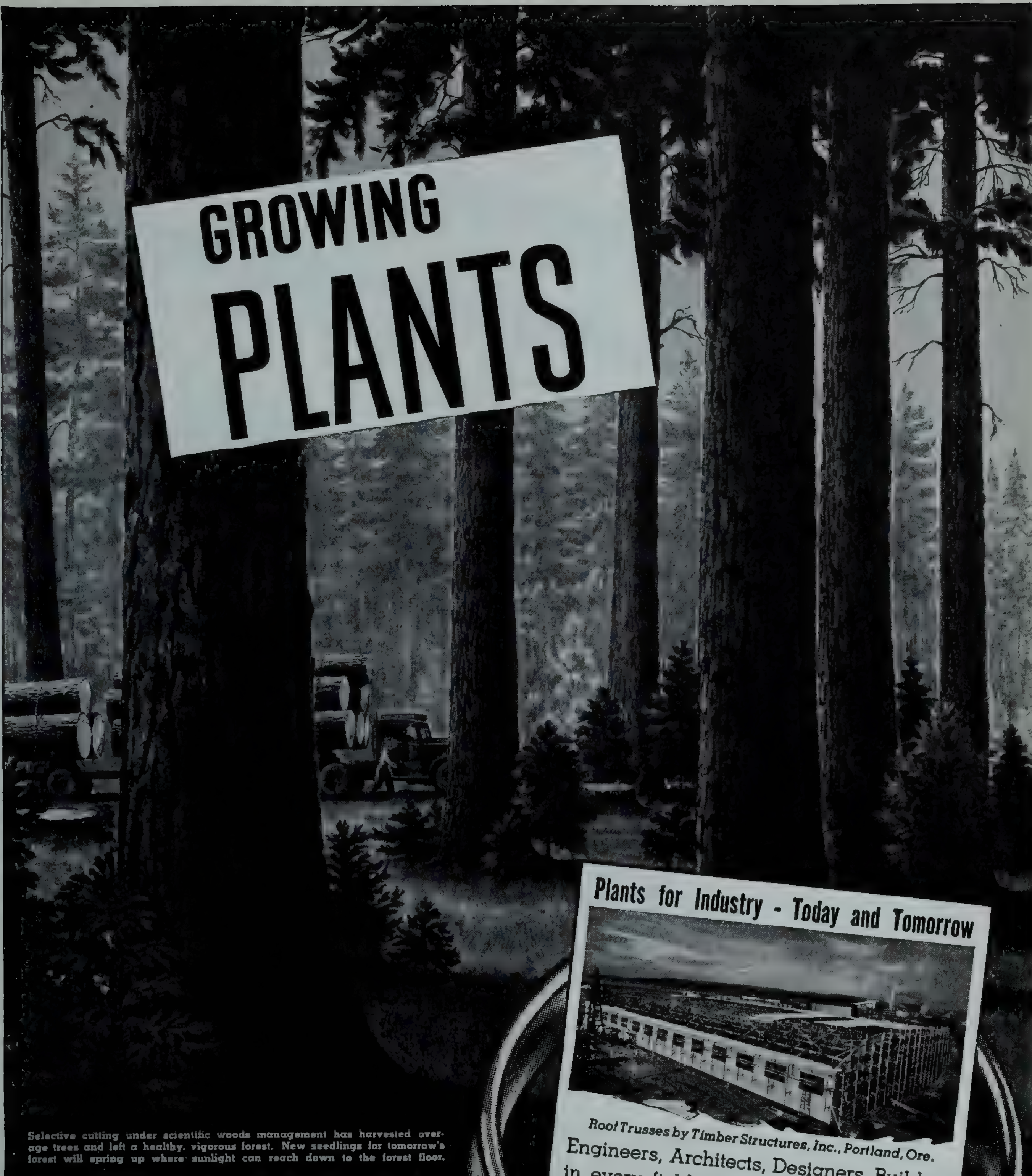
Canadian Vickers are also serving the "home front"...for we are making Vickers-Keeler Boilers and Kidwell Boilers for industry. Many installations have been made which stepped up tremendously the productive capacity of important war plants. Inquiries invited.

IF IT FLOATS OR FLIES VICKERS CAN BUILD IT!

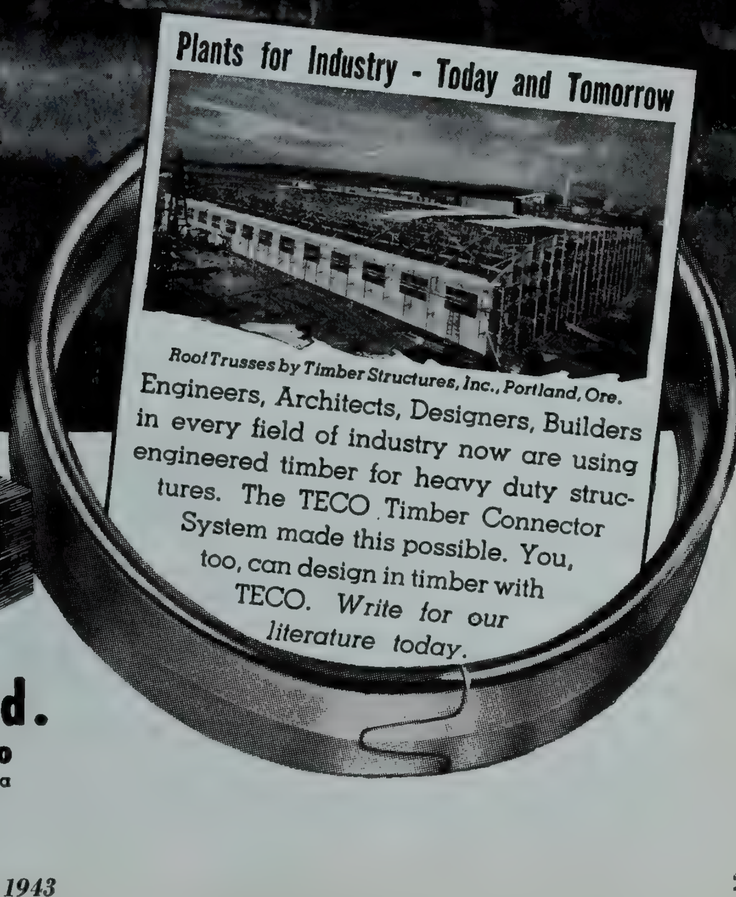
CANADIAN VICKERS LIMITED

HEAD OFFICE - MONTREAL

NEW GLASGOW WINNIPEG DRUMHELLER EDMONTON VANCOUVER

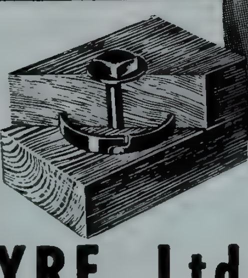



Selective cutting under scientific woods management has harvested over-age trees and left a healthy, vigorous forest. New seedlings for tomorrow's forest will spring up where sunlight can reach down to the forest floor.




Roof Trusses by Timber Structures, Inc., Portland, Ore.

Engineers, Architects, Designers, Builders in every field of industry now are using engineered timber for heavy duty structures. The TECO Timber Connector System made this possible. You, too, can design in timber with TECO. Write for our literature today.



*The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*

# V. H. McINTYRE, Ltd.

**4 St. Thomas Street, Toronto**

Manitoba Bridge & Iron Works, Ltd., Winnipeg, Manitoba

*Distributors for Prairie Provinces and Lakehead*

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, FEBRUARY 1943 | NUMBER 2

"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."

★ ★ ★

# CONTENTS



PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



**Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.**

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1942

**PRESIDENT**
C. R. YOUNG, Toronto, Ont.

**VICE-PRESIDENTS**

*deGASPE BEAUBIEN, Montreal, Que.
*K. M. CAMERON, Ottawa, Ont.
*A. L. CARRUTHERS, Victoria, B.C.
†H. CIMON, Quebec, Que.
†J. L. LANG, Sault Ste. Marie, Ont.
†G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**

*H. W. McKIEL, Sackville, N.B.
†T. H. HOGG, Toronto, Ont.
‡C. J. MACKENZIE, Ottawa, Ont.

**COUNCILLORS**

‡J. E. ARMSTRONG, Montreal, Que.
*A. E. BERRY, Toronto, Ont.
†S. G. COULTIS, Calgary, Alta.
†G. L. DICKSON, Moncton, N.B.
*D. S. ELLIS, Kingston, Ont.
*J. M. FLEMING, Port Arthur, Ont.
*I. M. FRASER, Saskatoon, Sask.
*J. H. FREGEAU, Three Rivers, Que.
*J. GARRETT, Edmonton, Alta.
†F. W. GRAY, Sydney, N.S.
*S. W. GRAY, Halifax, N.S.
†E. D. GRAY-DONALD, Quebec, Que.
†J. HAIMES, Lethbridge, Alta.
*J. G. HALL, Montreal, Que.
‡R. E. HEARTZ, Montreal, Que.
†W. G. HUNT, Montreal, Que.
†E. W. IZARD, Victoria, B.C.
†J. R. KAYE, Halifax, N.S.
*E. M. KREBSER, Walkerville, Ont.
†N. MacNICOL, Toronto, Ont.
*H. N. MACPHERSON, Vancouver, B.C.
*W. H. MUNRO, Ottawa, Ont.
†T. A. McELHANNEY, Ottawa, Ont.
*C. K. McLEOD, Montreal, Que.
†A. W. F. McQUEEN, Niagara Falls, Ont.
†A. E. PICKERING, Sault Ste. Marie, Ont.
†G. McL. PITTS, Montreal, Que.
†W. J. W. REID, Hamilton, Ont.
†J. W. SANGER, Winnipeg, Man.
*M. G. SAUNDERS, Arvida, Que.
†H. R. SILLS, Peterborough, Ont.
*J. A. VANCE, Woodstock, Ont.
*A. O. WOLFF, Saint John, N.B.

*For 1942 †For 1942-43 ‡For 1942-43-44

**TREASURER**
E. G. M. CAPE, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que.

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

### FINANCE
deG. BEAUBIEN, *Chairman*
J. E. ARMSTRONG
E. G. M. CAPE
G. A. GAHERTY
J. A. McCRORY
F. NEWELL

### LEGISLATION
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

### PAPERS
J. A. VANCE, *Chairman*
deG. BEAUBIEN
K. M. CAMERON
A. L. CARRUTHERS
H. CIMON
J. L. LANG
G. G. MURDOCH

### LIBRARY AND HOUSE
W. G. HUNT, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

### PUBLICATION
C. K. McLEOD, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

### BOARD OF EXAMINERS AND EDUCATION
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

### PROFESSIONAL INTERESTS
J. B. CHALLIES, *Chairman*
J. E. ARMSTRONG
G. A. GAHERTY
O. O. LEFEBVRE
H. W. McKIEL
J. A. VANCE

### THE YOUNG ENGINEER
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

### INTERNATIONAL RELATIONS
R. W. ANGUS, *Chairman*
J. B. CHALLIES, *Vice-Chairman*
E. A. ALLCUT
C. CAMSELL
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
M. J. McHENRY
C. R. YOUNG

### MEMBERSHIP
J. G. HALL, *Chairman*
S. R. FROST

### DETERIORATION OF CONCRETE STRUCTURES
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

### WESTERN WATER PROBLEMS
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

### ENGINEERING FEATURES OF CIVIL DEFENCE
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
L. GAGNON
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
G. McL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

### INDUSTRIAL RELATIONS
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
W. O. CUDWORTH
F. W. GRAY
E. G. HEWSON
A. M. REID
W. J. W. REID

### POST-WAR PROBLEMS
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. McL. PITTS
D. C. TENNANT

## LIST OF INSTITUTE MEDALS AND PRIZES

**Sir John Kennedy Medal** .......... For outstanding merit or noteworthy contribution to science of engineering, or to benefit of the Institute.

**Julian C. Smith Medal** .......... For achievement in the development of Canada.

**Duggan Medal and Prize** Medal and cash to value of $100.... For paper on constructional engineering involving the use of metals for structural or mechanical purposes.

**Gzowski Medal** .......... Gold medal.......... For a paper contributing to the literature of the profession of civil engineering.

**Plummer Medal** .......... Gold medal.......... For a paper on chemical and metallurgical subjects.

**Leonard Medal** .......... Gold medal.......... For a paper on a mining subject, open to members of the Canadian Institute of Mining and Metallurgy as well as The Engineering Institute.

**Students and Juniors** . . . Books to the value of $25 (5 prizes). . For papers on any subject presented by Student or Junior members.

**University Students** . . . . $25 in cash (11 prizes).......... For the third year student in each college, making the best showing in college work and activities in student or local branch of engineering society.

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* E. M. KREBSER, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville, Ont.

**CALGARY**
*Chairman,* H. J. McEWEN
*Vice-Chair.,* J. G. MacGREGOR
*Executive,* J. N. FORD, A. GRIFFIN, H. B. SHERMAN
*(Ex-Officio),* G. P. F. BOESE, S. G. COULTIS, J. B. deHART, P. F. PEELE
*Sec.-Treas.,* K. W. MITCHELL, 803—17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* D. HUTCHISON
*Vice-Chair.,* C. W. CARRY
*Executive,* B. W. PITFIELD, E. R. T. SKARIN, J. A. ALLAN, E. ROBERTSON, J. W. JUDGE
*(Ex-Officio),* J. GARRETT, R. M. HARDY
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B. STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical' Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON, R. J. G. SCHOFIELD, NORMAN EAGER, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, STANLEY SHUPE, A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN, 427 Concession Street, Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN, J. R. CARTER, J. D. LEE
*(Ex-Officio),* T. A. McGINNIS, D. S. ELLIS
*Sec. Treas.,* R. A. LOW, Dept. of Civil Engineering, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* MISS E. M. G. MacGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL, R. B. CHANDLER, S. E. FLOOK, O. J. KOREEN, S. T. McCAVOUR, W. H. SMALL, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER, J. M. FLEMING
*Sec. Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* F. T. JULIAN
*Vice-Chair.,* T. L. McMANAMNA
*Executive,* F. C. BALL, V. A. McKILLOP, H. F. BENNETT, A. L. FURANNA, R. S. CHARLES
*(Ex-Officio),* R. W. GARRETT, J. A. VANCE
*Sec.-Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* H. J. CRUDGE
*Vice-Chair.,* J. A. GODFREY
*Executive,* A. S. DONALD, E. R. EVANS, E. B. MARTIN, H. W. HOLE, G. C. TORRENS
*(Ex-Officio),* F. O. CONDON, G. L. DICKSON, H. W. McKIEL
*Sec. Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R., Moncton, N.B.

**MONTREAL**
*Chairman,* J. A. LALONDE
*Vice-Chair.,* R. S. EADIE
*Executive,* R. E. HEARTZ, J. B. STIRLING, J. M. CRAWFORD, J. COMEAU, H. F. FINNEMORE, R. C. FLITTON, G. D. HULME
*(Ex-Officio),* deG. BEAUBIEN, J. E. ARMSTRONG, J. G. HALL, W. G. HUNT, C. K. McLEOD, G. McL. PITTS
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* C. G. CLINE
*Vice-Chair.,* G. E. GRIFFITHS
*Executive,* A. G. HERR, R. T. SAWLE, G. F. VOLLMER, W. D. BRACKEN, J. W. BROOKS, J. H. TUCK, D. S. SCRYMGEOUR
*(Ex-Officio),* A. L. McPHAIL, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 1870 Ferry Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY, G. A. LINDSAY, R. YUILL, W. H. B. BEVAN, J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY, K. M. CAMERON, N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON, Dept. of Mines & Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* D. J. EMERY
*Executive,* C. R. WHITTEMORE, F. R. POPE, I. F. McRAE, R. L. DOBBIN, A. J. GIRDWOOD
*(Ex-Officio),* J. CAMERON, H. R. SILLS
*Sec.-Treas.,* A. R. JONES, 5, Anne Street, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldgs., Quebec, Que.

**SAGUENAY**
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER, J. FRISCH, B. BAUMAN, G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS, N. F. McCAGHEY, J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, P.O. Box 33, Arvida, Que.

**SAINT JOHN**
*Chairman,* D. R. SMITH
*Vice-Chair.,* A. O. WOLFF
*Executive,* H. P. LINGLEY, C. D. McALLISTER, C. C. KIRBY
*(Ex-Officio),* F. A. PATRIQUEN, V. S. CHESNUT, G. G. MURDOCH
*Sec.-Treas.,* G. W. GRIFFIN, P.O. Box 220, Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* VIGGO JEPSEN
*Vice-Chair.,* J. H. FREGEAU
*Executive,* E. BUTLER, R. D. PACKARD, A. C. ABBOTT, R. DORION, H. J. WARD, E. T. BUCHANAN, J. JOYAL, H. G. TIMMIS
*(Ex-Officio),* A. H. HEATLEY
*Acting Sec.-Treas.,* VIGGO JEPSEN, Consolidated Paper Corporation, Grand'Mère, Que.

**SASKATCHEWAN**
*Chairman,* A. P. LINTON
*Vice-Chair.,* A. M. MACGILLIVRAY
*Executive,* F. C. DEMPSEY, N B. HUTCHEON, J. G. SCHAEFFER, R. W. JICKLING, H. R. MacKENZIE, B. RUSSELL
*(Ex-Officio),* I. M. FRASER
*Sec.-Treas.,* STEWART YOUNG, P. O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK, C. R. MURDOCK, G. W. MacLEOD, K. G. ROSS, H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG, A. E. PICKERING, L. R. BROWN
*Sec. Treas.,* O. A. EVANS, 159 Upton Road.

**TORONTO**
*Chairman,* W. S. WILSON
*Vice-Chair.,* W. H. M. LAUGHLIN
*Executive,* D. FORGAN, R. F. LEGGET, S. R. FROST, F. J. BLAIR, E. G. HEWSON, C. F. MORRISON
*(Ex-Officio),* C. R. YOUNG, T. H. HOGG, A. E. BERRY, N. MacNICOL, H. E. BRANDON, J. J. SPENCE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD, R. E. POTTER, I. C. BARLTROP, E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT, H. N. MACPHERSON
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD, A. N. ANDERSON, F. C. GREEN, J. H. BLAKE
*(Ex-Officio),* A. L. CARRUTHERS, E. W. IZARD, A. S. G. MUSGRAVE
*Sec. Treas.,* R. BOWERING, 41 Gorge Road West, Victoria, B.C.

**WINNIPEG**
*Chairman,* D. M. STEPHENS
*Vice-Chair.,* J. T. DYMENT
*Executive,* C. V. ANTENBRING, N. M. HALL, T. H. KIRBY, E. W. R. BUTLER, H. B. BREHAUT
*(Ex-Officio),* J. W. SANGER, V. MICHIE, C. P. HALTALIN
*Sec.-Treas.,* THOMAS. E. STOREY, 55 Princess Street, Winnipeg, Man.

# FABRICATION OF LAMINATED TIMBER MEMBERS

***Principles Employed in Design and Manufacture of Built-Up Units***

VERNE KETCHUM, M.Am.Soc.C.E.
*Chief Engineer, Timber Structures, Inc., Portland, Ore., U.S.A.*

**Paper presented at Fall Meeting of the American Society of Civil Engineers, held jointly with the Engineering Institute of Canada, at Niagara Falls, Ont., on October 15, 1942**

**SUMMARY—Wooden beams with spans as great as 70 ft., and wooden trusses as long as 200 ft. are now possible through the use of glued laminated construction. One of the pioneers in this field, Mr. Ketchum, has promoted the development of commercial procedures that permit the economical use of smaller lumber sizes for the building of larger structures.**

Use of laminated timber in construction has increased steadily during the last few years. Especially during 1942, with the shortage of structural steel, the rate of increase has been greatly accelerated. Although lumber in various forms has to a large extent taken the place of steel for trusses and building frames, even in steel shop plants, the design and manufacture of laminated members and structures is subject to daily developments and improvements, and many new designs and details will be tested and used. However, some general information on fabrication processes has been established and can be given.

The basic principle in this type of construction is the combination of lumber, adhesives, and other materials to secure a structurally adequate product at a low price. It is not the aim to produce the most excellent structure that can be made, as that would entail a waste of materials, plant, and man-power. The aim is rather to secure reasonable strength by the most economical means.

For instance, where joints in the laminations are outside the section of maximum stress, butt joints are generally used because, though not the strongest type of joint, they are sufficiently strong in this position. It is a waste of lumber, glue, labour, and plant to furnish scarf joints which give 100 per cent strength when this full strength is not required.

Laminated construction using dry lumber has the distinct advantage of producing a member that will not check, warp, or distort after it has been put in place. The lumber is dried in small sizes, providing a better member in a much shorter time. Also, laminated members can have their sizes increased at the critical sections without increasing the size of the entire piece. With this type of construction, curved, cambered, or tapered members, which are pleasing to the eye, can be economically molded or shaped to the design size. These have been used extensively for curved and straight chords in trusses, for two-hinged and three-hinged arches, and for beams and columns.

It is now possible to construct beams of 70-ft. span, wood trusses 200 ft. long, and wood arches 200 ft. or more in span, using glued laminated construction. Columns can be built to take care of combined vertical loads and bending stresses and can be provided with corbels or enlarged ends.

The bowstring has long been considered one of the most economical types of trusses. Prior to the extensive use of laminated construction, it was necessary to build up the curved top chord at the site using 1 or 2-in. pieces and spiking or bolting them together to the desired curvature. Overlapped segmental pieces which had the top side band-sawed to the desired curve were also used. The top chords of these trusses may now be built up using glued laminated construction, which gives the strength and appearance of a single solid piece.

## Standard Lumber Sizes Used

To-day, nearly all laminated construction utilizes either Douglas fir, yellow pine, or hemlock. These species are the most plentiful of those suitable for such construction. The sizes of lumber used depend largely on whether the finished member is to be straight or curved. It is not practical to dry lumber for this purpose in thicknesses greater than the standard 2-in. commercial plank and this is the most economical thickness. Practical experience has shown that the thickness of a lamination should not be more than 1/150 of the radius of curvature. Such pieces bend readily and do not build up high initial stresses. Lumber of almost any width and length can be used provided that the lateral and horizontal splices are properly staggered and jointed.

Lumber used in laminated construction may be Dense Select Structural or lower grades. A very large percentage at the present time is No. 1 common lumber with a slope of grain of 1 to 10, conforming to Paragraph 215 of "Standard Grading and Dressing Rules" authorizing the use of a stress grade of 1,200 lb. per sq. in. This classification is for ordinary solid lumber cut green and air-dried under ordinary conditions.

*The Douglas Fir Use Book* states: "In dimensions sizes 4 in. and less in thickness, the development of defects during seasoning does not offset the increase in strength from drying as much as in larger sizes, and in these sizes used in dry locations, working stresses in extreme fiber in bending and compression parallel to grain are increased proportionately from equal grades of larger timbers."

This condition applies to practically all laminated construction since the requirement here is for small sizes of dry lumber. It would seem, therefore, that the use of the next higher stress grade or an increase to 1,400 lb. per sq. in. for laminated lumber under Paragraph 215 would be fully justified. The values given in Table I are those used and recommended by Timber Structures, Inc., of Portland, Ore.

Table I

Values in Pounds per Square Inch, for No. 1 Common Douglas Fir According to Paragraph 215

| | Solid—No Guarantee on Moisture Content | Laminated Dry Gluing Stock |
|---|---|---|
| Bending compression | 1,200 | 1,400 |
| Direct compression | 1,000 | 1,100 |
| Compression across grain | 325 | 325 |
| Horizontal shear | 120 | 120 |
| Modulus of elasticity | 1,600,000 | 1,600,000 |

We recommend that the values for other stress grades be increased accordingly. On Government work specifications allowing much higher stresses for the duration of the war emergency are now being used.

## Moisture Content of Lumber

For wood used in casein laminated construction, the moisture content may be from 10 to 20 per cent, and no close control of this content is necessary to produce good work. A moisture content from 10 to 15 per cent is ordinarily the most suitable. The moisture content of the lumber should be close to what it will attain in the actual structure to avoid a tendency for the glue joint to work during the seasoning process. It has been found that wood under cover in various parts of the United States will, under ordinary conditions, eventually reach a moisture content of from 8 to 15 per cent. Timber attains its maximum expansion at a moisture content of 28 to 30 per cent, and a greater content does not change the shape or size of the piece.

Two general types of glue are used in ordinary laminated construction—waterproof resin glue and water-resistant casein glue. The resin glue, while being as cheap per pound as the casein, and requiring less glue per unit of area, has other disadvantages which have cut down its use. It requires an operation temperature of over 70 deg. F., a higher finish than is found on commercial lumber, more care in spreading, higher pressures, and much more care in all other operations of manufacture. These requirements restrict resin gluing to work done by experts in temperature-controlled factories and prohibit its use at building sites.

Casein glue is now used almost entirely for ordinary construction. It is sold in powder form, usually in barrels, and must be stored in a dry place. One pound of the powder is usually mixed with two pounds of cold water to form from 1½ to 2 quarts of glue mixture, which will cover about 35 sq. ft. of surface. Small gluing operations can be done with a standard 12-quart pail but large ones require a mechanical mixer. In small operations the glue may be applied to the lumber using a 3-in. brush or larger, made of stiff vegetable fibers which will withstand the alkaline action of the glue and retain sufficient stiffness for efficient spreading. On large operations it is almost necessary to have a mechanical spreader. It will also be necessary to have a number of strong clamps for applying pressure. A sufficient number of clamps will have to be used to allow them to remain on the finished pieces until the glue has properly set.

Mixing of casein glue is usually done in a large tank by mechanical means and should be under the control of one man only per shift. The glue powder should be added slowly to the water and mixed for some 3 to 5 minutes until the mass thickens. The mixer should then be stopped and the mass allowed to rest for 15 minutes. After this period it should be again mixed for 2 to 3 minutes until the glue smooths out like heavy cream, ready for use.

Casein glue remains liquid and usable for a period of 6 to 8 hours at 70 deg. F., and 4 to 6 hours at 90 deg. F., but it gradually thickens into a rubbery mass which must be discarded. Therefore, only enough should be mixed at one time for one working shift.

### Mechanical Application of Glue

Glue is spread on the lumber with one of the standard types of spreaders which have been in use in various mill working plants for years. The spreader consists of sets of motor-driven rolls which revolve in a tank of glue and apply the glue to the board as it passes between the rolls. The rolls, being corrugated and under light pressure, apply a thin film to one or both sides of the board, as required. Depending on assembly time, moisture content of wood, and working temperature, sufficient glue should be applied so that the film will be moist when the pressure is applied. An ordinary lumber carrier can be used to move up the raw materials and to take away the finished product.

The working temperature for casein gluing may be anywhere above 50 deg. F., either for indoor or outdoor work. The glue and the lumber should be about the same temperature, and the water should be between 60 and 75 deg. F.

After the glue has been applied and the lamination put in place, it is necessary to apply pressure to the member. This may be done by either of two methods. The first consists of driving nails long enough to extend through at least two full laminations. Sufficient nails should be used so that for each 8 sq. in. of glued joint, there is at least one nail passing through a lamination on each side of the joint. For example, when laminating boards 2 in. thick, there should be one 20d nail head for each 8 sq. in., or one 60d nail head for each 16 sq. in. The other method of applying pressure consists of the use of standard clamps, which may consist of a commercial type of C-clamp or a homemade clamp using angles and bolts. Where laminated work is manufactured in a shop, the usual practice is to use nails only to hold down the ends of pieces, and to employ clamps for all the rest of the work. At the building site, where clamping equipment is not often available, nails are used entirely, as this method lends itself readily to use by inexperienced workmen with meager equipment. Practice has shown that it is better to use clamps throughout, even on the ends of pieces, than to use nails. It is the opinion of experienced manufacturers that the nailing method is inadequate to develop the pressures necessary for good work.

The pressure on glued joints should range from not less than 100 lb. per sq. in. to not more than 200, and should be applied by the use of jacks, clamps, or other equipment. Pressure should be applied within 20 minutes after the glue is spread on the lumber if it is applied to both faces meeting at a joint. If the glue is applied to one face only, the pressure should be applied within 15 minutes and should be maintained for at least 12 hours after the addition of the last lamination. As a general rule, the pressure should remain on the finished piece from 6 to 12 hours, depending on the moisture content of the wood and the temperature of the operation.

### Several Types of Joints Used

Scarfed joints may be formed in several ways, either by using a straight tapered bevel for both ends of the jointed members or by using various combinations of daps and bevels. Tests made by some authorities have indicated that a scarf with a straight bevel from 1:8 to 1:15, depending on the kind of wood used, will produce a full-strength scarf. It is recommended that a standard of 1:12 be adopted. Four types of joints are shown in Fig. 1.

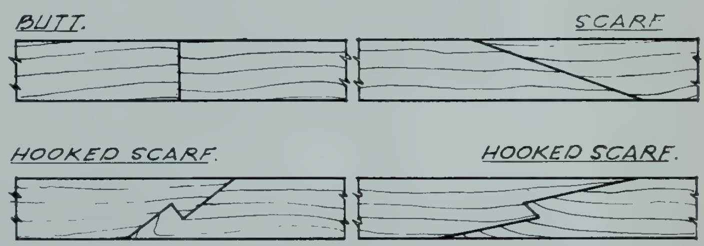



**Fig. 1—Four types of joints for laminated members.**

The location of scarf joints in compression members is not very important, and providing the two ends are in bearing no loss in strength results. A good bearing between butt joints, however, is very hard to obtain. For members in tension, such as the bottom chords of trusses or the tension side of beams, either the laminations must be scarfed and glued to full strength, or the loss of strength in the lamination must be taken into account in the design.

It is apparent that the laminations of beams which are spliced in areas of no tension can be butt-jointed without loss of design strength. Similarly, in areas of small tension, some laminations can be butt-jointed. In areas of high or full tension stress, however, lamination splices should be scarfed for full design strength. By careful arrangement, it would seem that in most cases all laminations could be butt-jointed and such joints located outside the areas of high tension. While the locations mentioned are more or less arbitrary, it should be recalled that nearly all beams are designed by arbitrary methods, and lamination splices may be considered in the same way.

A consideration of the distribution of stress through a beam will show that a lamination near the quarter point of the depth of the beam has a working value of only about ⅓ that of a lamination at the top of the beam, and a lamination at the center has practically no working value in tension or compression at all. It is thus apparent that a lamination in the middle of the beam may be composed of lumber having a lower stress grade, or may be butt-jointed with a relatively small loss of strength to the beam.

Since the maximum bending moment in a beam under static load occurs at one point only, the full design strength is required only at that point. In a beam of uniform section there is a reserve of strength in all other parts. Speaking now only of bending moments, we find that the full strength of a lamination in tension is required in only one lamination at only one point, and that is the extreme lamination on the tension side at the point of maximum bending moment. The reserve of strength in the remainder of the beam may be taken into account when considering splices and the stress grade of lumber to be used. Of course the stress grade of the timber will also have to be considered for the lamination under extreme compression at the point of maximum bending moment.

Authorities recommend that unscarfed joints be not closer together longitudinally than 40 times the thickness of the lamination so that there will be sufficient length for the proper transfer of the stress around the joint. It is also recommended that scarfed joints be placed not closer together than 25 times the thickness. Wherever possible, the outer lamination should be in one piece, but if not, at least it should extend in one piece across the section of maximum stress, as it is very difficult for the full stresses in the outer lamination to be transferred around a splice. All joints in curved members should be scarfed, as otherwise it is almost impossible to hold the jointed ends in position to form a satisfactory member. Some manufacturers scarf-splice all laminations in advance of assembly. First, the ends of the boards are scarfed and glued to form a lamination the full length of the member. When dry, this lamination is run through a planer to bring the scarfed joint to the same thickness as the remainder of the lamination. This planing is usually necessary as the ends of scarfed joints tend to "ride up" on each other, producing a thickening in the splice. Such a splice, if placed in the member without planing, would produce a bulge and adjoining opening. These laminations may then, of course, be treated the same as a full-length lamination without

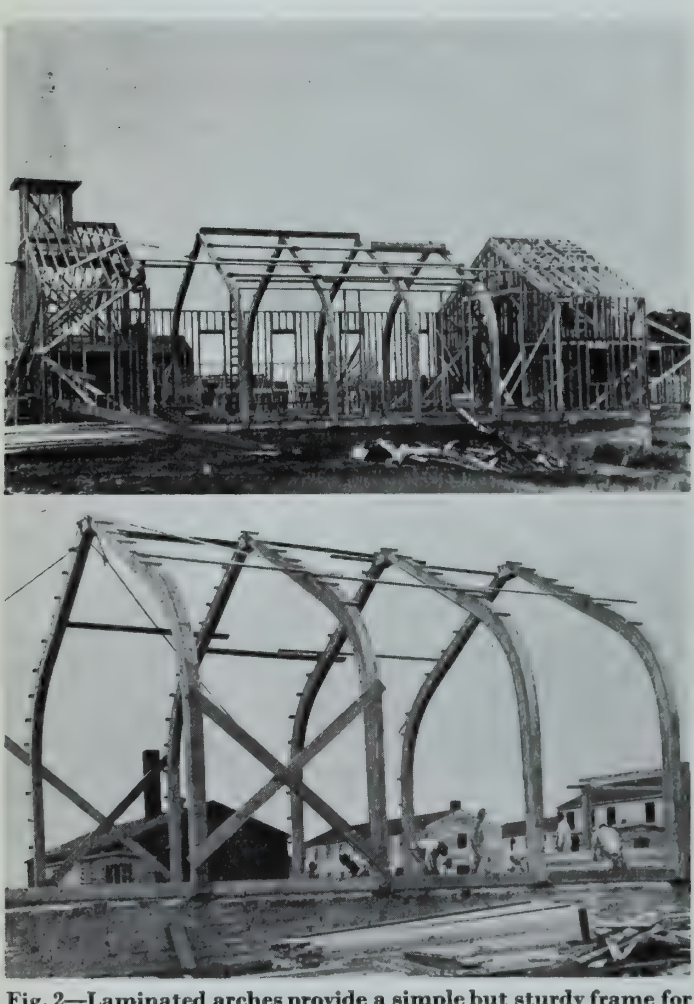


**Fig. 2—Laminated arches provide a simple but sturdy frame for an army camp chapel.**

scarfs and can be assembled into the member to produce a very satisfactory although more costly unit.

Thus two methods are available—the pre-glued scarf lamination just described, and the method of placing all the laminations directly in the member and gluing all the boards and joints in one operation. The choice between these two methods may well be based on the type, cost, and quality of the structure. Some successful manufacturers use the plain pre-glued and planed scarf-joint type throughout in preference to the butt or stepped scarf joint and maintain that they are thus able to produce a better product at little or no additional cost.

Many designers have insisted that steel stitch bolts be placed at short intervals through glued laminated members to help hold them together. These bolts are apparently intended to bolster up the strength of the glue for fear it will fail after the structure has been put together. We believe that glued, laminated construction as built during the last few years has given such satisfactory results that this lack of faith in glue is entirely unwarranted.

It is very hard to hold the extreme end of a lamination to a predetermined curve, and curved members will tend to straighten out slightly when the clamps and forms are removed. This springback is not great, but may sometimes be $\frac{1}{4}$ or $\frac{3}{8}$ in. in a 40 or 50-ft. truss chord. It seems to require some experience to forecast the amount of this springback, which can only be prevented by slightly distorting the curve, that is, by slightly accentuating it at the ends, from a point 3 or 4 ft. back.

### Preparation of Lumber for Gluing

All surfaces to be joined by gluing should be finished or machined; rough lumber should not be used. With casein glue, the ordinary finish such as is found on commercial 2-by-4's and 2-by-6's is satisfactory. The lumber to be used should be free of grease, dust, and dirt. To produce a good finish on the assembled member, exposed surfaces may be planed or sanded. Such finishing may be done as soon as the glue has hardened. An ordinary floor sander has been used for this work. Where it is intended to plane or sand the finished top chord of trusses or other members, the changed dimension should be considered in the design and in the detailing of any adjoining connections. For example, a top chord built up out of 2-by-6's would have a lateral dimension of $5\frac{1}{2}$ in. assembled, but after planing it would be cut down to approximately $5\frac{1}{8}$ in.

From experience to date, it seems safe to assume that casein-glued laminated construction will last as long as solid wooden members of any but the more durable species or treated material. The longest experience for glued prefabricated construction in the United States is about six years, and 30 years for built-in-place structures. The characteristics of casein glue render it unsuited for use in members in contact with damp earth or where the moisture content of the wood may repeatedly exceed 20 per cent. Properly made glued joints on all woods commercially used for construction framing have a shear strength of 3,000 lb. per sq. in. This means that under extreme strain breakage would be in the wood rather than in the glued joint. Test pieces used by the glue manufacturers must be made of hard maple in order to secure any breakage in the joint.

Fireproofing treatments consist of impregnating the wood with various salts and compounds under pressure in sealed cylinders. During the treatment the moisture content is increased to between 60 and 75 per cent under a pressure of 100 to 160 lb., and the temperature is 125 to 175 deg. F. Glue manufacturers claim that casein-glue joints will maintain 100 per cent joint value during any known fireproof treatment but that casein glue cannot be applied to lumber that has previously been fireproofed. Laminated members using resin glue will not stand up under fireproof treatment, but resin glue can be applied to lumber that has previously been fireproofed.

Glued-up laminated members using resin glue cannot later be treated by the Wolmanizing process of preservative treatment, but finished members using casein glue can later be treated by this process. Casein glue cannot be used on laminations that have been treated by the Wolmanizing process, but resin glue can be. Laminated built-up members can receive preservative treatments using a creosote base, but laminations that have been treated with a creosote material cannot be later glued either by resin or by casein glue.

At present, laminated construction is somewhat more costly than solid construction. Quotations for some recent jobs would indicate that the construction costs of laminated material delivered to the job were about 35 per cent higher, per thousand board-feet, than those for solid construction. The laminated construction gives a superior product and often this higher cost is justified. Also, laminated construction often permits the construction of larger structures and longer spans than would otherwise be feasible. Connecting hardware, ironwork, assembly, erection, engineering, and general overhead would be the same for both types of construction.

Where members are glued up at the site, they may be finished to any size which can be erected by the available equipment. Where they are built at a shop, at a distance from the site, splices must be used so that the pieces can be transported. It is usually not practical to transport pieces larger than 8 by 40 ft. on railroad cars, and highways have overhead clearances and legal restrictions that must be considered.

Laminated construction requires the very minimum of bolts, connectors, washers, and other steel items, and often avoids the use of steel entirely except for anchorage details. While laminated construction is relatively new in this country, the design follows old established principles, and the proper manufacture can be easily and quickly learned by men experienced in other lines of building construction. Both laboratory and field tests give conclusive proof of the usefulness and durability of this type of construction, and conservative owners and engineers should not hesitate to use this valuable material.

**Fig. 3—Fabrication of a truss web member in the shop. Note that one end is giving a square cut and the other end a bevel cut at the same time.**

Further progress in the manufacture of glues, and the development and simplification of fabrication processes for laminated members are continually improving this product and reducing its costs.

## NATIONAL RESEARCH COUNCIL SERVES WAR DEPARTMENTS

Scientific research in Canada during the past three years has been directed almost wholly to the solution of new and urgent problems arising out of the war. The National Research Council is serving as a central co-ordinating body directing research within its own laboratories and in the universities and industry. The Council has been appointed the official research station of the Navy, Army and Air Force in Canada. The close co-operation between Service personnel and research staff thus made possible has been a large factor in promoting the application of science to military problems.

#### FOR THE NAVY

Scientific problems arising in connection with the work of the Navy are studied jointly by officers from Naval Headquarters and civilian personnel on the Council's staff. Decisions can thus be taken promptly and work started without delay. The National Research Council maintains civilian scientific groups at several points on both the Atlantic and Pacific coasts who work in the closest co-operation with the Naval stations. A sizeable group is also located in Ottawa and contact is maintained with similar research stations in the United States and Great Britain.

Many of the problems presented relate to the supply of materials and the preparation of specifications. Highly technical problems have arisen from anti-submarine warfare and minesweeping operations. Several sections of the Division of Physics and Electrical Engineering are concerned almost exclusively with research and development programmes for the Royal Canadian Navy. In the electrical engineering section a shock and vibration machine based on standard British Admiralty design has been installed. The specifications for building the machine were modified to permit the use of Canadian materials. This machine is used for testing resistance to shock of various electrical equipment, such as switches, rheostats, junction boxes, lighting fixtures used by Navy and merchant ships. From the results obtained, specifications for all electrical equipment for the purposes enumerated are being developed as required. Problems investigated in the electrical engineering section have included studies of gear for magnetic minesweeping. A rocking machine to simulate the rolling of a boat has been constructed and tests of various instruments have been made on this unit.

In the Division of Chemistry many problems of interest to the Navy have been investigated. Work on paints, rubber, low-alloy high-strength steels and aluminum alloys, and sea-water resistance of various coatings and inhibition of corrosion of various metals by chemicals may be mentioned. In the Division of Mechanical Engineering likewise, the several laboratories are engaged on numerous problems for the Navy, notably in matters relating to engines and their lubrication, the design and test of boats of various types.

#### FOR THE ARMY

For the Army and also for the other Services all kinds of supplies have had to be tested to determine whether they are acceptable according to required military standards. Apparatus has been developed and constructed for work in ballistics on an increasing scale. Measuring equipment for munition proof and gun proof has been developed and is in continuous service at proving grounds. Problems on the direction of gun-fire have been attacked with success. Numerous tests have also been made on the armouring properties of various materials and work is in progress on the improvement of anti-aircraft projectiles.

An important war service was rendered in 1939 by promoting the development in Canada of optical glass manufacture for the production of precise optical parts for military equipment. The project is now being carried forward in production by a Government-owned company.

*(Continued on page 108)*

# ELECTRIC ARC WELDING

W. R. STICKNEY, M.E.I.C.
*Welding Engineer, The Canadian Bridge Co., Ltd., Walkerville, Ont.*

**Paper delivered before the Border Cities Branch of the Engineering Institute of Canada on November 27th, 1942**

## Introduction

It is not necessary to cite examples or give statistics to show the rapid increase in the use of metallic arc welding during recent years. This process is no longer a convenient or makeshift method of making repairs or fastening unimportant parts in place but has become the preferable, and in many cases the *only* satisfactory means of joining parts of important structures. Whereas the last Great War stimulated the use of welding in repair work, this war sees arc welding as perhaps the most important "victory tool" in history. The modern fighter planes and flying fortresses could not be built without it; the speed records we have seen established for fabricating cargo vessels and warships, the rapid production of military vehicles, tanks, guns and shells—in all these fields and more arc welding has proved to be one of the major factors in the successful production of all vital war materials.

This widespread use is due to improvement in the quality of weld metal made possible partly by better welding equipment, partly by the greater experience of engineers, operators and supervisors, but primarily, as will be shown later, to the development of modern electrodes.

Much of the following material has been abstracted from published papers and reports, and may serve to point out some of the outstanding features of present day metal arc welding practices, such as processes, electrodes, equipment, qualification and training of operators, preparation for welding, heat and mechanical problems, inspection and testing, and some recent developments.

## Welding Processes

A weld may be defined as a localized consolidation of metals by a welding process, made with or without filler metal, for uniting like metals in order to transmit considerable stress. The definition, however, includes subsidiary processes such as brazing and soldering, in which unlike metals are to be joined but whose products are not usually intended to transmit much stress. All welding processes require the application of heat, but some of them, for example forge and resistance welding, require the simultaneous application of pressure and heat.

There are three major types of welding which do not require pressure, namely electric arc welding, thermit welding and gas or oxy-acetylene welding: as a group they are classed as fusion welding in specifications and codes governing the fabrication of welded products and all have identical basic design requirements. In electric arc welding there are again three types of welding processes,—atomic hydrogen, carbon arc and metal arc. This paper will be confined to a discussion of the latter process.

Metal arc welding consists of a localized progressive melting and flowing together of adjacent edges of base metal parts by means of temperatures of approximately 10,000 deg. F. from a sustained electric arc between an electrode and the base metal. The melting electrode furnishes the filler metal, the arc being maintained by manually or automatically feeding the melting electrode at a uniform rate toward the base metal. 'Weld metal' is, therefore, that portion of the base and filler metals which has been melted during the welding operation.

When using direct current for welding, the heat developed at the positive terminal is greater than that developed at the negative terminal. Therefore, in view of the greater heat required to bring the base metal, or work, to the welding temperature, it is customary to attach this to the positive terminal of the generator, and the electrode to the negative terminal; this is called straight polarity welding. Under certain conditions, as when welding thin material or using some types of coated electrodes, the connections are reversed, giving rise to the expression—"welding with reversed polarity."

## Welding Rods and Electrodes

The ideal weld is one having the same properties as the parts joined. Such a weld when made in any arc welding process can be obtained only by effectively protecting the molten filler metal from the oxidizing and nitrogenizing effects of air during the entire range of liquification and solidification. Originally, all metal arc welding was done with bare electrodes; then it was discovered that a thin coating of lime gave much greater stability of arc and ease of welding. Bare rods of this type are seldom used today, since the welds are quite brittle, show very little elongation and have a low ultimate tensile strength. This is because the molten metal, being exposed to the air when passing through the arc, readily forms iron oxide and iron nitride which are hard and brittle. The melting rate of a bare rod is also much less than that of the same size of coated electrode.

The first covered electrode used was a bare rod wrapped in cardboard; the heat of the arc burned the cellulose producing carbon monoxide and hydrogen, both of which are splendid de-oxidizing agents, and resulting in a tougher and more ductile weld metal. Later on, mineral salts were used as a shielding medium and later still it was found that various minerals and their oxides added to the coating resulted in greatly improved properties in the weld metal. As a result of extensive development, the major functions of present day electrode coatings are as follows: to stabilize the arc, to protect, purify and refine the molten metal as well as control its viscosity, penetration, burn-off rate and hence speed of welding, to control the viscosity, surface tension, brittleness and porosity of the slag and therefore the type of bead or fillet deposited, and to add alloying ingredients to the deposited metal. The coatings are usually composed of a binder, a flux, a de-oxidizer, organic materials such as cellulose, and arc-stabilizing, slag and alloying ingredients. They might be classified in three types: (1) organic-coated or gas shielded, (2) organic and mineral coated or semi-slag shielded and (3) purely mineral coated or slag shielded. The gas shielded rods may be used for all positions of welding but will work on reverse polarity only; the semi-slag shielded rods can also be used in all positions especially where the fit-up is poor and will work equally well on either straight or reverse polarity. The slag-shielded electrode can be used only in the downhand or flat position, although there is one special type which has been developed for making horizontal fillet welds where the fit-up is good.

While it is of lesser importance, it is essential that the wire core be of normalized grain structure as the specific resistance of mild steel in this condition is most suitable for purposes of metal arc welding. Lack of uniformity in the final heat treatment of the wire is often responsible for the erratic behaviour of electrodes whose coatings are processed under identical conditions.

The importance of electrode coatings might be summed up by saying that no other development in welding has been as responsible for its widespread use today. Without them we could not have a.c. welding nor would it be possible to weld the high-tensile alloy steels. We could not obtain the speeds in welding now possible, nor could we effect the weight savings in the design of many structures and machines made possible by the joint efficiencies permissible when using covered electrodes.

### Equipment

Sources of the electric arc are both direct and alternating current. Motor driven generators are the commonest means of obtaining direct current, and for alternating current, either transformers, rotating motor generators, frequency changers or combinations of motor generators and frequency changers are generally used. There are two types of welding equipment—manual and automatic.

*Manual Arc Welding Equipment*—The direct current generators are of two kinds: (1) single or multiple operator, constant voltage generators, and (2) single operator, variable voltage generators. The first is a generator set which supplies a constant voltage to the welding system which in turn may supply one or a number of operators each of whom controls his welding current through an adjustable resistance. The second type delivers constant electrical energy to the welding system: i.e. sudden increase in the arc voltage (which is dependent on arc length) causes a decrease in the welding current and vice versa; this self-regulating feature results in greater arc stability and enables operators to make consistently sound welds. Setting the machine for the desired current output is done by means of precalibrated dials or indicator plates.

Welding machines which are built to N.E.M.A. standards can usually be depended on to give satisfactory performances. In selecting the type, size and rating, the character of the work contemplated and the available source of primary current should be considered. Multiple operator sets are advantageous where a large number of low-current arcs, at low operating factor (ratio of arc time to total time) are grouped in a limited area. Single operator sets are portable, and have greater independent adjustment and control of arc characteristics.

Not so many years ago, a.c. welding was used to a very small extent and only on light work, because of the difficulty in maintaining an arc with bare electrodes. Since the development of special covered electrodes, however, a.c. welding processes have greatly increased, and now they are used on all types of work and are very popular in present day shipbuilding yards.

Alternating current welding transformers should have a sufficiently high open circuit voltage to make the arc easy to strike but not too high to be dangerous and the method of current adjustment should be simple. Specially designed coatings on electrodes help to make the proper voltage possible, and the current is controlled by varying either the resistance or the reactance of the circuit. One disadvantage of a welding transformer is that being single-phase it imposes an unbalanced load on a polyphase circuit; if more than one transformer is used this may be compensated for to some extent by distributing them on different phases of the circuit.

The motor generator a.c. welding sets are somewhat like d.c. motor generator sets in that their mechanical details are similar and they also supply constant electrical energy to the welding system. They are generally controlled by a variable reactance, however, and generate alternating current at the required welding voltage but at a much higher frequency which improves arc characteristics and stability. The chief advantage of the rotating a.c. welder is the fact that it does not create an unbalanced load on a polyphase circuit.

There are many other relative merits and demerits of alternating and direct current welding equipment but one chief advantage of a.c. welding might be mentioned here. In making heavy welds on thick sections in restricted places and corners, using direct current the high currents changing direction around the weld cause magnetic forces to act on the welding arc and create what is called "arc blow." This results in an erratic arc causing blowholes and slag inclusions in the weld at the point of disturbance. Magnetic arc blow is greatly reduced if not entirely eliminated when using any a.c. welding equipment, and this feature has led to its widespread use in heavy welding industries.

*Automatic Arc Welding Equipment.*—An automatic welding head is a device for automatically striking and holding the arc between the electrode and the work to be welded. The success of any metallic arc welding operation is dependent on the maintenance of a uniform arc of proper length. In manual welding this is the duty of the operator, whose ability to hold a steady arc depends on his physical condition and degree of fatigue. Automatic welding equipments remove this variable and make it possible to obtain good sound welds even with an inexperienced welding operator.

There are many methods in use for automatically feeding the arc and striking the electrode but all contain three essential parts: (1) a motor to feed the electrode, (2) a means of control to strike and maintain proper arc length, and (3) a means of conducting electric current to the electrode. In addition some means must be provided for either moving the welding head over the work or the work past the welding head at a steady, uniform rate. The current may be either alternating or direct, and the electrodes for the majority of automatic machines are bare or lightly coated, some independent means of shielding the molten weld metal being provided. The wire is usually fed into the machine from a coil, eliminating stops and stub ends of electrodes; then, too, much higher currents can be used resulting in greater speeds in welding. This type of welding machine, however, requires special precautions in preparation of the joints—a most accurate bevelling or grooving being necessary to secure good results. They are limited in application, and are still used mainly on production work or where there is a large quantity of long, straight seams to be welded.

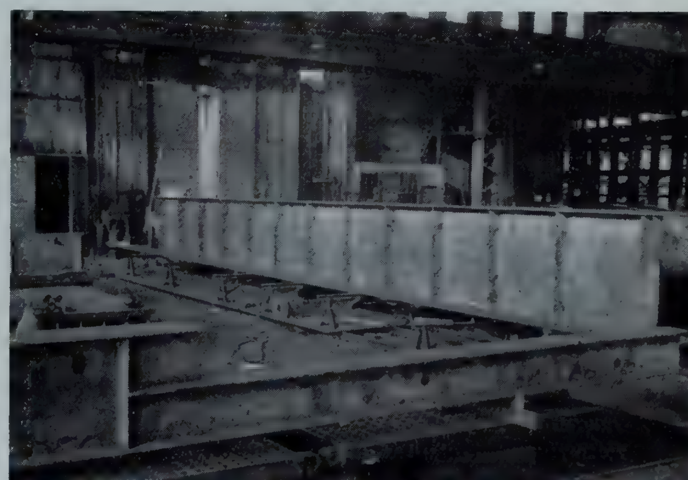


**Fig. 1—Girders and columns for mill buildings fabricated by welding rolled plates.**

### Training and Qualification of Operators

As yet it is impossible to define the term "welder" or "welding operator." Any attempted definition or specification of the term would vary between one industry and another and even between individual plants in the same industry. One plant may position all their arc-welding work and use large electrodes and alternating current. A first class operator with years of experience here would be of limited and perhaps no value on construction work or in a shipyard, where direct current may be used and a large part of the welding would be in the vertical and overhead position. Or, an operator may be highly skilled in welding thin sheet and have no training or experience in heavy plate fabrication or pipe welding. While many of the processes and their applications rest on the same fundamentals, a man trained only in those fundamentals has far to go before qualifying as a welding operator and being of value in any plant.

Assuming, then, that an employer has developed definite job specifications, the important thing is to obtain, in the shortest time, an operator who can perform work to those specifications. This can be done either within the plant itself or by an outside welding school.

When training is done in the plant, the employer selects the trainees, provides space, equipment, materials and instructors, and all instructions and qualifications are arranged for the specific requirements of that plant. The trainee is first taught safety practices, then how to strike an arc and lay down a neat, sound bead. Then he learns to tack pieces together and make the easier types of welds, progressing to the more difficult ones, until in possibly four to six weeks he may be ready to start on the simpler forms of work in the shop. In the meantime he is taught some of the theory of welding, and if necessary for that particular plant, how to read welding symbols and blueprints. In from four to six months' time the average operator should be reasonably proficient in the use of the arc as a fabricating tool in that plant.

Welding schools generally train a would-be operator differently, i.e. he gets no specialized training but general instructions in the fundamentals of various welding processes, both practical and theoretical and the observance of safety practices. Before such a man can be of value to any industry or workshop he must first undergo a period of further training with his employer. This period, of course, should be much shorter than the time required when the operator is trained in the plant.

**Fig. 2—Positioner for all-welded ship, allowing downhand welding.**

In metal arc welding, the physical properties of the weld metal, such as tensile strength and ductility, will be determined by the particular procedure of welding that is used. The reliability of the welded joint will be determined by the degree to which that weld metal is kept free of foreign materials and by the degree to which it is fused to the base material. Under a fixed procedure of welding these two latter factors are the only ones over which the welding operator has control. It is not considered necessary, therefore, to test the welds of every operator for tensile strength and ductility.

The first step in welding should be to adopt a procedure in which all essential variables are fixed within definite limits. This procedure should then be investigated to determine whether it will produce welds with the desired physical properties. Having established that a given procedure is satisfactory, comparatively simple tests, intended primarily to determine the ability of an individual to make a sound weld, may then be used for the qualification of welding operators.

### Heat and Mechanical Problems

The electric arc is particularly suitable as a source of energy for welding because the heat may be effectively concentrated on the surface of the metal being welded, and, in the case of the metal arc, the temperature is such as to boil the electrode away rapidly.

One of the factors controlling temperatures during welding is the dissipation of heat from the place where it is generated. Since the physical properties of solid steel are influenced by the maximum temperature of its liquid phase and the rate and manner of solidification, therefore, the manner in which cooling takes place will have a profound effect on the properties of the weld and adjacent metal. Characteristics inherited from these temperatures and cooling rates are only partly removed by later extensive mechanical and thermal treatment of the metal. Differences between weld metal and forged or cast metals are partly due to the high heat of fusion in welding and the rapid solidification rate which follows.

The rate of cooling depends chiefly on convection, radiation and thermal conductivity. In thin sections the heat loss is chiefly by convection and radiation, whereas in heavy sections it is mostly by thermal conductivity. Preheating is, therefore, often used for heavy sections where the welds are small in comparison to the mass of base metal in order to lower the cooling rate and to decrease the hardening and chilling effects on the heat affected zone.

The most common and widely known effect of temperature on metals is expansion on heating and contraction in cooling in all three directions, length, width and thickness. Since welding is a local operation and metal deposited in the arc is in a highly superheated molten state, the extent to which the base metal will be heated and cooled will be very limited and there will be little possibility of free expansion and contraction. Because of this, a state of constraint will be originated in all welded articles, and this constraint is conveniently expressed in terms of stresses. These stresses may or may not disappear when room temperature is reached, and those which remain are usually referred to as "locked up" or "residual" stresses due to welding. Heat input, however, is not always responsible for residual stresses since they readily result from machining and cold forming operations. Any process subsequently applied which results in a reduction or removal of such stresses is called stress-relieving.

Residual stresses then, in welded work are introduced by the partial heating of the metal adjacent to the weld followed by irregular cooling. Their magnitude depends not only on the rate and sequence of welding, but chiefly on the rigidity or resistance to distortion of the surrounding parts. The cooling of mild steel welds from the molten state down to 600 deg. F. is accompanied by considerable yielding but below this temperature the residual stresses will develop rapidly; should they become sufficiently high to cause yielding of the structure or member, distortion will result, with a corresponding decrease in residual stress.

In general, the more a structure distorts during or after welding, the less will be the residual stresses, but this does not necessarily mean that because the welded structure is not distorted it will have high residual stress. Proper joint design and preparation, symmetrical arrangement of welds about neutral axes of the member of structure and a carefully planned sequence of welding will go a long way toward keeping both distortion and residual stress to a minimum.

There is considerable evidence that residual stresses, whether induced by cold work or hot work, tend to distribute themselves in time and reduce in value particularly when subjected to external loading. In the majority of members of mild steel subject to gradually applied load stresses or to steady stresses, they are not of serious importance. In cases where the loads are suddenly applied or in members of high-strength steel, plastic deformation may not have time to develop so that high residual stresses may become serious. In such cases, stress relief either by heat treatment or static preloading is highly desirable. Metals which will be subject to low temperatures, members which are to be machined after welding and vessels subject to corrosion should all be stress relieved.

The most common method of stress relief is by heat treatment. For mild steel, the yield point stress at 1,200 deg. F. is reduced to 8,000 lb. per sq. in. or less, therefore, stresses above this amount will produce a flow in the steel and will be relieved. To do this it is necessary to heat the member slowly and uniformly in a suitable furnace, and hold it at the above temperature a sufficient time for plastic flow to take place, after which it is allowed to cool gradually and uniformly.

Other methods of stress relief are to peen the member or structure after welding or to slowly preload a structure before it is placed in service. In Europe it is not uncommon to apply internal pressure to welded containers of uniform thickness until the yield point of the metal is reached.

### Joint Design and Preparation

In the design of welded joints there are two general types of welds used, butt welds and fillet welds. These welds may be used in making many types of joints such as ordinary butt and fillet joints between parallel plates, tee joints between plates joining each other at an angle, corner joints and lap joints. The proper selection between butt and fillet welds is of importance both from the standpoint of economy in fabrication and service life of the structure, but no set rule can be applied for selecting the proper type.

Fillet welds, in general, require less preparation of the parts before welding because the parts may be lapped together without spending a great deal of time in bevelling and preparing the plate edges. If the plates are lapped it is not essential that their dimensions be held to close tolerances.

In joints where the plates are butted at right angles to each other it is necessary that the edge of the abutting plate be cut at right angles to the plate surface. This requires a single cutting operation with a shear, cutting torch or planer, but the prepared edge must be straight so that it will fit uniformly to the abutting plate. A space or gap between the two plates will reduce the effective size of the fillet welds and require the weld size to be increased by the amount of the gap, thus increasing the amount of weld material required.

Butt welds require a better fit of the parts to be joined and usually at least one of the plates is bevelled. For such welds in plates one quarter inch or less in thickness the edges are usually spaced about one eighth inch apart and are trimmed square. For plates over this thickness, the edges should be bevelled, either using a single vee, double vee, or U-type groove.

The inherent shape of a fillet weld is such that it produces abrupt changes in contour of the sections it joins, and consequently develops points of stress concentration, which may have to be considered in cases of dynamic loading. Most butt welds, especially those with little or no reinforcement, on account of their form, do not possess characteristics which produce stress concentrations; however, for the same reason they generally produce greater residual stresses, because greatest shrinkage takes place directly across the weld where the parts are not usually free to move. While the contraction in fillet welds is relatively the same, there is a possibility of a small movement occurring between the plates and in addition, the contraction is in such a direction it tends to bend or distort the parts thus lessening the residual stresses in them.

In order to increase the speed of welding it is desirable to deposit weld metal in the downhand position with large diameter electrodes. Butt welds are ideal for this purpose and are generally preferred. Fillet welds are of such a nature that usually one fusion zone is in the vertical plane. This necessitates either the use of small diameter electrodes or the use of welding jigs, manipulators or positioners to turn the work and permit downhand welding.

Another factor in connection with a selection between butt and fillet welds is that higher design stresses are often permitted for butt welds. The non-uniform stress distribution in fillet welds often results in secondary bending stresses or moments and so the permissible stresses are usually lower than for butt welds.

The preparation of the edges to be joined is of particular importance in welding. This procedure includes the preparation of the edges so as to provide the best possible conditions for welding, the cleaning of the metal edges, and the making of allowances for expansion and contraction caused by heating and cooling.

In preparing edges for tee joints and open, square butt welds, the plates should be cut so they will match accurately when assembled for welding. This cutting may be done either by mechanical means or by the oxyacetylene cutting blowpipe. For single and double vee butt welds the edges are bevelled by whatever economical means will produce the desired results, using flame cutting, edge planing, chipping or grinding. U-grooves are usually made with either oxyacetylene gouging nozzles or by means of a specially shaped tool on an edge planer.

Preparation for welding also involves making sure that the edges are clean and free of oil, grease, paint, rust, scale or slag from the flame cutting operation. With the edges properly bevelled and cleaned for welding, steps should be taken to insure that the finished job will be in correct alignment, the accuracy of such alignment, of course, depending on the type of work being welded. Short lengths of welds called tack welds placed at intervals along the joint are used for this purpose. They are either chipped or melted out during the welding operation or they may become part of the finished weld. Lengths of bars, strips of heavy plate or various shapes of steel, V-blocks, clamps, jigs and fixtures are all employed in various ways for maintaining alignment. The importance of careful preparation of material and a good fit-up at welded joints cannot be stressed too strongly.

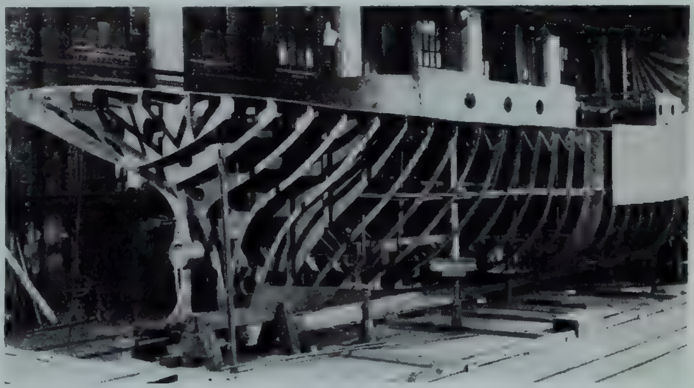


**Fig. 3—Framing for all-welded ship, with plating partly assembled.**

Not only will good fit-up reduce the amount of weld metal deposited but it will facilitate assembly and lower the residual stresses or distortion of the structure. When the decreased efficiency of the operator, greater waste of electrodes, straightening operations, etc., are taken into consideration, the cost per foot of weld will often be tripled as a result of poor fit-up.

For large or complicated work it is advisable to give careful study to the sequence of operations. This means a consideration of the location of all welds with reference to one another, the probable effect of expansion and contraction, the method of securing proper alignment and the order in which the welds should be made. Time spent in determining such a sequence of operations in advance will be well repaid by results during the subsequent welding operation.

### Inspection and Testing

As in the case of much fabricated work, what is done by a welding process often requires inspection during the course of construction, either by the manufacturer, purchaser, or an agency which furnishes such services. The structures on which inspection is required will vary widely in design and type of welding application, so that no one class of inspectors can be expected to be proficient in all of them.

The inspector should enter a shop with two main thoughts in mind—namely, to obtain a good job properly fabricated to the applying code or specification, and to expedite the completion and delivery as much as possible. This involves

(1) good judgment on his part in the interpretation and application of such code requirements (since even most carefully prepared rules are not always clear and complete) and (2) full co-operation with the manufacturer in obtaining desired results and maintaining friendly relations between purchaser and fabricator.

As yet no method of testing comparable to "tapping rivets" has been devised although some have been put forward which are partially successful. Most of them work best with butt-welds and are not as applicable to the fillet welds more commonly used in structural practice.

The most effective but also the most costly are the X-ray or Gamma-ray methods, in which photographs of the welds are taken, utilizing the penetrating radiations of the X-ray tube and of radium to detect the character and extent of defects. For most pressure vessels, the various codes make X-ray examination one of the requirements of their fabrication.

Where radiographic equipment is not available, examination is sometimes made by trepanning or cutting sections from the welds. These sections should be taken at points where the welds look most questionable, and polished, etched and examined for objectionable defects.

The "magnaflux" or magnetic powder method of testing may also be used on finished welded products of ferrous metals which can be magnetized. This consists of first magnetizing the work, then sprinkling iron filings on a paper over the weld. The filings collect at points where defects occur, but considerable experience is required to properly apply and judge the results of this test.

For structural welding the visual inspection by a competent inspector during and on completion of welding is satisfactory, but in addition there are several definite things which can and should be done to insure workmanship of good quality. First, none but properly qualified welding operators should be permitted to do any welding where strength is a requisite consideration. Second, a definite procedure control should be followed. This involves correct preparation of the parts to be welded, selection of proper electrodes, the technique of the welding process and provision for adequate supervision. Third, joint surfaces should be clean and free from dirt, grease and paint which would interfere with the welding process.

These three steps will go a long way toward producing sound welds of the required strength. There is left the visual inspection of the finished weld. Observation of the welder at work will furnish information as to the character of his welds such as proper arc, amount of penetration, and correct settings of current and voltage. The surface of the weld should be fairly smooth without blowholes and cracks, and the edges should appear to thoroughly merge with the base metal, with no overlapping or undercutting. Fillet welds should be of the correct size and outline, and butt welds which are reinforced must be between the minimum and maximum height tolerances.

Pressure tests are sometimes used for closed containers such as low pressure vessels, tanks and pipes; these may be either hydrostatic or air but the use of air for testing is dangerous unless the correct type of safety valve is properly installed first.

### Recent Developments

Great advances in welding techniques and equipment have been made which will influence the extent and character of future welding. Perhaps one of the most important developments of the past year is the successful introduction to industry of alternating current electrodes suitable for producing highest quality welds in the vertical and overhead positions. This means that many shops which were using a.c. welding for flat work only can now avoid the necessity of changing to direct current for vertical and overhead work, and obtain the inherent advantages of alternating current in all positions of welding.

Another development is the use of larger electrodes and higher welding currents where work conditions permit. By using larger electrodes it is possible to deposit two and even three times as much metal in a given time, obtaining faster production at great savings in cost. Arc blow is particularly troublesome when using high currents in d.c. welding, so that this development has been made possible only through the use of a.c. electrodes and equipment.

Recently there has been put on the market new welding equipment which has been developed especially for light gauge steel; this is leading to a tremendous increase in the use of metal arc welding in sheet metal work.

Armour plate, alloy steels in aircraft and other high-tensile steels are now being welded successfully with appropriate electrodes and technique. We can, therefore, build structures with welded high tensile steel and obtain double savings from the economy of welded shapes and details and the use of higher stresses permissible with such steels.

These are only a few of the many developments in welding processes and methods, but there are still many unsolved problems which offer fine opportunities for research and investigation. These problems will be largely solved by welders, metallurgists and engineers.

In the field of design, rigid frame structures are coming more and more into use, due to the ease with which they can be fabricated by welding with resultant economies in weight. Also, a great many items which were formerly made of cast iron or steel are now being replaced by weldments, but so far the welded part has been a close copy of the case one in size and shape. Here, then are wonderful opportunities for re-design whereby the amount of cutting, bending, welding and other operations may be reduced, and the full economy of metal arc welding may be realized. Welded joints well thought out by a designer who knows the action of a structure can be as near the attainment of ideal joints as practical and economic considerations will allow.

# REPORT OF COUNCIL FOR THE YEAR 1942

## TOGETHER WITH COMMITTEE AND BRANCH REPORTS

"Another year of war has come and gone, and through it all the Institute has continued to function in all its departments. Emphasis has been placed on certain activities and others have been allowed to subside, but on the whole it has been a year of greater activity. Increases in membership, and a substantial financial statement indicate that even under the disturbed conditions of to-day the engineers still look on the Institute as a vital part of the life of Canada, and an integral part of the war effort."

The above quotation is the opening paragraph of last year's report of Council. It is just as true of conditions throughout 1942 as it was for 1941. In fact, almost every section of last year's report could be used over again for this year. This is a good sign because it shows that the improvement and steady acceleration in Institute affairs is being well maintained.

Members are becoming spread over wide areas and in all parts of the world. New and greater responsibilities are being accepted on all sides. Unfortunately, only a few items of news get through, and it is impossible to form any adequate picture of the national service being rendered by the profession. It will be a happy day when the whole thrilling story can be told.

It is interesting to observe the difference in the effects of this war and the last one on Institute affairs. Between the first and the third years of the last war the membership increased only by sixty-nine. During the similar period of this war the membership has increased by eight hundred and thirty-eight. In one case the income increased by over Three Thousand Dollars and in the other case it has increased by over Nine Thousand Dollars. The more careful distribution of technical personnel, and the great industrial development in this country, have reduced the number of members on active service. In the last war thirty-six per cent of the entire membership was in the services.

In civilian affairs members continue to make great contributions. In Government departments and in industry engineers continue to occupy positions of administrative control, and technical responsibility. In the younger groups there is still the urge to leave peaceful industry for combatant activity, but many a young man, under pressure of his more important duty, has stayed at his industrial occupation while his interests and spirit were driving him to "go active".

Many members have been honoured—in the active forces and others in civilian occupation. Some have been wounded and others killed in action. Detail mention of these events is made from time to time in *The Engineering Journal*. as the information becomes available. Again it is apparent that the whole story will not be disclosed until hostilities have ceased, but the news that has come out in small amounts is an indication of the honourable part that is being and will be played by those who make up the membership of this organization. In the last war a great record was established. In this war it may even be surpassed.

### Branch Activities

The affairs of the branches have prospered in varying degrees. Those in large industrial centres have carried out active programmes, and have enjoyed increased membership. Some few branches have been less fortunate in that some of their members have moved to other areas and there has been no compensating movement into their areas. This tends to reduce activities and curtail expansion, but in spite of these conditions, all branches report a successful year.

### Visits to Branches

The president visited every branch in Canada, and attended every meeting of Council. His inspirational addresses have been a stimulus to Institute affairs right across the country. He spoke also to many other organizations, and during his western trip included six visits with branches of the Alumni Federation of the University of Toronto. In all these public appearances, both in Canada and the United States, he did much to enhance the prestige of the Institute and the profession.

### Council Meetings

Following established procedure, Council held several meetings away from Headquarters. These were at Vancouver, Niagara Falls, Toronto, and Halifax. In all, thirteen Council meetings were held throughout the year with an average attendance of twelve. Out of a total of forty-three councillors thirty-five attended at least one meeting, representing twenty-two out of twenty-five branches.

### Finances

Perusal of the reports from the Treasurer and the Finance Committee indicate that finances are in good shape. The largest surplus that has been accumulated in many years is shown. The collection of arrears of fees has reached a new high level, being $1,492.00 higher than last year. This is attributed to the fact that members are now all well employed, and that Headquarters has made a special drive to turn these paper assets into cash.

It is comforting to know that the Institute can operate with increasing financial stability even though fees are remitted to members overseas, and to members resident in combatant areas.

It is also of some satisfaction to see that in spite of new and increased activities which require substantial financial support, such as the Webster lectures and new committee undertakings, the balance sheet is still favourable.

### Annual Meeting

A review of the work of the year would not be complete without comment on the annual meeting held in Montreal. There seems to be unanimity of opinion that this was a record meeting from every point of view. The registration ran to eleven hundred and every function was patronized to the capacity of the facilities.

The good fortune of having Lieutenant General McNaughton as the banquet speaker was of itself a factor that would assure success. In addition to this as special guests were the presidents and secretaries of the seven leading engineering societies of the United States.

### International Relations

It is always a pleasure to report on the relations with sister societies in the Old Country and in the United States.

While the advent of war has made it more difficult to communicate with societies overseas, it has done much towards developing closer relationships. The common danger and the common effort to overcome it, have brought the British Isles and Canada closer together. The presence of so many Institute members "over there" has materially increased the number of contacts whereby each group has become better known to the other.

Many members of British Institutions are in Canada. Every effort has been made to locate such persons so that through the branches the facilities and hospitality of the Institute may be extended. Several branches report that they have frequently as guests engineers from across the Atlantic. It is to be hoped that these opportunities to welcome fellow members of the profession will be extended in 1943.

The presence of the presidents and secretaries of the seven leading American societies at the 1942 Annual Banquet in Montreal was one of the best indications of the further development of the already good relationship with the sister societies south of the border. This was a most unique and impressive compliment to the Institute, much appreciated by all members.

Very close contacts with these societies are steadily maintained. The Engineers' Council for Professional Development is a splendid medium for this purpose. The visits of officers of the Institute to American meetings and joint meetings, such as that held at Niagara Falls, in October, are natural channels through which flows a steadily increasing volume of understanding and good-will. Engineering societies on both sides of the border are splendid agencies for this wholesome development.

### Engineers' Council for Professional Development (E.C.P.D.)

In the second year of membership in this international co-operative body, it has been made even more apparent than before, that the Institute membership therein has placed it in a unique position to aid the profession and those aspiring to become a part of the profession. The continued study of problems by committees representing all eight member societies has produced new thoughts in the important general problems of professional development.

Committees on Engineering Schools, Student Selection and Guidance, Professional Training, Professional Recognition, and Engineering Ethics, have turned in annual reports which show that much time and thought has been expended by the prominent engineers who constitute their membership. The recommendations of these reports are the basis for the work of 1943, and indicate that this year will be productive of many more things helpful to the profession.

### Joint Meeting

One of the most successful and pleasant features of this year's programme was the joint professional meeting held in October at Niagara Falls, Ontario, with the American Society of Civil Engineers. It would be difficult to find a meeting that would be richer in those splendid qualities of good fellowship and professional interest.

Outstanding papers and inspirational non-technical addresses were delivered by members of both societies. Members of the Institute were particularly pleased with the contributions made by Canadians. President C. R. Young's luncheon address on "The Place of the Engineer", and Dr. H. J. Cody's banquet speech were reproduced in the December *Journal*.

It was the opinion of everyone that meetings of an international nature such as this should be held more frequently, not only because of the professional advantages, but also because of the opportunities afforded for developing better understanding between the individuals and the nations.

The Institute is glad to assure the officers and members of the American Society of Civil Engineers that visits such as this will always be welcome, and that the Institute will always be ready to co-operate to the fullest extent.

### Overseas Children

Up to the present there has been no report on the assistance given by the Institute and by members of the Institute to children and parents sent here from England for safety. This work has been so personal that it has not been thought wise to give any publicity to it. However, members will be glad to know that certain necessary assistance has been made available in many parts of Canada.

Members in such places as Halifax, Montreal, Toronto and Winnipeg are in contact with cases, and have been happy to lend aid and assistance. The Institute has been very active in some instances where the families of engineers have been involved, and has aided in supplying many of the necessities of life. The interest in these families will be continued as long as the need exists.

### Committees

During the year three new and important special committees have been established. The work of these committees is related directly to national problems and, because of its importance, members of the committees are making heavy personal sacrifices to see that real progress is achieved.

Reports of the committees follow, and it is recommended that members not already familiar with the work read them carefully in order to have an appreciation of what is being attempted. The committees are—Committee on The Engineering Features of Civil Defence, Committee on Industrial Relations and Committee on Post-War Problems.

### Wartime Bureau of Technical Personnel

The Bureau continues to do good work. Early in the year, Elliott M. Little and L. Austin Wright transferred from Director and Assistant Director respectively to the same positions in National Selective Service, and H. W. Lea and J. D. Dymond were selected to fill these vacancies in the Bureau.

Order-in-Council 638 passed in March gave the Bureau more power and authority, and provided certain controls which have aided materially. This legislation was the first attempt in Canada to apply compulsion in the manpower field.

Without having any legal obligation to do so, the Bureau functioned as a division of Selective Service, thereby orienting its work with the larger activity in order to aid in providing a complete coverage in a co-operative manner. Changes now being contemplated by the Department of Labour may make this relationship even closer. It is to be hoped that the new plans do not contemplate the total absorption of the Bureau into the Department, and the transfer of the administration to the Department in place of leaving it with the professional societies themselves as at present.

The Bureau was set up in February, 1941, by an Order-in-Council which named The Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, and the Canadian Institute of Chemistry to "organize the placement of technical personnel".

### Roll of the Institute

The membership of all classes now totals 5,652, which is again a new record. New names added to the roll for the year 1942 amounted to 485, but deaths, resignations and removals reduce the net figure to a gain of 279. This is a gratifying figure, particularly in face of the fact that all persons three years or more in arrears have been removed from the membership list. It is likely that the present outstanding total of arrears is the lowest that has obtained for many years.

During the year 1942, four hundred and sixty-nine candidates were elected to various grades in the Institute. These were classified as follows: One Honorary Member: one hundred and seventy-seven Members; sixteen Juniors; two hundred and fifty-six Students, and nineteen Affiliates. The elections during the year 1941 totalled four hundred and thirty-nine.

Transfers from one grade to another were as follows: Junior to Member, fifty-nine; Student to Member, thirty-two; Affiliate to Member, one; Student to Junior, eighty-eight; Student to Affiliate, one; a total of one hundred and eighty-one.

The names of those elected or transferred are published in the *Journal* each month immediately following the election.

### Removals from the Roll

There have been removed from the roll during the year 1942, for non-payment of fees and by resignation, sixty-one Members; twenty-one Juniors; sixty-eight Students, and one Affiliate, a total of one hundred and fifty-one. Sixteen reinstatements were effected, and twenty-one Life Memberships were granted.

## Deceased Members

During the year 1942 the deaths of fifty-four members of the Institute have been reported as follows:

Honorary Member

| | |
|---|---|
| Adams, Frank Dawson | Montreal, Que. |

Members

| | |
|---|---|
| Aggiman, Jacques Nissim | New York, N.Y., U.S.A. |
| Andrewes, William Edward | London, Ont. |
| Archibald, Ernest M | West Palm Beach, Florida, U.S.A. |
| Armstrong, Thomas Stiryaker | Port Arthur, Ont. |
| Baltzell, Willie Henry | Pittsburgh, Pa., U.S.A. |
| Bang, Claus Marius | Deer Lake, Newfoundland |
| Buckley, Rex Elmer | Glen Ferris, West Virginia, U.S.A. |
| Byers, Archibald Fullarton | Montreal, Que. |
| Cregeen, Kenneth Thomas | Montreal, Que. |
| Dennis, Earle Munro | Ottawa, Ont. |
| Duckworth, Walter Ritchie | Vancouver, B.C. |
| Duncan, G. Rupert | Fort William, Ont. |
| Evans, John Maurice | Montreal, Que. |
| Fuller, Royden John | Toronto, Ont. |
| Jackson, Donald Alphonse | Chatham, N.B. |
| Jackson, John H | Toronto, Ont. |
| Johnson, Edward Preston | Toronto, Ont. |
| Johnston, Harold Stanley | Halifax, N.S. |
| Johnstone, William Morrison | Ottawa, Ont. |
| Kester, Fred. Henry | Walkerville, Ont. |
| Kirkpatrick, Alexander M | Winnipeg, Man. |
| Mahon, Harry Wendell | Halifax, N.S. |
| Millidge, Edwin Reginald | Winnipeg, Man. |
| Morrisey, Henry Fairweather | Saint John, N.B. |
| MacDiarmid, Archibald Alexander | Quebec, Que. |
| MacKinnon, John George | Moncton, N.B. |
| Macphail, William Matheson | Winnipeg, Man. |
| McCurdy, Lyall Radcliffe | Montreal, Que. |
| McDowall, Robert | Toronto, Ont. |
| Palmer, John | Montreal, Que. |
| Parker, Thomas Wint Weir | Fergus, Ont. |
| Porter, John Earle | Windsor, Ont. |
| Reynolds, Philip | Ferndown, Dorset, England. |
| Robertson, A. Ross | Toronto, Ont. |
| Ross, Sir Charles | Passagrille, Florida, U.S.A. |
| Schlemm, Leonard Ernest | Montreal, Que. |
| Shanly, James | Kenogami, Que. |
| Smither, William James | Toronto, Ont. |
| Souba, William Henry | Minneapolis, Minn., U.S.A. |
| Stockett, Lewis | Vancouver, B.C. |
| Taylor, Charles | Selkirk, Man. |
| Tempest, John Sugden | Calgary, Alta. |
| Townsend, Charles Rowlatt | Montreal, Que. |
| Vaughan, Henry Hague | Montreal, Que. |
| Walton, Frederick Stanley | Prince Rupert, B.C. |
| Webb, Harry Randall | Edmonton, Alta. |
| White, Joseph James | Winnipeg, Man. |
| Wilson, Wm. Thomas | Dunscore, Dumfriesshire, Scot. |

Juniors

| | |
|---|---|
| Boyd, William Gamble | Kingston, Ont. |
| Mews, John Courtenay | Buchans, Newfoundland. |
| Porter, Lawson Bardon | St. John's, Newfoundland |

Students

| | |
|---|---|
| Murray, Robert Leslie | Vernon, P.E.I. |
| Swingler, Russell Henry | Ottawa, Ont. |

## Total Membership

The membership of The Institute as at December 31st, 1942, totals 5,652. The corresponding number for the year 1941 was 5,373.

| 1941 | |
|---|---|
| Honorary Members | 16 |
| Members | 3,560 |
| Juniors | 638 |
| Students | 1,084 |
| Affiliates | 75 |
| | 5,373 |

| 1942 | |
|---|---|
| Honorary Members | 16 |
| Members | 3,727 |
| Juniors | 655 |
| Students | 1,158 |
| Affiliates | 96 |
| | 5,652 |

Respectfully submitted on behalf of the Council,

C. R. Young, M.E.I.C., *President.*
L. Austin Wright, M.E.I.C., *General Secretary.*

## TREASURER'S REPORT

The President and Council:

As can be seen from the financial statement your Institute has had a successful year from a financial point of view, all of which is covered in the report of your Finance Committee.

The securities for your investment account which are shown in the statement as totalling $16,588.51 have been checked and found in order. The actual market value of these securities as at to-day's date is approximately $18,000.00.

Respectfully submitted,

E. G. M. Cape, M.E.I.C., *Treasurer.*

## FINANCE COMMITTEE

The President and Council:

It is with much pleasure that your Finance Committee reports a satisfactory financial year for The Engineering Institute of Canada.

The Balance Sheet, which has been prepared by the Auditors, shows a surplus of $3,208.56 for the year's operations, and that notwithstanding the fact that a new Special Building Fund Reserve was created, and that an unusual expenditure was incurred in publishing Professor Webster's lectures.

Your Committee feels that a Special Building Reserve should be created covering any possible future repairs or replacements of major character, and has set aside, for this purpose, an amount of $3,500. The reserve for the Building Maintenance has been increased from $1,350 to $2,000, which should cover the usual repairs.

The amounts covered by these special reserves, as well as that of the excess of the Revenue over Expenditure, for the year, has been invested in Government Bonds.

You have decided, last year, that the Past-Presidents' Fund, which is made up of private subscriptions, for a special purpose, should be reported to Council only. In consequence, the investment, represented by this Fund which amounted, in last year's report, to $6,212.90, has been withdrawn from the list of investments in this Report.

Respectfully submitted,

deGaspé Beaubien, M.E.I.C., *Chairman.*

## BOARD OF EXAMINERS AND EDUCATION

The President and Council:

Your Board of Examiners and Education for the year 1942 has had prepared and read the following examination papers with the results as indicated:

| | | Number of Candidates | Number Passing |
|---|---|---|---|
| I. | Elementary Physics and Mechanics | 2 | 1 |
| II. | (a) Strength and Elasticity of Materials | 3 | 2 |
| VII. | (a) General Paper on Structures | 2 | 1 |
| VII. | (b) (1) Structural Steel Design | 1 | 1 |

Respectfully submitted,

R. A. Spencer, M.E.I.C., *Chairman.*

## COMMITTEE ON POST-WAR PROBLEMS

The President and Council:

Your Committee on Post-War Problems begs to submit the following résumé of its activities for 1942.

The early part of the year was spent in organization. An endeavour was made to have where possible a reasonable distribution of membership that would be representative of all parts of the country as well as of both the public services and private industry.

After organization, a study was made of the memorandum entitled "Considerations for Evaluating Projects" submitted by the Sub-Committee on Post-War Construction Projects of the James Committee on Reconstruction of the Federal Government. This memorandum was subjected to critical examination by each branch of the Engineering Institute. The comments from the various branches were then studied by your Committee, the reports co-ordinated, certain suggestions originating with members of the Committee incorporated and the final results reported to Council for their approval and transmission to the proper quarters.

At the suggestion of the chairman of the Sub-Committee, each branch of the Institute was communicated with and given a list of local Citizens' Committees concerned with the Rehabilitation of Returning Soldiers. It was suggested that the branches might give some assistance to these committees. Each local Citizens' Committee of record, about one hundred in all, was written and offered the services of engineers in their work. The combined response of these letters indicated that in several branches active work was going on along these lines. A number of letters were received expressing appreciation of the offer of help and intimating that it would be accepted. One branch of the Institute in a centre in which there is no local Citizens' Committee has offered to give leadership in the organizing of such a group.

It is recommended that the Council give every encouragement to Institute Branches for the study of post-war problems both as a branch and by way of assistance to local representative Citizens' Committees, particularly in endeavouring to see, in the formation of the latter, that interested engineers are included in their personnel. This work presents an opportunity for disinterested public service on the part of the profession, and each engineer, to the extent that he makes a contribution to this work, will not only assist it constructively but will also be the means of impressing on the non-engineering members, and through them citizens generally, with the place that our profession can take in the general councils of a post-war economy. A great opportunity is before us. What we do with it is up to ourselves alone.

Respectfully submitted,

W. C. Miller, M.E.I.C., *Chairman.*

## COMMITTEE ON WESTERN WATER PROBLEMS

The President and Council:

Your Committee on Western Water Problems has been advocating the construction of further works to utilize fully Canada's share of the St. Mary and Milk Rivers in Alberta. By Order-in-Council dated February 17th, 1941, the Dominion Government named the following committee to study the matter:

Victor Meek (Chairman), Controller, Dominion Water and Power Bureau, Ottawa, designated by the Minister of Mines and Resources;

George Spence, Director, Prairie Farm Rehabilitation Branch, Regina, designated by the Minister of Agriculture;

William E. Hunter, Accounts Branch, Department of Finance, Ottawa, designated by the Minister of Finance.

This Government Committee prepared a comprehensive report which has recently become available in printed form. We quote its general recommendations as follows:

"The Committee is not unmindful of the tremendous burden placed upon the Federal treasury because of the War. We realize the necessity of minimizing expenditures which are not essential to the war effort. We realize that the commencement of construction at this time would involve the employment of labour, skilled and unskilled, and the use of materials essential to war industry. We believe, however, that the St. Mary and Milk Rivers Development should be included as a part of the Dominion's post-war rehabilitation programme and we recommend:—

"(1) That the proposed development be reserved as a post-war measure.

"(2) That the Dominion and the Province of Alberta enter into an agreement, to be confirmed by legislation, setting out the general principles governing the development as a co-operative undertaking.

"(3) That surveys and investigations be continued so that construction may be begun without delay after the war.

"(4) That this report be referred to the Committee on Reconstruction."

In view of its importance we suggest that members of the Institute make a point of studying this report. Those wishing to obtain a copy should write the Director, Prairie Farm Rehabilitation Branch, Department of Agriculture, Regina.

In November, 1942, informal meetings were held in the West under the auspices of the Sub-committee on Natural Resources of Dr. James' Reconstruction Committee and the sites of the proposed St. Mary River works were visited. Dr. James' Committee was represented by Dr. J. B. Challies, M.E.I.C., Prof. J. J. O'Neill, M.E.I.C., and Prof. L. C. March. Members of your Committee were invited to present their views and at the various sessions your committee was well represented.

Respectfully submitted,

G. A. Gaherty, M.E.I.C., *Chairman.*

## COMMITTEE ON ENGINEERING FEATURES OF CIVIL DEFENCE

The President and Council:

In April, 1942, Professor F. Webster, Deputy Chief Engineer of the Ministry of Home Security, London, England, gave a series of lectures in Toronto, under the auspices of The Engineering Institute of Canada. In May, the general secretary of the Institute requested the chairman of each Branch of the Institute to appoint a Branch Committee to deal with the local application of the information presented at those lectures.

In June, the Committee on Engineering Features of Civil Defence was set up, to consist of members appointed by the president of the Institute and of the chairmen of the Branch Committees appointed under the general secretary's request. During the year, 21 branches appointed Branch Committees, one of which is serving two branches. The personnel of this Committee now consists of 13 members appointed by the president, 6 of whom are also Branch Committee chairmen, and 15 other Branch Committee chairmen, making a total of 28.

In connection with the engineering features of civil defence, this Committee has co-operated with the Hon. Dr. R. J. Manion, Director of Civil Air Raid Precautions, and the Branch Committees have co-operated with Dr. Manion's appropriate Provincial A.R.P. Committees and with local A.R.P. organizations. This Committee, with the hearty co-operation of the Canadian Engineering Standards Association, has maintained contact with that Association, and through the Branch Committee chairmen, has acted in an advisory capacity to the Branch Committees, all with a view to avoiding duplication of effort.

This Committee has had prepared and Council has had printed and placed on sale through Headquarters of the Institute, a 55-page book entitled "Structural Defence Against Bombing." This reference book on the engineering features of civil defence as applied to structures has been well received by engineers and architects.

This Committee, jointly with authorized representatives of the Royal Architectural Institute of Canada and the Canadian Construction Association, prepared a memorandum suggesting an organization to cover an essential field in civil defence not now covered by either Dr. Manion's A.R.P. organization, or by military organizations. With an appropriate letter of transmissal dated November 3, 1942, this memorandum was forwarded to the Prime Minister as a joint submission over the signatures of the presidents of these three organizations. It was promptly acknowledged, but so far no action on it has been reported.

This Committee is continuing its work on specifications and instructions relative to the engineering features of civil defence in connection with air raid shelters and the protection of existing and proposed hotel, apartment, office, store, plant and other buildings and dwellings, and of the personnel and equipment in them.

Respectfully submitted,

John E. Armstrong, m.e.i.c., *Chairman.*

## MEMBERSHIP COMMITTEE

The President and Council:

During the past year your Membership Committee made a careful study of those sections of our By-Laws relating to the classifications of "Branch Affiliate," "Institute Affiliate" and "Member". In doing so they gave consideration to the resolutions from Montreal and Toronto Branch Executives, also, suggestions submitted by officers and members of the Institute from coast to coast.

The basis of our study was an endeavour to simplify the procedure and ensure a uniform interpretation of our By-Laws with regard to the election of Members until more normal conditions return, when our By-Laws can be revised.

Final recommendation was submitted to Council at its December 19th meeting in Montreal, and included a memo to be sent to all Branch Executives, together with a form to be used in summarizing the qualifications of each applicant.

Respectfully submitted,

John G. Hall, m.e.i.c., *Chairman.*

## COMMITTEE ON PROFESSIONAL INTERESTS

The President and Council:

The Committee on Professional Interests is glad to report that during 1942 another definite step forward was taken towards the goal of Dominion-wide professional solidarity when, on January 12th, at Saint John, an agreement between the Institute and the Association of Professional Engineers of the Province of New Brunswick was consummated.

It is the opinion of the Committee that each of the co-operative agreements that have been entered into to date affecting the provinces of Nova Scotia, Saskatchewan, Alberta and New Brunswick is proving its real worth. They add up to an impressive total and indicate a trend toward a common membership between the national engineering society and the provincial registration bodies that should in time become Dominion-wide.

In the four provinces mentioned, practically all the corporate members of the Institute now enjoy the advantage of registration.

A draft of a co-operative agreement between the Institute and the Association of Professional Engineers of the Province of Manitoba has been worked out by a joint Manitoba committee representing both the Institute and the Association. The draft has been agreed to in principle by the Council of the Institute and when approved of by the officers of the Association will be submitted for formal endorsation by the Institute as required by Section 78 of the By-laws.

During the year, preliminary discussions were instituted by the Montreal Branch looking to a co-operative agreement between the Institute and the Corporation of Professional Engineers of Quebec.

As for the provinces of Ontario and British Columbia, the readiness of the Institute's committee to discuss co-operation in any form with the efficiently operated registration bodies is well known.

Respectfully submitted,

J. B. Challies, m.e.i.c., *Chairman.*

## COMMITTEE ON INDUSTRIAL RELATIONS

The President and Council:

At its meeting in Toronto on April 25th, 1942, the Council of The Engineering Institute of Canada passed a resolution instructing the president to draw terms of reference for an Industrial Relations Committee and recommended to Council the composition of such a committee. At its meeting in May, 1942, the Council ratified the recommendations of the president and a Committee on Industrial Relations was formed. In selecting the members of this Committee, representation was secured from engineers engaged in Industrial Relations work and the broader field of administration, as well as from those engaged in presenting courses on this subject in the three universities of McGill, Queen's and Toronto.

The first meeting of this committee was held in Toronto on July 25th, 1942; further meetings have been held September 11th, October 16th, November 25th, 1942, and January 22nd, 1943.

Naturally, as the subject of industrial relations was new to the work of the Institute, the Committee has spent a considerable amount of time in general discussion and in study of the broad subject as well as in consideration of the special approach which engineers and the Institute should make in order to develop constructive suggestions and a sound programme for the future. As part of its general programme, it has arranged for the publication in the *Journal* of the Institute of articles on industrial relations and reprints of outstanding articles which have appeared elsewhere.

In reviewing the general subject, it was early found that some universities and engineering colleges were teaching certain phases of industrial relations. Letters were sent to the universities in Canada and details of the various courses being taught were gathered together and tabulated. Information of this tabulation was sent to the universities with the recommendation that study be given to the expanding of the present courses in industrial relations and offering the assistance of the Committee if they so desired. The Committee at the present time has a sub-committee working on a suggested syllabus dealing with a course in industrial relations, particularly applying to engineering colleges.

Through the co-operation of the Papers Committee, a letter was sent by that Committee to all branches, recommending that during the session one or more papers dealing with industrial relations be presented before the Branch and offering the assistance of this Committee in obtaining speakers if it was desired. Correspondence has been carried on with the branches and papers have been presented before various branches of the Institute and other papers are scheduled.

At the request of the committee in charge of the Annual Meeting, this Committee has assumed the responsibility for one session at the Annual Meeting and has arranged for Professor Viteles of the University of Pennsylvania and in charge of Personnel Research of the Philadelphia Electric Company, to present a paper on "A Scientific Approach to the Problems of Employee Relations" and Dr. Bryce M. Stewart, Director of Research, Industrial Relations Counselors, Inc., New York, formerly Deputy Minister, Department of Labour for Canada, to speak on "The Role of the Industrial Relations Executive in Company Management"; arrangements are also being made for thorough discussion of these subjects.

Your Committee has been greatly encouraged by the interest shown in this subject and in its activities by many of the university heads who have been contacted and by many members of the Institute. Progress made by the Committee since its appointment would indicate that while little in the way of concrete results can be shown, a good start has been made and in the subject like the one before it, hasty action might defeat the whole purpose of its discussions. It is hoped that enough has been done to show the necessity for such a committee and that future committees will extend the work that has been started.

Respectfully submitted,

Wills Maclachlan, M.E.I.C., *Chairman.*

## LEGISLATION COMMITTEE

The President and Council:

No legislation affecting the interests of the Engineering Institute or of the engineering profession in general, came to the attention of the Committee during 1942. There is consequently nothing to report.

Respectfully submitted,

John L. Lang, M.E.I.C., *Chairman.*

## COMMITTEE ON THE TRAINING AND WELFARE OF THE YOUNG ENGINEER

The President and Council:

The Committee on the Training and Welfare of the Young Engineer asks leave to make its fourth annual report.

During the year you have asked for reports on several matters referring especially to the younger members of the profession. These included—

(a) The continuance of the five Student and Junior prize competitions; and

(b) The possibility of Government grants-in-aid to engineering students after the war ends.

Council has taken action on our report on the first, and it is hoped that competition will be increased in the several Zones. The second question will require further and continued study before any definite recommendations can be offered.

## COMPARATIVE STATEMENT OF REVENUE AND EXPENDITURE

For the Year Ended 31st December, 1942

### Revenue

| Revenue | 1942 | 1941 |
|---|---|---|
| **Membership Fees:** | | |
| Arrears | $ 5,049.11 | $ 3,557.00 |
| Current | 27,563.49 | 26,686.75 |
| Advance | 527.80 | 569.44 |
| Entrance | 2,581.87 | 1,632.00 |
| | $35,722.27 | $32,445.19 |
| **Publications:** | | |
| Journal Subscriptions | $ 8,263.77 | $ 7,698.65 |
| Journal Sales | 74.41 | 36.72 |
| Journal Advertising | 18,645.42 | 15,723.32 |
| | $26,983.60 | $23,458.69 |
| Income from Investments | $ 545.49 | $ 505.10 |
| Refund of Hall Expense | 500.00 | 450.00 |
| Sundry Revenue | 39.17 | 102.16 |
| Total Revenue for Year | $63,790.53 | $56,961.14 |

### Expenditure

| Expenditure | 1942 | 1941 |
|---|---|---|
| **Building Expense:** | | |
| Property and Water Taxes | $ 1,328.98 | $ 1,995.48 |
| Fuel | 592.53 | 578.68 |
| Insurance | 177.85 | 154.78 |
| Light, Gas and Power | 363.82 | 339.05 |
| Caretaker's Wages and Services | 1,031.00 | 976.00 |
| House Expense and Repairs | 847.43 | 385.52 |
| Special Building Repairs—net | ........ | 3,120.03 |
| Building Fund Reserve | 3,500.00 | ....... |
| | $ 7,841.61 | $ 7,549.54 |
| **Publications:** | | |
| Journal Salaries and Expense | $20,298.76 | $17,639.26 |
| Provincial Sales Tax | 33.36 | 357.34 |
| Sundry Printing | 650.29 | 589.80 |
| | $20,982.41 | $18,586.40 |
| **Office Expense:** | | |
| Salaries | $12,912.59 | $13,825.79 |
| Telegrams, Postage and Excise Stamps | 1,152.42 | 1,290.12 |
| Telephones | 667.75 | 598.55 |
| Office Supplies and Stationery | 1,353.25 | 1,663.48 |
| Audit and Legal Fees | 325.00 | 315.00 |
| Messenger and Express | 119.39 | 141.54 |
| Miscellaneous | 408.23 | 449.51 |
| Depreciation—Furniture and Fixtures | 364.48 | 368.63 |
| | $17,303.11 | $18,652.62 |
| **General Expense:** | | |
| Annual and Professional Meetings | $ 1,689.73 | $ 764.20 |
| Meetings of Council | 719.25 | 292.57 |
| Travelling | 734.49 | 785.83 |
| Branch Stationery | 146.33 | 148.90 |
| Prizes | 407.80 | 350.32 |
| Library Salary and Expense | 2,021.62 | 1,079.49 |
| Interest, Discount and Exchange | 168.92 | 107.48 |
| Examinations and Certificates | *40.36* | *7.32* |
| Webster Lectures—net | 996.20 | ..... |
| Committee Expenses | 590.38 | 558.02 |
| Advances re Overseas Children | 225.00 | ........ |
| National Construction Council | 100.00 | 100.00 |
| Sundry Expense | 169.28 | 110.07 |
| | 7,928.64 | 4,289.56 |
| Rebates to Branches | $ 6,526.20 | $ 6,111.03 |
| Total Expenditure | 60,581.97 | 55,189.15 |
| Surplus for Year | 3,208.56 | 1,771.99 |
| | $63,790.53 | $56,961.14 |

### Student Selection and Guidance

The brochure "The Profession of Engineering in Canada" was printed in February and upwards of 9,000 free copies have been distributed to all the high schools of all the provinces of Canada, and to the universities, with instruction in the English language. In December, through the generosity of Dr. J. B. Challies and his associates, 5,000 copies of a French translation were printed. These are being distributed to all the high schools and classical schools in Quebec and the other provinces where instruction is in French.

### Branch Student Guidance Committees

These have been set up in 21 of the twenty-five branches. The personnel in every case is composed of outstanding members of our profession. This augurs well for the success of the undertaking. Each of these committees, and also the Branches which have not yet appointed committees, have been supplied with information as to the objectives of our committee, instructions on the approach to students, copies of "Engineering as a Career" and of the "Manual for Counsellors," both of the Engineers' Council for Professional Development, and of the Institute brochure. You will doubtless be interested in some of the results.

The Halifax Branch, under the leadership of Professor A. E. Flynn, M.E.I.C., has organized the whole province, including the Cape Breton Branch district, and District Vocational Counsellors have been appointed to cover the forty schools from which the greater number of students are graduated. The Provincial Science Library has purchased books on guidance for the use of these counsellors. There is definite co-operation evident among all those interested in engineering education.

The Montreal Branch has given definite leadership in Quebec under Jacques Benoit, M.E.I.C. The Quebec, Saguenay and Saint Maurice Valley Branches are now cooperating fully and the issue of the French edition of the brochure has stimulated interest.

Through the efforts of G. R. Langley, M.E.I.C., chairman of the Peterborough Branch committee, a general Vocational Guidance Committee was set up by the Peterborough Board of Education and three members of the Engineering

## COMPARATIVE STATEMENT OF ASSETS AND LIABILITIES

As at 31st December, 1942

**Assets**

| | | 1942 | 1941 |
|---|---|---|---|
| **Current:** | | | |
| Cash on hand and in bank | | $ 1,204.97 | $ 826.24 |
| Accounts Receivable | $ 4,513.53 | | |
| *Less:* Reserve for Doubtful Accounts | 95.04 | 4,418.49 | 3,299.43 |
| Arrears of Fees—Estimated | | 2,500.00 | 2,500.00 |
| | | $ 8,123.46 | $ 6,625.67 |
| **Special Funds—Investment Account:** | | | |
| Investments—at Cost | 6,282.64 | | |
| Cash in Savings Accounts | 1,239.69 | 7,522.33 | 13,636.35 |
| **Investments—at Cost:** | | | |
| Bonds: | | | |
| Dominion of Canada, 3%, 1951 | $2,500.00 | | |
| Dominion of Canada, 3%, 1956 | 5,500.00 | | |
| Dominion of Canada, 4½%, 1948 | 96.50 | | |
| Dominion of Canada, 4½%, 1958 | 180.00 | | |
| Dominion of Canada, 4½%, 1959 | 4,090.71 | | |
| Montreal Tramways, 5%, 1951 | 950.30 | | |
| Montreal Tramways, B, 5%, 1955 | 2,199.00 | | |
| Province of Saskatchewan, 5%, 1959 | 502.50 | | |
| Shares: | | | |
| Canada Permanent Mortgage Corp., 2 shares—$100.00 each | 215.00 | | |
| Montreal Light, Heat and Power Cons.—40 shares N.P.V. | 324.50 | | |
| | | $16,558.51 | $11,058.51 |
| Sundry Advances | | 400.00 | 100.00 |
| Deposit with Postmaster | | 100.00 | 100.00 |
| Prepaid Insurance | | 200.00 | 275.00 |
| Gold Medal | | 45.00 | 45.00 |
| Library—At cost less depreciation | | 1,448.13 | 1,448.13 |
| Furniture and Fixtures—At cost less depreciation | | 3,280.33 | 3,317.73 |
| Land and Buildings—Cost | $91,495.22 | | |
| *Less:* Depreciation | 55,495.22 | 36,000.00 | 36,000.00 |
| | | $73,677.76 | $72,606.39 |

**Liabilities**

| | | 1942 | 1941 |
|---|---|---|---|
| **Current:** | | | |
| Accounts Payable | | $ 2,674.23 | $2,476.18 |
| Rebates to Branches | | 507.30 | 479.39 |
| | | $3,181.53 | $ 2,955.57 |
| Special Funds | | 6,823.45 | 13,336.60 |
| Reserve for Building Fund | | 3,500.00 | |
| Reserve for Building Maintenance | | 2,000.00 | 1,350.00 |
| **Surplus Account:** | | | |
| Balance as at 31st December, 1941 | $54,964.22 | | |
| *Add:* Excess of Revenue over Expenditure for year as per Statement attached | 3,208.56 | 58,172.78 | 54,964.22 |
| | | $73,677.76 | $72,606.39 |

We have audited the books and vouchers of The Engineering Institute of Canada for the year ended 31st December, 1942, and have received all the information we required. In our opinion the above Statement of Assets and Liabilites and attached Statement of Revenue and Expenditure for 1942 are properly drawn up so as to exhibit a true and correct view of the Institute's affairs as at 31st December, 1942, 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.

(Sgd.) Ritchie, Brown & Co.,
*Chartered Accountants.*

Montreal, 19th January, 1943.

Institute of Canada are members of that committee. The E.I.C. activities have been extended to other municipalities in the branch district.

At Toronto, The Engineering Institute of Canada and the University of Toronto Alumni Guidance Committees have joined forces to cover all the schools in that city. Professor R. F. Legget, M.E.I.C., has given this work his personal attention. The branch holds a successful Students' Night every year and with more than 1,400 engineering students at the University of Toronto, this feature will no doubt be emphasized in the future and help to bring the students in contact with practicing engineers. The recent formation of a Junior Section in Toronto should go a long way toward increasing the interest of the younger engineers in the affairs of the Institute.

The Border Cities and London Branches have depended largely on the efforts of individual members to carry out the guidance programme, with a fair degree of success. The work at Windsor has been divided between C. G. R. Armstrong, M.E.I.C., and T. H. Jenkins, M.E.I.C., and many students have received valuable advice from them. The London Branch interviews have not been as numerous, but were equally effective and they extend into the four cities of the district.

In the Western Provinces committees have been formed in all the branches except Lethbridge. The principal activity has been in the Calgary and Saskatchewan Branches. Unfortunately, Professor H. R. Webb, M.E.I.C., who had been appointed chairman of the Edmonton Branch Committee, met a tragic death early last summer.

At Calgary, where student guidance work had been carried on for a number of years by service clubs in co-operation with the school board authorities, the Institute committee is working through the present local organization, and under the chairmanship of J. B. deHart, M.E.I.C., increased activity is expected.

D. A. R. McCannel, M.E.I.C., Chairman of the Saskatchewan Branch committee, has organized local committees in the several cities of the province. The Collegiate Institute Boards have welcomed these advisors and it is expected that the coming year will show definite results.

The Winnipeg Branch has been active under the chairmanship of Professor A. E. Macdonald, M.E.I.C., and they have adopted a programme embracing the schools of the city of Winnipeg and of the province of Manitoba. The committee is ready to supply speakers and it is discussing the matter of student guidance with the educational authorities.

Both branches of the Institute in British Columbia have set up committees and these are co-operating with the local organizations in presenting the needs for the engineering profession to interested students.

### Programme for 1943

It is evident that several methods of approach may be adopted in order to present the information which we have concerning engineering guidance. In some communities, addresses to student bodies and individual interviews have been used with very good results. The distribution of the Institute brochure has brought enquiries from individual students all over Canada. It is evident that this booklet alone has brought to the young men sufficient information to compel them to think seriously of their approach to further studies. The work of these committees has now started along a definite course and your committee is sure that the interest of the branches will increase provided, of course, the general committee continues its activities.

The circumstances of the war has taken many of our young engineers from their normal activities and from contacts with the older members of the profession. Some day these men will return, more experienced, more disciplined and ready to take their rightful place in the Canadian professional, economic and social life. To these will be added the increased number of students graduating from our universities. What will we have to offer them? Those who will return to former employment may not adapt themselves readily to changed methods and conditions. A rehabilitation process must be evolved to meet this situation.

Others will come back to no former employment. We must associate ourselves with the study of post-war problems if for no other reason than that we have a moral obligation to help these men. It is evident not only in Canada but in the United States, that national and local governments will be embarking on extensive post-war reconstruction projects. For this work the young engineer should be especially trained not only technically but to handle the administration under a governmental set-up. Other engineers will be used in industries and ultimately move on to managerial positions and again, research will require a greater number of technically trained men who are adapted to this type of work.

The Professional Training Committee of the Engineers' Council for Professional Development is preparing a booklet for distribution to young men, giving a lead in such matters as have been described. It will be the duty of our committee to watch the progress, to study the local situations, and to present concrete proposals to the Institute. It is our hope that many of the senior members of the Institute will give some attention to this problem and their advice will be welcomed.

Respectfully submitted,

Harry F. Bennett, M.E.I.C., *Chairman.*

## LIBRARY AND HOUSE COMMITTEE

The President and Council:

This committee reports as follows for the year 1942:

Owing to the fact that a great deal of building repair work was done in 1941, repairs were held to absolute essentials during the year. The largest items, outside of minor routine repairs, being re-roofing the new section of the building that had been already authorized in 1941 and repairs to the front entrance steps which will be continued next spring.

Routine work was handled very efficiently and economically by the staff.

### Library

Tabulated below is a summary of the accessions to the library in the past year together with the number of requests for information received by the librarian:

| | |
|---|---|
| Books borrowed | 406 |
| Bibliographies (a total of 29 pages) | 22 |
| Photostats furnished: | |
| Negatives | 229 |
| Positives | 171 |
| Figures | 13 |
| Requests for information: | |
| By telephone | 779 |
| By letter | 373 |
| In person | 412 |
| Books presented by publishers for review in the Journal | 46 |
| Books presented to the library | 13 |
| Proceedings and Transactions | 27 |
| Reports (including Standards and Tentative Standards) | 373 |
| ARP and Civilian Defence | 11 |

We also acquired material published by the Office of Civilian Defence, Washington, D.C.

The above figures show an increase in the use of the library for the past year. It is recommended that a complete survey of the library be made with a view to removing obsolete material from the shelves. It might be possible, for this purpose, to obtain the advice of members of the Institute well versed in the various branches of engineering.

Publishers of technical books in the United States and Great Britain should be requested to send review copies of their new books in acknowledgment of the Book Notes appearing monthly in the *Journal*. Thus it would be possible, at little cost, to provide the library with the newest books.

Respectfully submitted,

WALTER G. HUNT, M.E.I.C., *Chairman*.

## EMPLOYMENT SERVICE

The President and Council:

The marked decrease in the activities of the Employment Service as shown in the accompanying table is due mainly to the new legislation of the Wartime Bureau of Technical Personnel.

| | 1941 | 1942 |
|---|---|---|
| Registered members | 77 | 34 |
| Registered non-members | 75 | 45 |
| Number of members advertising for positions | 14 | 19 |
| Replies received from employers | 9 | 48 |
| Vacant positions registered | 229 | 134 |
| Vacancies advertised in the Journal | 35 | 58 |
| Replies received to advertised positions | 110 | 101 |
| Men's records forwarded to prospective employers | 302 | 35 |
| Men notified of vacancies | 306 | 117 |
| Placements definitely known | 71 | 30 |

On March 23rd, 1942, the Wartime Bureau of Technical Personnel was given control over the distribution of technical manpower. Under these regulations, it became compulsory for our members, along with other technically-trained persons, to register with the Wartime Bureau if they had not already done so, and to report to the Bureau if afterwards they became unemployed or available. The same regulations make it necessary for the employer to notify the Bureau of each specific need for technical personnel and to apply for permission to employ any technically-trained person.

The effect of these regulations has been an important decrease in the number of inquiries from employers filed with our Employment Service Bureau and, correspondingly, a smaller number of applications for employment from engineers. The additional time thus made available to our Bureau staff has been well taken up by other activities which had to be taken care of during the absence of the general secretary, on loan to the National Selective Service at Ottawa.

The establishment during the year, by the Wartime Bureau, of regional offices in Montreal and other centres, has afforded closer co-ordination of effort between the Bureau and our Employment Service. Members and other engineers who have applied to us during the year have been properly instructed as to the governmental regulations with which they were expected to comply and have been directed to the regional offices of the Wartime Bureau. Useful exchanges of information have been made between the Ottawa office of the Bureau and our Employment Service. Again this year, the Employment Page of the *Journal* has been open to members and employers and has proved of distinct value in establishing contacts.

Assistance has been continued to the armed forces in recruiting their technical personnel. In this connection, the assistant general secretary is a member of a committee, in Military District No. 4, for the selection of potential French Canadian officers.

Respectfully submitted,

L. AUSTIN WRIGHT, M.E.I.C., *General Secretary*.

## COMMITTEE ON INTERNATIONAL RELATIONS

The President and Council:

Conditions accompanying the war and the generally disturbed state of affairs, have not been conducive to formal international relations, so that there has been little for the Committee to do. The intimate contacts between Great Britain, the United States and Canada, incident to war contracts and supplies, has, however, greatly strengthened informal relationships.

As far as the United States is concerned, the Engineers' Council for Professional Development, on which the Institute has three members, apart from five others who are members of its Committee, has kept up connection between us and them, and some account of the work of this Council has already appeared in the Journals of the Societies. Several members of the International Relations Committee have attended the professional meetings of some of the American founder societies, and at least one paper was presented by one of the members in that connection.

One event of unusual importance was the joint meeting, held at Niagara Falls, Ontario, October 13th to 15th, 1942, of the American Society of Civil Engineers and The Engineering Institute of Canada. The total attendance was about 400, and many of our members were present at the meetings, and our president and others took a prominent part therein. Civilian defence of Canada and the United States was one of the subjects discussed, and members of both societies were greatly pleased by the spirit of friendship and good feeling existing between these two adjacent nations.

The Committee records its profound sorrow over the recent death of Past-President H. H. Vaughan, one of its members. Mr. Vaughan had a very close connection with our own Institute, The American Society of Mechanical Engineers and the Institution of Mechanical Engineers, and was in a position to create very harmonious relations amongst members of the profession in different countries. He is a distinct loss to the Committee.

Respectfully submitted,

ROBERT W. ANGUS, M.E.I.C., *Chairman*.

## COMMITTEE ON DETERIORATION OF CONCRETE STRUCTURES

The President and Council:

The Committee on Deterioration of Concrete Structures has nothing to report this year. The members of the Committee are all busy men and due to war conditions it seems to me inadvisable to press them in connection with committee work unless some special problem should come up which was related to the present emergency.

At the beginning of the year I questioned whether or not this committee should be continued if it could not be active, but there is plenty of work for the committee to do in more favorable times; and I am now inclined to the belief that we should maintain it in its present form ready to work actively when the war is over, for at that time there will be much deferred maintenance to be carried out on concrete structures and the work of the committee will become of interest to a great many of the Institute's members.

Respectfully submitted,

R. B. YOUNG, M.E.I.C., *Chairman*.

## PUBLICATION COMMITTEE

The President and Council:

The Publication Committee submits the following report for the year 1942:

As usual, the principal work of the committee has been the publication of the *Engineering Journal*, and we feel that in spite of the difficult and strenuous times through which we are passing the standards have been well maintained.

It is a source of satisfaction to point to the many contributions the *Journal* has received from special correspondents overseas. Most of these have been along aeronautical lines, and our correspondents have been experts in that field. Correspondence from members in the United States has also been an important feature of several numbers of the *Journal*. The committee is indeed grateful to these people for their contributions.

The Institute's membership in the Engineers' Council for Professional Development has brought to us several excellent papers which appeared simultaneously in the publications of all the societies making up the membership of the Engineers' Council. These articles all related to the professional and ethical side of engineering.

Several excellent papers have been submitted to the committee for which publication was denied because the censors failed to give approval.

An important publication for the year was the French translation of the booklet "The Profession of Engineering in Canada." The English version was printed last year. This publication and translation was carried on under the auspices of the Committee on the Training and Welfare of the Young Engineer, but it also received the approval of the Publication Committee. The Institute is much indebted to Messrs. Huet Massue and H. Gaudefroy for their assistance in preparing an excellent translation.

Another publication which has entailed a lot of work and expense was the printing of the notes of Professor Fred Webster's lectures on "Structural Defence Against Bombing." Since the original confidential notes were printed, an abridged edition has been published which has already gone into the second printing. The work associated with these publications was very largely attended to by the Institute's Committee on the Engineering Features of Civil Defence, and the Publication Committee is glad to take this opportunity to acknowledge the excellent work of that Committee.

Although it involves no work for the Publication Committee, it is interesting to report that the advertising portion of the *Journal* continues to operate on a quite satisfactory basis. The volume of advertising is being well sustained.

In May of 1943, the *Engineering Journal* will celebrate its 25th Anniversary. It is proposed to fittingly acknowledge this anniversary by means of a special number.

Respectfully submitted,

C. K. McLeod, M.E.I.C., *Chairman.*

## PAPERS COMMITTEE

The President and Council:

The Papers Committee has not accomplished as much during the year as it had hoped to do. The war work undertaken by the various members is restricting most other activities. However, some meetings have been arranged, and the following is a brief outline.

Harry F. Bennett of London, Ontario, chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, made a tour of all the four maritime provinces early in the year. These meetings were well attended and his visit was very much appreciated.

Professor Fred Webster, deputy chief engineer, Ministry of Home Security, London, England, visited seven branches, Halifax, Saguenay, Montreal, Ottawa, Toronto, Vancouver, and Victoria. His topic was "The Structural Features of Defence Against Bombing."

The committee would like to emphasize the value of regional meetings of Council. Such meetings promote co-operation between engineers, and are stimulus to closer relationship between branches, inasmuch as they bring together officers of the Institute and councillors from all branches in the zone.

A perusal of the reports of branches indicates that the papers through the year have been of a high standard. The committee believes that assistance to branches could be extended by a better supply of motion picture films as well as papers.

It is encouraging to see that the officers and members of the Institute are developing the practice of visiting branches when, for business or other reasons, they travel in different parts of Canada.

Respectfully submitted,

James A. Vance, M.E.I.C., *Chairman.*

## STUDENTS' AND JUNIORS' PRIZES

The reports of the examiners appointed in the various zones to judge the papers submitted for the prizes for Students and Juniors of the Institute were submitted to Council at its meeting on January 16th, 1943, and the following awards were made:

H. N. Ruttan Prize (Western Provinces). No papers received.

John Galbraith Prize (Province of Ontario), to Robert J. G. Schofield, Jr.E.I.C., for his paper "Cotton Yarn Dyeing."

Phelps Johnson Prize (Province of Quebec—English), to Paul O. Freeman, S.E.I.C., for his paper "Cold Rivetting—Its Principles, Procedure and Advantages".

Ernest Marceau Prize (Province of Quebec—French), to René Dansereau, S.E.I.C., for his paper "Etude comparative de la construction, par la rivure et par soudure, d'un pont-route en acier."

Martin Murphy Prize (Maritime Provinces). No papers received.

## GZOWSKI MEDAL COMMITTEE

The President and Council:

It is the unanimous recommendation of your Committee that the Gzowski Medal for the year 1942 be awarded to Dr. S. D. Lash, M.E.I.C., for his paper, "Notes on the Analysis and Design of Rectangular Reinforced Concrete Slabs Supported on Four Sides," as published in the September, 1941, issue of the *Journal.*

Respectfully submitted,

H. V. Anderson, M.E.I.C., *Chairman*

## DUGGAN MEDAL AND PRIZE COMMITTEE

The President and Council:

Your Committee, consisting of Messrs. J. M. Fleming and R. C. Flitton together with the writer, has examined carefully a number of papers presented to the Institute during the year ending June 30, 1942 which appeared to meet the conditions prescribed for this award.

Having reached a unanimous decision, the members of your Committee would recommend that the award be made to J. H. Maude, M.E.I.C., for his paper, "The New Oil-Hydraulic Press in Munitions Manufacture," as published in the February, 1942 issue of the *Journal.*

Among other papers of outstanding interest, your Committee would like to mention the paper by Howard Johnson, M.E.I.C., on "Shipyard Production Methods," and W. F. Drysdale's paper on "The Manufacture of the 25-Pounder in Canada."

Respectfully submitted,

John T. Farmer, M.E.I.C., *Chairman.*

## PLUMMER MEDAL COMMITTEE

The President and Council:

Your Committee has considered the papers presented during the prize year, July, 1941 to June, 1942, and recommends that the Plummer Medal for 1942 be awarded to Professor E. A. Allcut, M.E.I.C., for his paper, "Producer Gas for Motor Transport," as published in the April, 1942 issue of the *Journal.*

Respectfully submitted,

C. R. Whittemore, M.E.I.C., *Chairman.*

### LEONARD MEDAL COMMITTEE

The President and Council:

Among the papers submitted for consideration for the Leonard Medal award there are several considered by your Committee to be of a high standard, and it has not been easy to differentiate in making a selection for the award. However, a substantial majority of the Committee approves for first place, the paper entitled, "The Ore Deposits of Nickel Plate Mountain, Hedley, B.C." by Paul Billingsley and C. B. Hume, as published in the October, 1941 issue of *The Canadian Mining and Metallurgical Bulletin* and your Committee therefore recommends this paper for the award.

Respectfully submitted,

JOHN MCLEISH, M.E.I.C., *Chairman.*

### JULIAN C. SMITH MEDAL COMMITTEE

Carrying out the instructions pertaining to the award of the Julian C. Smith Medal for 1942, the special committee consisting of Past Presidents Hogg, Mackenzie, and myself has made a selection of names.

The regulations pertaining to the medal require this committee to select not more than two names from the nominations and that these names shall be submitted by open letter ballot to all Councillors not later than October 1st of each year. The two names that have been selected are the following:

Dr. H. G. Acres, Consulting Engineer, Niagara Falls, Ont.
Mr. R. M. Smith, Deputy Minister of Ontario.

Respectfully submitted,

C. R. YOUNG, M.E.I.C., *President.*

### NOMINATING COMMITTEE

*Chairman:* G. A. VANDERVOORT

| *Branch* | *Representative* |
|---|---|
| Border Cities | C. G. R. Armstrong |
| Calgary | F. K. Beach |
| Cape Breton | J. R. Morrison |
| Edmonton | J. Garrett |
| Halifax | I. P. Macnab |
| Hamilton | A. Love |
| Kingston | H. W. Harkness |
| Lakehead | E. L. Goodall |
| Lethbridge | N. H. Bradley |
| London | F. T. Julian |
| Moncton | H. W. McKiel |
| Montreal | E. R. Smallhorn |
| Niagara Peninsula | A. L. McPhail |
| Ottawa | W. H. Munro |
| Peterborough | W. T. Fanjoy |
| Quebec | A. O. Dufresne |
| Saguenay | S. J. Fisher |
| Saint John | V. S. Chesnut |
| Saskatchewan | H. R. MacKenzie |
| Sault Ste Marie | L. R. Brown |
| St. Maurice Valley | M. Eaton |
| Toronto | Wm. Storrie |
| Vancouver | W. O. Scott |
| Victoria | S. H. Frame |
| Winnipeg | H. L. Briggs |

# Abstracts of Reports from Branches

**Note—For Membership and Financial Statements see pages 82 and 83**

### BORDER CITIES BRANCH

The Executive Committee held nine meetings during the year for the transaction of branch business.

During the year, the Executive appointed two very important committees which have functioned in such a way as to greatly increase the usefulness of the Engineering Institute to the community at large.

Mr. C. G. R. Armstrong was appointed chairman of the Branch Committee on Student Guidance and Counselling and has been very active in this connection. His report shows that the response to his efforts has been very gratifying.

Mr. P. E. Adams has been appointed chairman of the Branch Committee on Structural Defence Against Bombing. The members of the committee are drawn from those who attended Professor Webster's lectures in Toronto on April 22nd, 23rd and 24th. This committee will become of increasing value to the public as its activities become more widely known and deserves the hearty support of all Institute members.

Seven Branch meetings were held during the year, including the Annual Meeting, and the joint meeting with the A.S.M.E. of Detroit, at which our president, Dean Young, presided.

The meetings held were as follows, attendance being shown in brackets.

Feb. 20—Mr. James N. Livermore, of the Engineering Department of the Detroit Edison Company, spoke on **The Adaptation of Air Conditioning to an Existing Office Building** (37).

Mar. 13—Mr. Warren C. Miller, of St. Thomas, president of the Association of Professional Engineers of Ontario, spoke on **The Work of The Associations of Professional Engineers.** (35).

April 10—Mr. A. E. Davison, transmission engineer of the Hydro Electric Power Commission of Ontario, presented a paper on **220 Kilovolt Lines in Ontario 1941** (44).

May 22—The speaker was Mr. W. H. Furlong, chairman of the Board of the Sandwich, Windsor and Amherstburg Railway, who spoke on **Canada's War Effort as shared by the S.W. & A.** (26).

Oct. 16—This dinner was held in honour of the president of the E.I.C., Dean C. R. Young, of Toronto, and the president of the A.S.M.E., Mr. J. W. Parker, of Detroit. The meeting was attended by members of the Detroit section of the A.S.M.E. (100).

Nov. 27—Mr. W. R. Stickney, of the Canadian Bridge Company of Windsor, spoke on **Electric Arc Welding** (33).

Dec. 11—The Annual Meeting and election of officers. Mr. T. H. Jenkins, designing engineer of the Grand Trunk Western Railway, spoke on **Wartime Railroad Transportation.** (21).

We record with regret the passing of three of the Branch's charter members: Messrs. J. E. Porter, F. H. Kester and W. H. Baltzell.

### CALGARY BRANCH

The following report covers the activities of the Branch for the year 1942. Attendances are shown in brackets:

Jan. 12—**Anglo-American Responsibilities,** by Mr. Max Ball. (100).

Jan. 29—Programme in charge of and convened by Juniors and Students. Mr. B. A. Monkman spoke on **The Minnewanka Lake Power Project.** Motion Pictures—**Manufacture of Army Vehicles,** courtesy of the Ford Motor Company (47).

Feb. 12—Motion Pictures—**Rainbows in the Rockies.** Commentary by Mr. V. A. Newhall. **Copper Mining in Arizona,** courtesy of Mr. Gaddis, of Canada Wire & Cable Company (44).

Feb. 26—Motion Picture—**Construction of the Hydro Plant near Yellowknife, N.W.T.,** Commentary by Mr. A. G. Bennett of Bennett and White Construction Company (47).

Mar. 14—Annual Meeting, following luncheon (31).

April 10—Dean C. R. Young, president of The Engineering Institute of Canada, visited the Branch; following the President's talk, lunch was served (76).

July 29—**Effects of Aerial Bombing,** by Professor I. F. Morrison. (50).

Sept. 25—Mr. C. A. Price on **Recent Electrical Developments.** Motion Pictures—**Arc Welding,** courtesy Canadian General Electric (109).

Oct. 28—Mr. S. N. Green on **History of Aircraft Construction over the Past Thirty Years** (44).

Nov. 12—**The Edmonton Power Plant,** by Mr. R. R. Couper (38).

Nov. 26—Mr. James Fowler spoke on **The History and Scope of The Provincial Institute of Technology, and its Function in Relation to the War Emergency Programme** (25).

Dec. 10—Showing of coloured pictures, **The Flora of the West,** Commentary by Mr. McAlla. This was our annual Ladies' Night. Luncheon was served following lecture (82).

During the year the Branch Executive Committee met nine times.

### CAPE BRETON BRANCH

During the year the branch held three meetings, the first on **The St. Lawrence Waterway** and **The Young Engineer** at which Mr. H. F. Bennett was the speaker; the second on **Air Raid Precautions and Civil Defence** by Messrs. Ira McNab and G. Clarke.

The third meeting was a dinner in honour of the visit of the presidential party in August, the speakers being the members of the party and several local representatives of industry.

### EDMONTON BRANCH

During the year 1942 there has been a large influx of American engineers to Edmonton; invitations have been given to these to attend our regular meetings and interesting additions to our discussions have been obtained thereby.

In order to meet these engineers from the U.S.A., the Branch held a reception or cocktail party on November 6th which was attended by 31 Canadians and 25 American guests. The Americans responded by inviting our members to a similar party in December.

The following is a summary of our regular meetings with attendances shown in brackets. Except for the July meeting, these were all preceded by a dinner.

Jan. 21—**Geophysical Methods of Oil Exploration** by W. H. Gibson of the McColl-Frontenac Oil Co. (40).

Feb. 24—**The Cascade Power Development** by B. A. Monkman, Field Engineer for the Calgary Power Company (50).

Mar. 27—**Chemicals and the War Effort** by Dr. E. H. Boomer of the Department of Chemistry at the University of Alberta (43). Election of Branch Officers for the 1942-43 Session took place at this meeting (43).

April 9—Dean C. R. Young, president of the E.I.C. visited the Branch and gave an interesting and instructive address on the work being done by the Institute (37).

July 20—Prof. I. F. Morrison, one of the Edmonton Branch's delegates to the Webster lectures spoke on **The Effects of Aerial Bombing** (35).

Nov. 13—**Development of Natural Resources in Relationship to the Railways** by G. M. Hutt, Assistant Development Commissioner of the C.P.R. (32).

Dec. 9—**The Work of Ducks Unlimited in Canada** by G. R. Fanset, Chief Engineer of Ducks Unlimited Canada (38).

### HAMILTON BRANCH

The Executive Committee held nine business meetings with an average attendance of seven members. The figures in the brackets show the attendance at the meetings of the Branch.

Jan. 9—The Annual Business Meeting and Banquet was held at the Royal Connaught Hotel. The guest speaker, Professor E. A. Allcut, University of Toronto, spoke on **Substitute Fuels for Gasoline.** President C. J. Mackenzie and the general secretary, L. Austin Wright were present and each addressed the gathering. W. A. T. Gilmour closed the meeting by introducing the new chairman, Stanley Shupe who replied in a few words.

Feb. 10—**Hardening by Induction,** by Dr. H. B. Osborne, Jr., research and development engineer, Tocco Division, Ohio Crankshaft Company. This was a joint meeting with American Society of Metals (Ontario Chapter) also the American Institute of Electrical Engineers (Hamilton Group) and was held in the Westinghouse Auditorium. (135).

Mar. 20—**Cotton Yarn Dyeing,** by R. J. G. Schofield, Jr.E.I.C., **The Application of Electric Drive to Machine Tools,** by Andrew M. Swan, S.E.I.C., and **A History of Water Power Development on the Saguenay River,** by K. R. Knights, S.E.I.C.

This was the annual Junior and Student night and the three contestants submitted excellent papers. After the contest, Chancellor G. P. Gilmour, as our guest speaker gave a most interesting address entitled **Useful and Useless Learning** (62).

Mar. 31—**Essential Air Raid Precautions,** by E. Arthur Pinto, M.E.I.C., at the Delta Collegiate Auditorium, when the following were our guests; Hamilton Civil Guard, under the command of Lieut. Col. H. S. Robinson; Officers and men of the Army Trades School, under the command of Col. White, M.E.I.C.; Auxiliary Firemen and A. R. P. workers under the command of Major Wilson and the Women's Auxiliary Defence Corps and Band, under the command of Brigadier Molly Mockler. Cash prizes were awarded to A. M. Swan and R. J. G. Schofield who had been judged the winners of the contest of the previous meeting (1121).

April 10—**Trends in Design of A. C. Generators,** by C. M. Laffoon, Manager, A. C. generator engineers, Westinghouse Electric and Mfg. Company, Pittsburgh. This was a joint meeting with the A.I.E.E. (Hamilton Group) and was held in the Westinghouse Auditorium (176).

May 5—**Magnesium: Lightest Commercial Metal,** by Dr. L. M. Pigeon, Metallurgist, Dominion Magnesium Company, located at Halleys. This meeting was held at McMaster University (48).

June 23—**Welding and War,** by E. W. P. Smith, B.Sc.E., consulting engineer, The Lincoln Electric Company, Cleveland, Ohio. This meeting was a joint meeting with the Niagara District Electric Club and was held in McMaster University (96).

May 16—**Insulation and Condensation in Buildings,** by W. W. Cullen, chief engineer of insulation, H. W. Johns-Manville Company, New York. This was a joint meeting with the Hamilton Chapter, Ontario Association of Architects and Geo. T. Evans, M.R.A.I.C., president of the local Chapter conducted the meeting as chairman (38).

Aug. 7—Official opening of the **Shand Dam,** near Fergus, Ontario, was conducted by Premier Mitchell Hepburn who gave an important address to the engineers, contractors, distinguished guests and public gathered to witness this ceremony. Executive members of the Hamilton Branch attended as guests of the management.

Oct. 6—**P.P.C. Street Railway Cars,** by J. A. M. Galilee, Assistant Advertising Manager, and L. A. Shaver, control engineer, both of the Can. Westinghouse Company. This was a joint meeting with the Hamilton Group of the A.I.E.E. (150).

Nov. 18—**Air Bombing and Structural Defence,** by D. C. Tennant, M.E.I.C., engineer, Ontario division, Dominion Bridge Company. Meeting was held at McMaster University (63).

The main activities of the year have been the formation of a branch committee on Engineering Features of Civil Defence and the participation in the work of the Hamilton Council of Adult Education Agencies.

Some surveys and reports have been made in connection with the civil defence effort but the public does not appear to feel the need for proper precautions in case of actual danger.

The matter of adult education was promoted by Professor C. H. Stearn of McMaster University and the Branch took part in this work from its inception and it is hoped and expected that we may be of use to this new organization.

In response to the request of the Vocational Guidance Department of the Hamilton Y.M.C.A., for volunteers from a number of professional societies to participate in an experimental project to determine if there were any personality differences between occupations on the professional level, a number of members of the Branch volunteered. The test chosen for this experimental project was the Rorschach Psychodiagnostic Group method. The branch was later informed of the result.

## HALIFAX BRANCH

During the year, four regular dinner meetings, one evening meeting, and two special dinner meetings, were held, all of which were found to be interesting and enjoyed by those present. These meetings were as follows:

Feb. 27—Mr. H. F. Bennett, of the London, Ontario Branch, and chairman of the Institute Committee on the Young Engineer. His subject was **The Engineer of To-morrow.**

Mar. 11—Prof. F. Webster, a member of the Research Experimental Staff of the Ministry of Home Security, London, England. He spoke to us on **Engineering Features of Civil Defence.**

Mar. 20—A moving picture was shown in the Nova Scotia Technical College Assembly Hall on **Photoelastic Stress Analysis,** prepared by Prof. A. E. MacDonald, of Engineering, University of Manitoba.

April 23—Dr. Allen E. Cameron, Deputy Minister of Mines for the Province of Nova Scotia. His subject was, **The Development of Nova Scotia Resources.**

Aug. 7—On this occasion we were privileged to be visited by the president of the Engineering Institute of Canada, the vice-presidents for Ontario, Quebec, and the Maritime provinces, the general secretary, and the assistant general secretary. During the morning a regional council meeting was held which was well attended. In the afternoon, a very pleasant trip on the harbour was arranged through the courtesy of His Majesty's Canadian Navy, through the good offices of Rear Admiral G. C. Jones. In the evening, a dinner was held in honour of the President, at which the President was the guest speaker; his subject being, **The Institute and the Engineering Profession.**

Oct. 22—Mr. J. R. Sutherland, Editor of *The Evening News*, New Glasgow, whose address dealt with a six week's visit which he has just made to the British Isles.

Nov. 19—Mr. D. B. Lindsay, Manager, Clark Ruse Aircraft Ltd. His subject was, **Aircraft, Overhaul and Repair for the R.C.A.F.**

During the year, the executive held ten meetings, at which ordinary routine business was transacted.

Since the last annual meeting, the Halifax Branch has become one of the "Big Four" and is now privileged to be represented by two councillors. The executive recommended to Headquarters that Mr. J. R. Kaye, be appointed as a second councillor from this branch, and his appointment was unanimously confirmed by Headquarters. Mr. Kaye was also appointed the representative of the Halifax Branch on the Joint Finance Committee of the Halifax Branch of the Engineering Institute of Canada, and the Association of Professional Engineers of Nova Scotia.

Two special committees have been set up by the executive, they being the Committee on Engineering Features of Civil Defence, with Mr. Ira P. Macnab as chairman, and the Committee on the Guidance and Welfare of Young Engineers, of which Prof. A. E. Flynn, was appointed chairman.

The chairman was also asked to appoint a committee to co-operate with the local committee on post-war reconstruction, of whom the local chairman is Mr. Fred Alport. It was decided that the executive as a whole, would act as a committee.

## KINGSTON BRANCH

The following meetings were held by the Branch this year:

Mar. 20—A very interesting address on **Aircraft in War** was given by Wing-Commander Morgan Keddie of the Norman Rogers Training School at a meeting held at the Badminton Club.

Nov. 10—Guest speaker at the opening meeting of the winter programme was Professor J. C. Cameron, Head of the Industrial Relations Section at Queen's University.

Dec. 8—A special meeting was held at the LaSalle Hotel to welcome the president, Dean C. R. Young of the University of Toronto. Mr. K. M. Winslow, chairman of the Branch, presided and Dean Young was introduced by Col. Le Roy Grant.

### LAKEHEAD BRANCH

The following meetings were held by the Branch this year:

Jan. 14—Mr. Z. Kryzwoblocki of the Canadian Car and Foundry Co. Ltd., Fort William, gave an address on **The Rocket Wing-Bomb and Rocket Torpedo.**

Feb. 13—The Annual Dance of the Lakehead Branch was held in the Norman Room of the Royal Edward Hotel in Fort William.

April 4—A special dinner meeting was held in the Prince Arthur Hotel, Port Arthur, to welcome the president of the Institute, Dean C. R. Young.

June 10—The annual dinner meeting of the Lakehead Branch was held at the Port Arthur Golf and Country Club.

Nov. 11—**Iron Ore Occurrences in the Lake Superior District** was the subject of an address given by Mr. Jules J. Cross, M.E., well-known engineer of Port Arthur and discoverer of the great hematite ore body at Steep Rock Lake near Atikokan, Ontario.

### LETHBRIDGE BRANCH

During the year 1942, the following meetings were held:

Jan. 31—Joint dinner meeting at the Marquis Hotel with the Association of Professional Engineers of Alberta. Wing-Comdr. Jones spoke on **Bombing and Gunnery Training** (49).

April 8—Annual meeting and election of new officers.

April 11—Afternoon meeting in the Marquis Hotel to welcome the president of the Institute, Dean C. R. Young.

Three executive meetings were also held during the year with an average attendance of six.

### LONDON BRANCH

During the year 1942, the executive held seven business meetings. Eight regular and special meetings were held as follows. Attendance is given in brackets.

Jan. 21—Annual meeting and election of officers held at the Grange Tea Rooms, London. **The Rise of The University,** by Dr. Floyd Maine, of the University of Western Ontario. (35).

Feb. 27—Regular Meeting held in the Officers Mess, Talbot Street Armouries, London, **Madawaska Development,** by Otto Holden, M.E.I.C., Chief Hydraulic Engineer, Hydro Electric Power Commission of Ontario (45).

Mar. 18—Regular Meeting held in the Officers Mess, Talbot Street Armouries, London. **Drainage Systems,** by Geo. A. McCubbin, M.E.I.C., Drainage Engineer, Chatham, Ont. (35).

April 21—Regular Meeting held in Board Room, Public Utilities Commission, London, F. T. Julian, M.E.I.C., Branch Chairman, Report of Annual Meeting and Institute Affairs (28).

May 21—Special Dinner Meeting. Complimentary Dinner to Warren C. Miller, M.E.I.C., President of the Professional Engineers of Ontario. Held at the London Hunt & Country Club. (35).

Sept. 25—Regular Meeting held in the Board Room of the Public Utilities Commission, London, Dr. A. E. Barry, M.E.I.C., Director of Public Health, Toronto, **Some Changing Concepts in Public Health Engineering.**

Nov. 4—Regular Meeting held in the Board Room of the Board of Education, City Hall, London. **The Effect of Bombing on Structures,** by H. F. Bennett, M.E.I.C., District Engineer, Dept. Public Works, London (70).

Dec. 2—Special Supper Meeting for President C. R. Young at Hotel London, followed by a regular meeting in the Williams Memorial Library (35).

### MONCTON BRANCH

The Executive held six meetings during the year. Seven meetings of the branch were held, at which addresses were given and business transacted as follows:

Feb. 25—A meeting was held in the City Hall. H. F. Bennett, B.Sc., District Engineer, Department of Public Works, London, Ont., gave an address on **The Great Lakes System.**

Mar. 24—A meeting was held in the City Hall. Films dealing with **Photoelastic Stress Analysis** were shown. C. S. G. Rogers gave a running commentary.

June 1—A dinner meeting was held in the Brunswick Hotel. H. Franklin Ryan, B.Sc., General Electric Co., Halifax, N.S., gave an address on **Plastics.** Mr. Ryan placed on display numerous samples, and his remarks were illustrated by slides. Nominations for branch officers for 1942-43 were made at this meeting.

June 29—The annual meeting was held on this date.

Aug. 3—A dinner meeting was held in the Y.M.C.A. The guest speaker was Dean C. R. Young, president of the Engineering Institute of Canada. Addresses were also given by Vice-President K. M. Cameron and Assistant General Secretary Louis Trudel.

Nov. 11—A combined meeting of Moncton Branch and the Engineering Society of Mount Allison was held in the Science Building, Mount Allison University, Sackville. A film entitled **The Inside of Arc Welding** was shown.

Nov. 12—A meeting was held in the City Hall, at which the film **The Inside of Arc Welding** was shown.

### MONTREAL BRANCH

The outstanding event of the year was the fifty-sixth Annual General and Professional Meeting. With a registration of over 1,000, it was a complete success. The Institute was fortunate in being able to greet Lieutenant General and Mrs. A. G. L. McNaughton at the Annual Dinner. The General Committee on arrangements was under the able chairmanship of Mr. Walter G. Hunt. The Executive Committee is much indebted to the various chairman and members of the sub-committees who were responsible for this most successful meeting.

#### Papers and Meetings Committee
(Chairman—C. A. Peachey)

Eight meetings of the Committee were held during the year and in spite of the war little difficulty was experienced in filling the autumn programme. The spring programme (1943), however, was more difficult to complete.

A feature of the year was the special meeting held to hear Professor F. Webster of England, lecture on the effects of bombings on structures.

As usual the annual plant visit was a decided success. About 350 members visited the plant of the Dominion Bridge Co. and were tendered a reception by the officials of the company.

Previous to his paper on **Industrial Democracy and Its Survival,** delivered before the Branch on November 5, Mr. P. Ackerman gave a course of five lectures which were attended by several members as a preparation to discuss the subject at the meeting.

It may be said that the meetings were, in general, exceptionally well attended, especially during the fall, as shown by the figures given in brackets in the following list of papers delivered during the calendar year of 1942:

Jan. 8—**Shipyard Production Methods**—An Outline of Building Operations for Steel Vessels, by Howard Johnson (185).

Jan. 15—Annual Meeting of the Branch (140).

Jan. 22—**The Problems Encountered in Erecting Canada's First Directive Broadcast Station,** by E. O. Swan (70).

Jan. 29—**Airplane Transport Design,** by John T. Dyment, M.E.I.C. (90).

Feb. 5 & 6—Annual General and Professional Meeting.

Feb. 12—**Photoelastic Stress Analysis,** by C. G. Axworthy (130).

Feb. 19—**Plates in Shipbuilding,** by W. B. McCreery (80).

Feb. 26—**Subcontracting in Canada's Munition Industries,** by F. L. Jeckell (75).

Mar. 5—**Synthetic Rubber,** by Dr. R. S. Jane (215).

Mar. 12—**An Engineer Looks at Music,** by S. T. Fisher, Jr.E.I.C. (140).

Mar. 19—**The Modernization of a Puerto Rico Electric Generating Station,** by John T. Farmer, M.E.I.C. and E. A. Goodwin, M.E.I.C. (55).

Mar. 26—**Blackouts and Protective Lighting,** by Samuel G. Hibben (150).

April 9—**The Electron Microscope,** by Dr. D. A. Keys (160).

April 28—**Effects of Bombings on Structures,** by Professor F. Webster (175).

Oct. 8—**Aquifers and Water Wells,** by J. W. Simard, M.E.I.C. (175).

Oct. 15—**Air Power Theories and Aviation Progress in Reality,** by Z. Krzywoblocki (145).

Oct. 22—**Engineering Aspects of Air Bombing and Structural Defence,** by D. C. Tennant, M.E.I.C. (200).

Oct. 29—**Plant Visit**—Dominion Bridge Co. Ltd. (350).

Nov. 5—**Industrial Democracy and Its Survival,** by P. Ackerman, M.E.I.C. (175).

Nov. 12—**Ventilating Buildings Manufacturing War Equipment,** by H. E. Ziel (125).

Nov. 19—Annual Student Night (165).

Nov. 26—**Manpower Control and Employer-Employee Relations,** by L. Austin Wright, M.E.I.C. and Douglas B. Chant (200).

Dec. 3—**Design, Manufacture and Installation of 120 KV Oil-Filled Cables in Canada,** by O. W. Titus and D. M. Farnham (110).

Dec. 10—**Mechanization and Modern Military Tactics,** by Capt. A. C. Rayment, M.E.I.C. (80).

### Junior Section

(Chairman—J. E. Hurtubise)

The activities of the Junior Section have been somewhat curtailed this year; all the papers that were arranged for the spring session had to be cancelled because the authors had either joined the army or were too busy with war work. The attendance at the meetings was smaller than usual for the same reasons.

Mr. Graham Wanless, who was Branch News Editor and a member of the executive of the Junior Section resigned when he joined the staff of National Research Council. His departure for Ottawa deprives the Branch of his valuable services.

The Student Night, which took place on November 19, was very successful. Mr. P. E. Salvas of Ecole Polytechnique took the first prize with an interesting talk on the "Launching of Ships," and Messrs. Maclure and G. Bisaillon were awarded second prizes for original papers on "Introduction to Wooden Shipbuilding" and "Long Range Cruising Control" respectively.

Mr. W. G. Hunt addressed the McGill students and Mr. L. Trudel the students of Ecole Polytechnique with regard to enrolment in the Junior section of the Institute explaining the advantage to be gained. The results of their talk have been most gratifying.

The following is a list of the Junior Section meetings with the attendance given in brackets:

Jan. 26—Annual Meeting—Mr. Jean Flahault, S.E.I.C., spoke on **Some Engineering Aspects of the German Army.** (83).

Feb. 16—**Nomography,** by A. Looker, S.E.I.C. (14).

Mar. 16—**The Experimental Study of Stress,** by Raymond A. Frigon, M.Sc., S.E.I.C. (18).

Mar. 30—**Modern Trends in the Maintenance of Lubricating Oil,** by Bruce M. Scriver, S.E.I.C. (15).

April 13—**Some Mechanical Properties of Rubber,** by Graham G. Wanless, Jr.E.I.C. (24).

Oct. 19—Opening Night, the secretary of the Branch, Mr. L. A. Duchastel, gave a short talk, replacing the chairman, Mr. J. A. Lalonde who was unable to attend (70).

Nov. 19—Student Night. **Design and Production of Marine Engines,** by R. A. Ritchie (McGill); **Launching of Ships,** by P. E. Salvas (Ecole Polytechnique); **Introduction to Wooden Shipbuilding,** by J. H. Maclure (McGill); **Long Range Cruising Control,** by G. Bisaillon (Ecole Polytechnique) (160).

### Membership Committee

(Chairman—Henri Gaudefroy)

The Executive Committee was called upon to approve a recommendation that no more Branch affiliates be admitted.

After a careful study, a motion to that effect was passed and approved at the November meeting.

No further Branch affiliates will therefore be accepted by the Montreal Branch. It was also recommended that the present ones who do not pay their fees regularly be automatically dropped.

It has been observed that although many students of L'Ecole Polytechnique belonged to the Institute, there was a lack of participation by senior graduates. It was decided to ask the Membership Committee to organize a campaign with a view to obtaining their adherence.

A group of eighteen members were assembled to carry out the work and a total of 175 circular letters were issued to prospective members. The group contacted 87 of these persons during the year but so far only 8 new applications have been received; however, it is expected that if the work is carried out next year, there are good possibilities that at least 44 new members should be enlisted.

### Obituaries

It is with regret that we record the names of those who have died during the year and we wish to extend to their families the most sincere sympathy of the Branch.

HONORARY MEMBER—Dr. Frank Dawson Adams

MEMBERS

| | |
|---|---|
| Archibald Fullarton Byers | John Palmer |
| Kenneth Thomas Cregeen | Leonard Ernest Schlemm |
| John Maurice Evans | Charles Rowlatt Townsend |
| Lyall Radcliffe McCurdy | Henry Hague Vaughan |

### Reception and Entertainment Committee

(Chairman—M. S. MacGillivray)

Refreshments were served at the Annual Meeting and the opening fall meetings of the Branch and of the Junior Section and also at the Student Night. Out-of-town speakers were entertained by members of the Papers and Meetings Committee as it was decided last year to suspend regular courtesy dinners for the duration. The Branch Smoker was held as part of the entertainment provided by Mr. W. W. Timmins and members of his Committee during the Annual Meeting of the Institute. A record attendance of 794 was established.

### Committee on Provincial Professional Interests

(Chairman—J. A. Lalonde)

In view of the progress being made in several provinces towards closer co-operation between the Institute and the provincial professional associations, this committee continued this year to explore the possibilities in this province.

Several meetings were held between February and June, at which the agreements passed in four other provinces were closely studied, and a draft of a proposed agreement between the Institute and the Corporation of Professional Engineers of Quebec was drawn up. This draft was submitted to the Executive Committee of the Branch and subsequently to Council. Authorization was obtained to discuss its contents informally with the Institute Committee on Professional Interests, the other Branches of the Institute in the province and the Corporation of Professional Engineers of Quebec.

Copies of the proposed agreement were forwarded the St. Maurice Valley, Quebec and Saguenay Branches and the Committee met with their official representatives on September 11th, 1942.

The chairman of the Committee was invited to a Council Meeting of the Corporation on October 24th, 1942.

Finally, on December 11th, a joint meeting was held with the representatives of the various Branches and three representatives from the Corporation.

A draft of the agreement, as proposed at this meeting, is now being written. It is the intention of your Committee to send a copy of this draft together with recommendations to the Council of the Institute.

### Committee on the Engineering Features of Civil Defence

(Chairman—G. McL. Pitts)

Upon recommendation of the Institute this special committee was formed following the lectures given in Toronto by Prof. F. Webster and is composed of all members of the Branch who followed the lectures. Meetings were held

| Branches | Border Cities | Calgary | Cape Breton | Edmonton | Halifax | Hamilton | Kingston | Lakehead | Lethbridge | London |
|---|---|---|---|---|---|---|---|---|---|---|
| **MEMBERSHIP** | | | | | | | | | | |
| **Resident** | | | | | | | | | | |
| Hon. Members | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. |
| Members | 48 | 97 | 30 | 64 | 163 | 89 | 37 | 29 | 16 | 30 |
| Juniors | 5 | 11 | 3 | 9 | 10 | 18 | 8 | 4 | 1 | 3 |
| Students | 6 | 10 | 2 | 20 | 16 | 20 | 24 | 5 | 2 | 1 |
| Affiliates | .. | 1 | 2 | 1 | 2 | 1 | 1 | 5 | .. | .. |
| Total | 59 | 119 | 37 | 94 | 191 | 128 | 72 | 43 | 19 | 34 |
| **Non-Resident** | | | | | | | | | | |
| Hon. Members | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Members | 17 | 17 | 23 | 6 | 71 | 19 | 3 | 17 | 23 | 12 |
| Juniors | 2 | 3 | 5 | 1 | 6 | 1 | 1 | 2 | 9 | 1 |
| Students | 2 | 5 | 4 | .. | 13 | 1 | 5 | 5 | 7 | 2 |
| Affiliates | .. | .. | 3 | .. | .. | 1 | .. | .. | .. | 1 |
| Total | 21 | 25 | 35 | 7 | 90 | 22 | 9 | 24 | 39 | 16 |
| Grand Total December 31st, 1942 | 80 | 144 | 72 | 101 | 281 | 150 | 81 | 67 | 58 | 50 |
| " December 31st, 1941 | 98 | 145 | 77 | 113 | 256 | 146 | 91 | 68 | 58 | 50 |
| Branch Affiliates, December 31st, 1942 | .. | 42 | .. | .. | .. | 14 | .. | .. | .. | 1 |
| **FINANCIAL STATEMENTS** | | | | | | | | | | |
| Balance as of December 31st, 1941 | 210.56 | 103.57 | 255.06 | 93.14 | 220.61 | 280.55 | 40.27 | 229.14 | 89.03 | 209.92 |
| **Income** | | | | | | | | | | |
| Rebates from Institute Headquarters | 187.52 | 284.45 | 230.75 | 38.70 | 90.27 | 311.33 | 122.03 | 130.60 | 27.30 | 102.45 |
| Payments by Professional Assns. | .. | 54.75 | 90.00 | 220.50 | 360.20 | .. | .. | .. | 76.25 | .. |
| Branch Affiliate Dues | .. | 148.50 | .. | .. | .. | 30.00 | .. | .. | .. | .. |
| Interest | .. | 43.54 | .. | .. | 0.60 | 67.63 | 0.11 | 0.70 | 5.50 | 1.50 |
| Miscellaneous | 278.42 | 61.46 | 16.00 | 107.00 | .. | 15.00 | .. | 260.60 | 4.00 | .. |
| Headquarters Building Fund Subscriptions | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Total Income | 463.94 | 592.70 | 336.75 | 366.20 | 451.07 | 423.96 | 122.14 | 391.90 | 113.05 | 103.95 |
| **Disbursements** | | | | | | | | | | |
| Printing, Notices, Postage① | 28.61 | 105.39 | 2.01 | 48.52 | 78.17 | 86.24 | 9.74 | 15.83 | 6.23 | 50.93 |
| General Meeting Expense② | 331.02 | 88.00 | .. | 39.43 | 75.95 | .. | 6.53 | 158.25 | 1.50 | 8.73 |
| Special Meeting Expense③ | .. | 173.55 | 26.83 | 183.72 | 87.73 | 252.92 | 15.30 | 208.45 | .. | 25.45 |
| Honorarium for Secretary | .. | .. | .. | 50.00 | 37.50 | .. | .. | 10.00 | .. | .. |
| Stenographic Services | 10.00 | .. | .. | .. | 25.65 | 50.00 | .. | 2.00 | .. | 5.00 |
| Headquarters Building Fund | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Travelling Expenses④ | .. | 21.90 | 32.60 | 27.85 | .. | 131.50 | .. | .. | .. | .. |
| Subscriptions to other organizations | .. | .. | .. | .. | .. | .. | 15.00 | .. | .. | .. |
| Subscriptions to *The Journal* | .. | 24.00 | .. | .. | .. | .. | .. | .. | .. | .. |
| Special Expenses | 27.10 | 25.00 | .. | 7.50 | 59.11 | .. | 5.00 | .. | .. | .. |
| Miscellaneous | .. | 21.22 | 15.80 | .. | 22.67 | 46.06 | .. | 6.00 | 4.45 | 0.06 |
| Professional Assn. Registration Fees | .. | .. | 90.00 | .. | .. | .. | .. | .. | .. | .. |
| Total Disbursements | 396.73 | 459.06 | 167.24 | 357.02 | 386.78 | 566.72 | 51.57 | 400.53 | 12.18 | 90.17 |
| Surplus or *Deficit* | 67.21 | 133.64 | 169.51 | 9.18 | 64.29 | *142.76* | 70.57 | *8.63* | 100.87 | 13.78 |
| Balance as of December 31, 1942 | 277.77 | 237.21 | 424.57 | 102.32 | 284.90 | 137.79 | 110.84 | 220.51 | 189.90 | 223.70 |

①Includes general printing, meeting notices, postage, telegraph, telephone and stationery.
② Includes rental of rooms, lanterns, operators, lantern slides and other expenses.
③Includes dinners, entertainments, social functions, and so forth.
④Includes speakers, councillors or branch officers.

## F THE BRANCHES AS AT DECEMBER 31, 1942

| Moncton | Montreal | Niagara Peninsula | Ottawa | Peterborough | Quebec | Saguenay | Saint John | St. Maurice Valley | Saskatchewan | Sault Ste. Marie | Toronto | Vancouver | Victoria | Winnipeg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .. | 2 | .. | 2 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | .. |
| 31 | 811 | 69 | 312 | 33 | 89 | 63 | 48 | 31 | 96 | 21 | 375 | 113 | 43 | 116 |
| 6 | 166 | 15 | 39 | 17 | 14 | 18 | 5 | 15 | 23 | 7 | 65 | 5 | 3 | 22 |
| 4 | 431 | 18 | 44 | 19 | 11 | 24 | 10 | 15 | 1 | 1 | 75 | 11 | 3 | 82 |
| .. | 22 | 4 | 3 | .. | 1 | 4 | 2 | 1 | .. | .. | 17 | 2 | .. | 3 |
| 41 | 1432 | 106 | 400 | 69 | 115 | 109 | 65 | 62 | 130 | 29 | 533 | 131 | 50 | 223 |
| .. | 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 14 | 43 | 6 | 49 | 22 | 15 | 3 | 48 | 4 | 38 | 33 | 14 | 46 | 10 | 20 |
| 3 | 22 | .. | 12 | 4 | 5 | 1 | 5 | 4 | 8 | 7 | 5 | 4 | 3 | 6 |
| 5 | 33 | .. | 14 | 3 | 7 | 1 | 24 | 7 | 13 | 9 | 4 | 7 | 3 | 9 |
| .. | 1 | 1 | 2 | 1 | 1 | .. | .. | 1 | 1 | 1 | 1 | 1 | .. | .. |
| 22 | 99 | 7 | 77 | 30 | 28 | 5 | 77 | 16 | 60 | 50 | 24 | 58 | 16 | 35 |
| 63 | 1531 | 113 | 477 | 99 | 143 | 114 | 142 | 78 | 190 | 79 | 557 | 189 | 66 | 258 |
| 41 | 1399 | 117 | 444 | 89 | 141 | 92 | 102 | 74 | 260 | 90 | 521 | 197 | 65 | 231 |
| 4 | 19 | 10 | 20 | 8 | .. | .. | .. | .. | .. | 12 | .. | 1 | 1 | 9 |

*For voting purposes only, there should be added to Montreal Branch, an additional 310 members, 181 being resident in the United States, 98 British possessions and 31 in foreign countries.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38.10 | (6) 2,287.26 | 296.95 | 827.58 | 134.42 | 33.90 | 229.66 | 257.88 | 110.94 | 23.29 | 427.39 | 695.75 | 284.00 | 99.90 | 333.35 |
| 60.40 | 1,954.39 | 232.35 | 552.04 | 136.96 | 270.12 | 175.50 | 31.10 | 111.92 | 37.30 | 160.83 | 681.53 | 303.92 | 125.50 | 307.06 |
| 60.00 | .. | .. | .. | .. | .. | .. | 148.00 | .. | 202.19 | .. | .. | .. | .. | .. |
| 35.00 | 83.00 | 39.40 | 54.00 | 24.00 | .. | .. | .. | .. | .. | 36.00 | .. | .. | 3.00 | 45.00 |
| 3.41 | 6.82 | 3.00 | 46.08 | 0.60 | 0.36 | .. | .. | .. | .. | 9.13 | 11.04 | 1.60 | .. | 22.50 |
| 25.75 | 578.35 | 4.88 | 42.95 | 36.44 | 134.77 | 32.50 | 303.80 | 152.84 | .. | 145.75 | 178.85 | .. | 50.00 | 41.70 |
| .. | 53.00 | .. | .. | .. | 70.00 | .. | .. | .. | .. | .. | .. | .. | 3.00 | .. |
| 34.56 | 2,675.56 | 279.63 | 695.07 | 198.02 | 475.25 | 208.00 | 482.90 | 264.76 | 239.49 | 351.71 | 871.42 | 305.52 | 181.50 | 416.26 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23.73 | 765.20 | 52.01 | 175.01 | 64.78 | 98.32 | 29.10 | 48.42 | 25.93 | .. | 16.94 | 183.37 | 90.44 | 40.70 | 114.23 |
| 13.00 | 296.01 | 19.95 | .. | 50.00 | 16.42 | 13.15 | 1.62 | 10.00 | 94.41 | 179.56 | 132.63 | 52.40 | 40.00 | 55.75 |
| 67.34 | 142.12 | 23.27 | 208.90 | 11.31 | 181.89 | 167.06 | 346.72 | 233.21 | .. | 44.26 | 272.91 | 62.05 | 39.03 | 15.75 |
| 25.00 | 300.00 | 75.00 | .. | .. | 100.00 | .. | 25.00 | .. | 60.00 | 25.00 | 125.00 | 50.00 | 35.00 | 75.00 |
| 10.00 | 120.00 | 5.00 | 50.00 | .. | .. | .. | 10.00 | 5.00 | 12.00 | 1.00 | 2.60 | 20.00 | 12.10 | .. |
| .. | 500.00 | .. | .. | .. | 75.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| .. | 12.02 | 11.75 | .. | .. | 21.65 | 44.82 | .. | .. | 7.40 | .. | 75.50 | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | 30.00 | .. | .. | .. | .. | 10.00 | .. | .. | .. |
| 8.00 | 34.00 | 16.45 | 6.00 | 6.00 | .. | .. | .. | .. | .. | 12.00 | .. | .. | .. | 18.00 |
| .. | (5) 1,040.00 | 113.23 | 182.90 | 2.30 | .. | .. | .. | .. | 23.75 | .. | 30.00 | .. | .. | 70.00 |
| 22.94 | 44.40 | 3.17 | 26.08 | .. | 3.64 | 16.72 | 28.68 | .. | 4.63 | 1.40 | 76.70 | 8.70 | 57.31 | 10.80 |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 70.01 | 3,253.75 | 319.83 | 648.89 | 134.39 | 496.92 | 300.85 | 460.44 | 274.14 | 202.19 | 280.16 | 908.71 | 283.59 | 224.14 | 359.53 |
| 14.55 | *578.19* | *40.20* | 46.18 | 63.63 | *21.67* | *92.85* | 22.46 | *9.38* | 37.30 | 71.55 | *37.29* | 21.83 | *42.64* | 56.73 |
| 02.65 | 1,709.07 | 256.75 | 873.76 | 198.05 | 12.23 | 136.81 | 280.34 | 101.56 | 60.59 | 498.94 | 658.46 | 305.83 | 57.26 | 390.08 |

(5) Includes contribution to annual meeting of the Institute.
(6) Includes $500.00 for building fund received in 1941 and disbursed in 1942.

to consider the type of study most needed and it was agreed to undertake specific studies in accordance with items 4 and 5 of the terms of reference of the Institute Committee on the Engineering Features of Civil Defence.

Student Guidance Committee

(Chairman—Jacques Benoit)

This Committee was formed following a recommendation of the Institute Committee on the Training and Welfare of the Young Engineer and its activities comprised the following:

1—Preparation of a list of High Schools and private schools of both French and English language in the Branch area.
2—Preparation of a letter addressed to each school principal informing him of our aim to assist the student and asking for an opportunity to discuss this matter, which letter will be mailed before the end of the year.
3—Distribution of French version of engineering profession booklet through the Institute Headquarters.
4—Study of methods used by the Engineering Council for Professional Development in meeting and advising boys about to decide on a vocation. Also study of instructions received from Mr. H. F. Bennett, chairman of the Committee on the Training and Welfare of the Young Engineer.
5—Preparation of short guide to be used by the Committee members in addressing the students.

Most of the work has been of a preliminary nature but following the distribution of the proposed circular letter, it is planned next year to visit schools and talk to students in groups and individually and possibly arrange visits to engineering enterprises.

Publicity Committee

(Chairman—Gordon D. Hulme)

At the request of the chairman of the Annual General and General Professional Meeting of the Institute, the Branch Publicity Committee handled all publicity matters for the Annual Meeting of the Institute. Several meetings were held for the members of the press and they were supplied with all available information concerning the Institute and all the functions of the meeting. Besides articles in periodicals, items were found in 71 newspapers and a survey showed that 25 per cent more publicity was given on this meeting than on the one held the year before.

The Montreal newspapers received information regarding Branch meetings held during the year and several visits were made to the press in order to maintain friendly relations. In some cases the newspapers were urged to have a reporter cover meetings but when the topic under discussion was not of general interest and only of a technical nature, this practice was omitted. From casual observations of articles published it is felt that the relationship between the Branch and the newspapers is on the most satisfactory basis.

## NIAGARA PENINSULA BRANCH

The Branch Executive held five business and one electoral meeting during the year in order to conduct the affairs of the branch.

The outstanding event for the year was, of course, the joint convention of the Engineering Institute of Canada and the American Society of Civil Engineers, held in Niagara Falls, October 14-15. The branch was pleased to be able to assist, in a small way, the planning of this meeting.

The programme committee arranged and conducted the following professional meetings:

Jan. 22—Joint dinner meeting with the Niagara District Chemical and Industrial Club, held at the Welland House, St. Catharines. The speaker was Mr. Douglas Lorimer, who talked on **The Wartime Control of Chemical Resources.**

Feb. 26—Dinner meeting held at the General Brock Hotel, Niagara Falls. Messrs. J. P. Skillen and C. Vrooman, of the Canadian Westinghouse Company, spoke on the **Application of Relays and Meters for Industrial Substations.**

Mar. 19—Joint dinner meeting with the Buffalo Section of the American Society of Civil Engineers, held at the Mather Arms, Fort Erie. Mr. D. B. Niederlander, of the John W. Cowper Company, spoke on **The Construction of the Pine Camp Cantonment.**

April 15—Joint dinner meeting with the Canadian Section of the American Water Works Association, during their convention at the General Brock Hotel, Niagara Falls. Messrs. A. E. Berry and W. Storrie spoke on **Modern Practice and Developments in the Water Works Field.**

May 21—Annual dinner meeting of the branch, held at the Leonard Hotel, St. Catharines. Our president, Dean C. R. Young, spoke to us on Institute Affairs and **The Engineer and The War.**

June 24—Special evening lecture, held in the Page-Hersey Auditorium, Welland. The late Mr. E. W. P. Smith, consultant to the Lincoln Electric Company, Cleveland gave a review of **Modern Electric Welding** and how it may assist the war effort.

Oct. 14-15—The usual October meeting was cancelled in order that the branch might attend and co-operate with the Activities of the Joint Convention of the E.I.C. and the American Society of Civil Engineers. The sessions were held at the General Brock Hotel, Niagara Falls.

Nov. 26—Dinner meeting held at the Leonard Hotel, St. Catharines. Mr. J. M. Galilee, of the Canadian Westinghouse Company, gave a demonstration talk on **Recent Advances in Electrical Research.**

## OTTAWA BRANCH

During the year the Managing Committee held nine meetings for the transaction of general business.

It is with deep regret that we report the deaths of two of our members: Mr. E. M. Dennis, M.E.I.C., and Mr. R. H. Swingler, S.E.I.C.

As in previous years the Branch donated two sets of draughting instruments to the Ottawa Technical School for presentation as prizes for proficiency in draughting. A copy of "Technical Methods of Analysis" by Griffin was presented to the Hull Technical School to be awarded to one of its students.

The following is a list of meetings held during 1942, with attendance figures in brackets. Unless otherwise indicated, these were luncheon meetings at the Chateau Laurier.

Jan. 8—Annual evening meeting, National Research Laboratories. Address by J. W. Bateman, B.A.Sc., M.I.E.S., Manager, Lighting Service Department, Canadian General Electric Company Limited; **Magic of the Spectrum,** with demonstration equipment and lantern slides in colour. (265).

Jan. 22—F. Cooksey, District Chief Drill Master, Fire Brigade, Ottawa; **Incendiary Bombs** (84).

Feb. 19—R. E. Hayes, B.Sc., M.E.I.C., Manager, Engineering Department, The General Supply Company of Canada Limited, Ottawa; **Earth Moving Takes Wings,** with a sound film (77).

Mar. 5—M. S. Kuhring, Division of Mechanical Engineering, National Research Council, Ottawa. **Engine Testing Tribulations** (65).

Mar. 26—P. Lebel, M.E.I.C., Asphalt Technologist, Imperial Oil Company of Canada, Montreal. **The Portland-Montreal Pipe Line,** with a sound film in colour (140).

April 9—W. R. Campbell, City Traffic Manager, Trans-Canada Air Lines, Ottawa. **Skyway Across Canada,** with a sound film in colour (108).

April 17—Evening meeting, held jointly with the Canadian Institute of Mining and Metallurgy and the Society of Chemical Industry; Auditorium, National Research Laboratories, Ottawa. Address by A. E. Byrne, Glyptals and Insulating Materials Section, Supply Department, Canadian General Electric Company Limited, Toronto. **Plastics** with demonstration equipment and lantern slides (250).

April 20—Evening meeting, Auditorium, National Research Laboratories, Ottawa. Address F. Webster, Dean of Engineering, University of Rangoon. **Bombs and Structures** with a slow-motion film. (175).

May 7—Evening meeting, Auditorium, National Research Laboratories, Ottawa. Address by C. E. MacDonald, B.A.Sc., C.I.M.M., A.S.M., Manager of Domestic Sales, International Nickel Company of Canada Ltd., Toronto. **The Mining, Smelting, and Refining of Nickel-Copper Ores,** with a sound film (35).

Sept. 16—C. R. Young, B.A.Sc., C.E., M.E.I.C. **Post-War Importance of Engineers** (84).

Sept. 25—Evening meeting, held jointly with the Society of Chemical Industry. Address I. M. Rabinovitch; **Chemical Warfare,** with lantern slides (280).

Oct. 22—Evening meeting, held jointly with the Canadian Institute of Mining and Metallurgy, Auditorium, National Research Laboratories, Ottawa. Address O. W. Titus, B.A.Sc., A.I.E.E., Chief Engineer, Canada Wire and Cable Company Limited, Toronto. **Copper Mining in Arizona,** with a silent film (60).

Nov. 5—R. M. Gooderham, B.A.Sc., M.E., Shipbuilding Branch, Department of Munitions and Supply, Ottawa; **Increasing Welded Production,** with a sound film in colour. (121).

Nov. 19—Evening meeting; Auditorium, National Research Laboratories. Address by George L. Long, Bell Telephone Company of Canada, Montreal. **Your Voice as Others Hear It** with demonstration equipment (285).

Dec. 17—G. L. Jennison, Priorities Branch, Department of Munitions and Supply, Ottawa; **PRP** (88).

## PETERBOROUGH BRANCH

The following meetings were held during the year, with attendances shown in brackets:

Jan. 22—Mr. Frank O'Byrne, of Associated Screen News, on **Visual Aids for the Industrialist** (56).

Jan. 24—Social Evening (Ladies Night).

Feb. 5—Mr. F. R. Pope of Western Clock Company, Peterborough, on **Alarm Clocks—How they are made** (30).

Feb. 19—E. V. Leipoldt of the Shawinigan Engineering Co., Montreal, **Electrical Design of the LaTuque Development** (59).

Mar. 12—Dr. H. B. Osborn of Ohio Crankshaft Co., Cleveland, Ohio. **Surface Treating by Induction** (55).

Mar. 26—Mr. H. M. Dunkerley, Inspection Board, Dept. M. & S., United Kingdom and Canada. **Mechanism in Warfare** (55).

April 9—Messrs. G. R. Langley, R. L. Dobbin, J. W. Pierce, A. J. Girdwood, J. F. Osborn, all of Peterborough Branch, on **Discussion of Post-War Problems** (57).

April 23—Mr. G. E. Bourne of C.G.E. Co., Toronto, on **Electricity in Modern Warfare** (60).

May 7—Student Night, Mr. R. Scott and Mr. A. M. McQuarrie (49).

May 20—Annual Business Meeting (34).

Nov. 5—Mr. R. N. Fournier of C.G.E. Co., Toronto, on **Electric Heat in Industry** (40).

Nov. 26—Annual Dinner with President C. R. Young, and Vice-President K. M. Cameron as speakers (96).

Dec. 10—Mr. Montague of the H.E.P.C. of Ontario, on **The DeCew Falls Development** (52).

## QUEBEC BRANCH

During the past year, seven meetings of the Executive Committee were held at which the attendance averaged eight members or sixty per cent.

Seven general Branch meetings were also held through the year as listed below with the attendance given in brackets:

Mar. 24—**Aerial Photography,** by Mr. Théo. Miville Dechêne, M.E.I.C., at School of Mines Theatre, Laval University. (53).

Mar. 30—**Aluminum, Strategic Metal,** by Mr. P. M. Haenni, D.Sc. Métallurgie, at the School of Mines Theatre, Laval University (80).

July 31—**Dinner Meeting** in honour of **Dean C. R. Young's visit** at the Garrison Club (45).

Aug. 17—**Second Annual Golf Tournament** at Levis and distribution of many prizes (45).

Sept. 28—**Electric Welding,** by Mr. R. N. Fournier, specialist of General Electric Company, at the School of Mines Theatre, Laval University (45).

Dec. 12—**Visit of the New St-Michel-Archange Hospital,** organized by Mr. Y. R. Tassé (40).

Dec. 14—**General Annual Meeting** and election of Officers of the Quebec Branch, at The School of Mines Theatre, Laval University. **Bombing and its effects,** by Mr. Robert Sauvage, M.E.I.C. (40).

## SAGUENAY BRANCH

During the year 1942 the Branch held eleven general meetings as follows:

Jan. 15—**Man As An Engineering Miracle,** by Prof. D. L. Thomson, Dept. of Biochemistry, McGill University. The motion picture, **Tacoma Bridge Failure,** was shown. After the lecture, tea was served by the Junior Red Cross.

April 22—**The Lions Gate Bridge,** illustrated lecture by Dr. Philip L. Pratley, D.Eng., Consulting Engineer.

May 18—**Air Raid Precautions,** by Prof. F. Webster, Deputy Chief Engineer of the Ministry of Home Security, Great Britain.

June 11—**The Portland-Montreal Pipe Line,** industrial film was shown and a running commentary was given by Mr. Paul Lebel, Consulting Engineer, Technical Service, Imperial Oil Co. Ltd. **Electrical Fibre Glass,** industrial film was shown with a running commentary by Mr. C. A. Booth of the Fibre Glass Co. of Canada Ltd.

Aug. 13—Annual Meeting. Dean C. R. Young was our honorary guest and he was accompanied by Vice-Pres. de Gaspé Beaubien, and K. M. Cameron and the assistant-general secretary of the Institute, Louis Trudel.

Sept. 2—**Welding,** Mr. L. T. Larson, welding expert of the Allis-Chalmers Co. Milwaukee, Wisconsin.

Oct. 8—The motion picture **Inside Arc Welding** was shown.

Oct. 15—**The Aluminum Industry and the War Effort,** by Mr. A. W. Whitaker, Jr., General Manager of the Aluminum Co. of Canada Ltd.

Oct. 30—**Processing Equipment—Mills and Kilns,** by Mr. F. T. Agthe, Engineer with the Allis-Chalmers Co. of Milwaukee, Wisconsin.

Nov. 19—**Automatic Combustion Control,** by Mr. A. G. Stewart, Vice-President and General Manager of the Bailey Meter Co. Ltd., Montreal.

Dec. 17—**Welding,** by Mr. P. H. Thae, welding engineer, Canadian General Electric Co. Ltd., Toronto.

## SAINT JOHN BRANCH

During the year the Executive Committee held eight meetings for transaction of general business. Average attendance was six members.

With deep regret we report the death, in June, of Lt.-Colonel H. F. Morrisey, M.E.I.C., Councillor of the Institute representing the Saint John Branch. A. O. Wolff, M.E.I.C., was appointed to fill the vacancy until the next annual election.

Seven general branch meetings were held as follows, with attendance thereat given in brackets:

Jan. 12—Joint dinner meeting with Moncton Branch and the Association of Professional Engineers of New Brunswick. Special guests were Premier J. B. McNair, Premier of New Brunswick; K. M. Cameron, Vice-President of the E.I.C., for Ontario, and L. Austin Wright, General-Secretary of the E.I.C. A joint co-operative agreement was signed between the Institute and the Association by Messrs. Cameron and Wright for the Institute and Messrs. G. L. Dickson and C. C. Kirby for the Association. Witnesses were Messrs. A. Gray and H. W. McKeil for the Institute and Messrs. A. A. Turnbull and G. A. Vandervoort for the Association. The Premier spoke on **Canada's War Effort.** F. O. Condon, chairman of the Moncton Branch was in the chair (60).

Feb. 24—Supper meeting. Harry F. Bennett, chairman of the Committee of the Young Engineer, spoke on **The Engineers of To-morrow,** and reported on the work done by the Committee. Guests were Dr. E. J. Alexander, Principal of Saint John High School; W. B. Main, Director of Vocational School and Dr. W. J. Shea, Principal of St. Vincent's High School (23).

Mar. 26—Supper meeting. A moving picture entitled **Photoelastic Stress Analysis** was shown. Prior to showing the picture a description of the film and explanation of the theory of the photoelastic stress analysis was read by Sidney Hogg. The paper was prepared by Prof. Macdonald of the University of Manitoba (28).

May 7—Annual dinner and election of officers of the Branch. Before the business meeting was called to order some very fine coloured motion pictures of fishing and hunting in New Brunswick were presented by H. P. Lingley. D. R. Smith reported verbally on his attendance at lectures given in Toronto by Prof. Webster, Deputy Chief Engineer to the Ministry of Home Security in Great Britain, on the various phases of bombing action (28).

May 22—Luncheon meeting to entertain the visiting Dominion Council of the Association of Professional Engineers of Canada. Ten delegates were present from other provinces and seven officers of the New Brunswick Association. President D. A. R. McCannell, Regina, representing the Saskatchewan Association, spoke on the vital part engineers are playing in the war effort, and the burden that would be theirs in post-war reconstruction programmes (33).

Aug. 10—Supper meeting. Special guests were Dean C. R. Young, president of the Institute; K. M. Cameron and deGaspé Beaubien, vice-presidents, Louis Trudel, asst. general secretary and G. A. Gaherty of the Montreal Engineering Company. Dean Young spoke on the present activities of the Institute, its various committees and the importance of their work. He outlined a scheme proposed by the Government to finance worthy students in college in order to alleviate the scarcity of trained technicians which was facing it. Mr. Cameron asked for better recognition of the student and junior members and also spoke on post-war reconstruction and its problems. Each of the other guests also spoke (40).

Dec. 29—Supper meeting. A paper entitled **The Effect of Aerial Bombing on Structures,** prepared by Dean I. F. Morrison, Professor of Applied mechanics, University of Alberta, was presented by D. R. Smith, chairman. The lecture was illustrated by lantern slides (35).

## ST. MAURICE VALLEY BRANCH

Six meetings were held during the year; three at Shawinigan Falls, two at Three Rivers and one at Grand'Mère. A brief summary of these meetings, with the number of people attending in brackets, is as follows:

Mar. 20—At Shawinigan Falls High School. A film entitled **From Rapids to Electricity.** Speaker: Mr. Guy Rinfret, M.E.I.C. (400).

April 22—At Cascade Inn, Shawinigan Falls. A dinner and the Annual Branch Meeting with installation of new officers. A talk was given by Dr. R. S. Jane on **Synthetic Rubber—Its Possibilities and Development** (80).

June 25—At Chateau de Blois, Three Rivers. A dinner meeting and speech on **Electric Heat in Industry,** by Mr. R. N. Fournier (40).

July 30—At Laurentide Inn, Grand'Mère. A dinner meeting to welcome President Young and his party, which included Past President Lefebvre, Vice-President Cameron, Councillor Armstrong, Asst. Gen. Secretary Trudel and Huet Massue (60).

Sept. 24—At the Technical School in Three Rivers. A film entitled **The Inside of Arc Welding,** by the Canadian General Electric Company (40).

Oct. 22—At Cascade Inn, Shawinigan Falls. A speech by Mr. A. W. Whitaker, Jr. on the subject of **Aluminum in Wartime** (100).

## SASKATCHEWAN BRANCH

Thirty-three members are on active service with His Majesty's Forces, all holding commissions in the Navy, Army or Air Force.

With the exception of one special meeting, all meetings were held jointly with the Association of Professional Engineers, to which the members of the Saskatchewan Section of the American Institute of Electrical Engineers were invited. The respective programmes were as follows:

Jan. 23—Ladies Night, at which Mr. E. Dickinson gave an illustrated lecture on his experiences in Bolivia during the past several years.

Feb. 20—Annual Meeting, addressed by S. J. Latta, Commissioner, Bureau of Publications, Saskatchewan, on **Our Way of Life.**

Mar. 10—(1) Film on **The Manufacture of Plywood,** shown by F. C. Leroux, S.E.I.C., Vancouver, B.C. (2) Film shown by F. Heseltine, Manager, Saskatchewan Division, Canada Wire and Cable Co., on **Copper Mining and Refining in Arizona.**

April 20—Special meeting to welcome Dean C. R. Young, President, Engineering Institute of Canada.

Oct. 19—A visit to the Crime Detection Laboratory, R.C.M.P. Barracks, Regina; the main speaker being Surgeon (Dr.) Maurice Powers, Director of Criminal Investigation for Canada.

Nov. 19—(1) Address by Dr. John Mitchell, Head of Soils Department, University of Saskatchewan, on **The Soils of Saskatchewan.** (2) Film, in colour, presented by Geo. E. Kent, M.E.I.C., showing conditions in Peru and Ecuador.

Dec. 17—(1) Address by Mr. R. T. Blackmore, Technical Service Department, British American Oil Co., on **The Fuel and Oil Requirements of the Modern Gasoline Engine.** (2) Film shown by Mr. R. M. Pugh, Provincial Apiarist on **Bees and the Production of Honey in Saskatchewan.**

The average attendance at these meetings was 48.

## SAULT STE. MARIE BRANCH

The Executive Committee met on January 13th, 1942 and appointed standing committees. The committees and their respective chairmen are as follows:

| | |
|---|---|
| Papers and Publicity | A. E. Pickering |
| Membership | W. D. Adams |
| Entertainment | J. L. Lang |
| Junior Engineer's | T. F. Rahilly |

The Executive Committee met four times during the year to transact and promote the activities of the Branch and Institute.

During the course of the year two additional committees were appointed. One headed by the chairman and secretary, whose purpose was to advise prospective students in engineering. The other, consisting of J. L. Lang, E. M. MacQuarrie, P. P. Martin, K. G. Ross and G. W. MacLeod, was established to study Post War Problems and Rehabilitation.

As usual the Branch Affiliates took an active part in the Branch affairs. At one meeting the discussion was led by a Branch Affiliate.

We were honoured with the visit from the president of the Institute, C. R. Young and Vice-President K. M. Cameron on April 2, 1942.

Seven dinner meetings were held during the year. The average attendance was twenty-five members and guests. The meetings were usually on Friday night, but this rule was not rigidly adhered to, as some meetings were arranged to suit the convenience of the speaker.

Programmes of the meetings were as follows:

Jan. 30—**Progress and Design in the Operation of High Efficiency Power Plants,** by W. E. S. Dyer, M.E.I.C.

Feb. 27—An illustrated address on **Some Recent Trends in Industrial Applications of Electricity,** by Fred. A. Becker, field engineer, Canadian General Electric Company.

April 2—Visit of President C. R. Young and Vice-President K. M. Cameron.

April 24—**New Principles in Heating Becker Coke Ovens,** by Wm. Seymour, M.E.I.C.

Oct. 30—Open discussion on **Post War Reconstruction and Rehabilitation.**

Nov. 27—**Foundation Problems in the Winnipeg Area,** by Professor A. E. MacDonald, University of Manitoba.

Dec. 18—Annual Meeting.

The executive regrets the loss of the following resident members through change of address: W. E. S. Dyer, Wm. VanEvery, F. Smallwood and Wm. Seymour. The last two mentioned had served on the executive for many years and were past chairmen of the branch.

## TORONTO BRANCH

The Annual Meeting of the Branch was held in the Debates Room, Hart House, University of Toronto. The meeting was preceded by a paper given by W. B. Redfern, M.E.I.C., on **Waterworks and Sewerage Installation for Wartime Housing Projects.**

During the past year the Executive Committee held twenty-one meetings with an average attendance of ten.

The regular meetings held during the year are listed below with the attendance given in brackets.

Jan. 15—Students' Night. **Frequency Modulation Receiver,** W. O. Cartier. **The Successful Engineer,** D. Schmidt. **Pre-Stressed Concrete Construction,** W. S. Glynn. **On Spinning of Aeroplanes,** C. B. Livingstone. **Centrifugal Pumps,** A. B. Extence. **Mercury Arc Power Rectifiers,** C. W. Shearer (78).

Jan. 29—**Design and Construction of a Concrete Head Frame for the Hollinger Mine,** Dr. A. H. Harkness, M.E.I.C., and R. J. Fuller, M.E.I.C. (75).

Feb. 19—**Hydraulic Misbehaviour in Water Power Units,** Mr. Forrest Nagler (85).

Mar. 5—**The Organization and Work of Research Enterprises, Limited,** Lt.-Col. W. E. Phillips, D.S.O., M.C. (85).

Mar. 19—**Power Transformer Station and Transmission Line Problems with Particular Reference to Burlington 220 K.V. Station and Associated Lines,** Mr. C. F. Publow, and Mr. A. E. Davison (75).
April 23—**Air Raid Damage to Structure,** Prof. F. Webster.
Nov. 5—**Welding Large Electrical Equipment,** Mr. H. Thomasson (70).
Nov. 20—**DeCew Falls Development of H.E.P.C. of Ontario,** Otto Holden, M.E.I.C. (65).
Nov. 27—**Surface Hardening by Induction,** Dr. H. B. Osborn, Jr., Joint Meeting with Toronto Section, A.I.E.E.
Dec. 3—**Glass in National Defence,** Mr. C. J. Phillips (85).
Dec. 5—**Saving Hydro Power for Victory,** Dr. T. H. Hogg. M.E.I.C. Joint Meeting with the Royal Canadian Institute.

Previous to each regular meeting, dinner was held at Hart House, attended by the members of the Executive, speakers and members of the Branch.

On April 22, 23 and 24 a series of lectures by Professor F. Webster dealing with **Structural Defence Against Bombing,** was given before representatives of the engineering profession from all over the Dominion, except the Pacific Coast. General arrangements were made by Headquarters of the Engineering Institute and local arrangements were made by the Toronto Branch.

It is with deep regret that the Toronto Branch records the deaths of the following members of the Branch during the year: Professor W. J. Smither, Robt. McDowall, R. J. Fuller, A. Ross Robertson, and John H. Jackson.

## VANCOUVER BRANCH

The following meetings of the Branch were held this year:

Jan. 20—First meeting of the branch in 1942. The speaker was W. D. McLaren, general manager of the West Coast Shipbuilders Ltd., a company engaged in building standard cargo vessels for Wartime Merchant Shipping Ltd. His subject was **Ships: Selection of Type.**
During the month, members of the branch were guests at a meeting on the subject of arc welding held under the auspices of the British Columbia Chapter of the American Society for Metals. The principal speaker was Mr. James F. Lincoln, president of the Lincoln Electric Company of Cleveland and director of its allied companies in Canada, England and Australia. His subject was **Electric Welding Developments.**
April 17—Dinner meeting held in the Georgia Hotel in honour of the president of the Institute, Dean C. R. Young. Branch Chairman W. O. Scott presided and forty members and guests were present.
The Branch was exceedingly fortunate in having three lectures delivered by Professor F. Webster of London, England, on the subject of air raid shelters and the making of structures bomb-resistant. A large attendance of members and specially invited guests at each lecture indicated the degree of interest in the subject.
May 27—At a meeting held in the Medical-Dental Building, Professor Frank Forward, professor of metallurgy at the University of British Columbia, spoke on **Metallurgical Progress in the War.**
Sept. 17—An address entitled **The Failure of the Tacoma Narrows Bridge** was given by A. H. Finlay, associate professor of civil engineering at the University of British Columbia.
Oct. 22—**The Design and Construction of the Scanlon Dam** was the subject of a paper given before the Branch by William Jamieson, field engineer for the Powell River Co. Ltd., Powell River, B.C. Following his address Mr. Jamieson displayed many interesting photographs and plans of the work.
Nov. 9—Members of the Branch were guests at a meeting of the Vancouver section of the American Institute of Electrical Engineers. Dr. H. S. Osborne, plant engineer of the American Telephone and Telegraph Company, and national president of the American Institute of Electrical Engineers gave an interesting address on **The Conservation of Critical Materials.**

## VICTORIA BRANCH

Five meetings of the executive committee, six general branch meetings, two lecture meetings and one industrial visit were held during 1942 as follows:

Jan. 16—Dinner meeting. Annual meeting and election of officers. Introductory talk by Mr. W. H. Mathews of the Provincial Dept. of Mines on **Polarized Light** followed by a film **Photoelastic Stress Analysis.**
Apr. 2—Dinner meeting. Mr. A. S. G. Musgrave gave a very interesting talk on **Aerial Photography and Mapping in the Great War,** accompanied by still pictures, maps and photographs of Palestine, Egypt and France.
Apr. 15—Dinner meeting. In honour of President Young and the occasion of the presentation of the "Julian C. Smith" medal to Mr. Charles Alexander Magrath, an honorary member of the Institute and a famous engineer. "A pioneer in the development of the West, a surveyor qualified to practice in every province and an expert in the conservation and use of water."
May 11—Lecture meeting. **Structural Defence Against Bombing,** by Professor Webster, Deputy Chief Engineer, Ministry of Security, Great Britain, attended by members, members of other engineering associations, architects and members of public utilities, A.R.P., etc.
May 19—Lecture meeting. **Making and Shaping of Steel,** courtesy of United States Steel Corporation and introduced by Mr. F. Wilkinson of the United States Steel Export Co. of Vancouver, B.C. Two-reel film depicting steel from mine to finished product. Attended by members, other engineers, machinists, shipyard workers, etc. Sponsored by Victoria Branch, of the Institute, Yarrows Ltd. and the Victoria Machinery Depot Ltd.
Aug. 12—Luncheon meeting. **Methods of cleaning Water Main,** described by Mr. L. S. Olding of the National Water Main Cleaning Co. of New York, followed by a visit to operations of this company in Oak Bay Municipality.
Dec. 2—Dinner meeting. **The Alaska Highway,** describing "Topographical Features," "Details of Construction," "Personal Experiences on Construction." "Maps and Photographs" in the order named by Messrs. F. C. Green, Surveyor General of the Province, A. L. Carruthers, Chairman of the B.C. Highway Board, H. C. Anderson, Assistant Chief Engineer, Provincial Dept. of Public Works and Norman Stewart, B.C.L.S.
Dec. 17—Luncheon meeting. Nominations for Branch officers and general business.
Dec. 19—Industrial visit. Members and their wives were invited to visit Yarrows Ltd., Yard No. 2, to observe methods of organization and construction and to witness the launching of a corvette. Courtesy of Mr. Norman Yarrow, and Mr. E. W. Izard.

## WINNIPEG BRANCH

The following meetings were held by the Branch during the year 1942:

Jan. 8—Meeting in Theatre F of the University at which Mr. G. A. Howard, Supervisor of Apprentices, C.N.R. Western Region, gave an interesting talk on **The Selecting and Training of Apprentices.**
Feb. 5—Annual Meeting. Following the reports of the various officers and committee chairmen, a very interesting film on **Copper Mining Methods** was shown by courtesy of the Canada Wire and Cable Co.
Feb. 19—Meeting in Theatre F of the University when an address by Dr. F. D. White, Professor of Biochemistry, Medical College, Winnipeg, on the subject of **The Present Status of Gas Warfare** proved very instructive and interesting.
Mar. 5—Meeting in Theatre F of the University when the modern method of construction of **Prefabricated Houses** was described by Mr. Ralph Ham, since deceased.
Mar. 19—Meeting in Theatre F of the University at which two Student papers were given. Mr. W. A. Bowman spoke on **Construction of Temporary Grain Storage Annexes** and Mr. C. H. Glenn spoke on **Electric Arc Furnaces.**
Apr. 2—Meeting in Theatre F of the University when a seven-reel film entitled **The Making and Shaping of Steel** was shown.
Apr. 6—Special Luncheon Meeting in the Hudson's Bay Company Dining Room when we were privileged to have the president and his party as our guests. In the absence from the city of both the chairman and vice-chairman of the Branch, Mr. J. W. Sanger, councillor, occupied the chair.
Apr. 16—Meeting in Theatre F of the University when a talk and film on the subject, **Rubber in Defence** was presented by Mr. J. McGale, Branch Manager, the B. F. Goodrich Rubber Co. of Canada.
Oct. 15—Special closed meeting held in Theatre F of the University when Mr. F. S. Adamson, assistant engineer, City Engineers Department, gave a very interesting paper on the material received in the lectures at Toronto by Prof. Webster. The subject of the paper was, **Structural Defence Against Bombing.**
Nov. 5—Meeting in Theatre F of the University at which Mr. C. A. Smith, Branch Manager, Ford Motor Co. gave an interesting paper on **Mechanical Transport.** This paper was followed by a very instructive film depicting assembly, testing, and actual service of this type of equipment.
Dec. 3—Meeting in Theatre F of the University at which two films were shown. **The Erection of the Golden Gate Bridge** and **The Manufacture of Sheet Steel.**

### RUBBER FROM GUAYULE

From *The Engineer* (London), December 18, 1942

While the synthetic rubbers serve many purposes as well as does the natural product—are even better for some, it is said—there are some products for which they are not so well adapted, at least when used alone. In the manufacture of tyres, for example, it has so far been found necessary to use a certain proportion of natural rubber for satisfactory results.

The great need for rubber of any kind, and especially the need for some natural rubber, has caused the United States government to intensify investigations into rubber-bearing plants adapted to culture in that country, and to start actual production of the more promising ones. There are a number of such plants, both native and imported, which are capable of producing greater or lesser amounts of rubber. This article is concerned with guayule. Guayule rubber is the same kind of rubber as that produced by the Hevea tree of the East Indies, and while the two have slightly different properties in some respects, they are readily interchangeable for most purposes. Guayule rubber makes excellent tyres, used either alone or in conjunction with other rubbers.

Guayule is a shrub, with the botanical name *Parthenium argentatum*. It looks a good deal like sagebush, and grows wild in North-Central Mexico and an adjacent area in the "Big Bend" section of Texas. The mature shrub is usually 3 ft. or less in height, and has crooked, brittle branches. Its leaves are slender and greyish-green, with slightly irregular edges, and the many inconspicuous yellowish flowers are borne on short slender stems.

In its native habitat, guayule grows generally on outwash fans of limestone soils, where the soil is light in texture and well drained. As indicated by its natural range, it requires a mild climate, though dormant plants have withstood a temperature of 5 deg. Fah. without being killed. It is very drought-resistant and can live where rainfall ranges from 10 in. to 15 in. per year. Like most other plants, though, the better the growing conditions, the larger and faster it grows.

Unlike the Hevea rubber tree, where the rubber is contained in the sap and is drawn off by tapping the trunk, the guayule shrub deposits pure rubber in the fibres of the plant itself, under the bark. It deposits the rubber when the soil moisture begins to run short, so for most effective rubber production the plant requires a relatively short, wet growing season followed by a long, dry period. This is the condition that obtains where the plant grows naturally, and that must be present where it is to be grown. If moisture is available for growth too much of the year, little rubber is produced.

The guayule plant deposits some rubber each year of its life, and may live for twenty years or more. However, under cultivation the peak of production is reached during early maturity, and since the plant is destroyed in recovering the rubber, the most economical cropping period is four or five years. Under optimum growing conditions, the rubber content of the shrub, when dry, ranges from 18 to 22 per cent of its weight. In case of need, it may be harvested earlier, but with a corresponding reduction in yield. The rubber occurs in both the branches of the plant and the roots, and extraction is accomplished by crushing and pulverizing the shrub and floating the rubber particles off on water.

It was not until 1904 that large-scale production of guayule rubber got under way, with the erection of processing plants in Mexico and Texas. By 1909, 30 million dollars of American capital was invested in the business, and the factories have exported some 4,000 tons of rubber annually. The figure for 1940 was 4,106 tons. There is no longer a factory in Texas, but four of them operate in Mexico.

One of the early operators in Mexico was the Intercontinental Rubber Company. In 1912 the company decided to try domesticating guayule in the United States, and Dr. W. B. McCallum, chief botanist for the company, collected seeds from several hundred strains of the plant, which he took to southern Arizona. There experimentation was started, looking both to improving the productiveness of the plant and to finding situations suitable for growing it commercially.

Later, it was decided that the Salinas Valley of California offered the best climatic conditions for both continued experimentation and commercial production, and the operation was moved there in 1924-25. A mill capable of producing about 10,000 lb. of rubber per day was built, and since that time about 8,000 acres of guayule has been grown in the valley and processed in the mill. The rubber has been sold under the trade name "Ampar", and used for many purposes, including the manufacture of tyres.

Of much greater importance, however, is the fact that over the intervening thirty years Dr. McCallum kept up an elaborate and painstaking experimental programme, which has greatly increased the productiveness of the guayule shrub. The wild shrub, which, of course, is of all ages when harvested, turns out on the average about 10 per cent of its dry weight in rubber, while the best of the improved strains make around 20 per cent at five years of age. At the same time experiments were carried on to discover the strains best suited to various situations of growth. The hundreds of strains with which the research programme originally started have been boiled down to about ten, of which four produce the bulk of the actual planting stock. There is no reason to suppose that the limit has been reached in breeding up the plant in productiveness or in adapting it to diverse growing conditions. Thirty years is a very brief time in which to improve a long-lived plant such as guayule.

Because of the generally low world price of rubber, the company had never felt justified in embarking on a large production programme, but it did perfect machinery and methods of culture and processing adapted to production on any scale, should occasion ever warrant expansion. Of still greater importance, when the country began looking for a source of rubber supply to take the place of East Indian imports, was the fact that some 23,000 lb. of seed from the best strains of guayule had been collected and were in storage available for planting. This seed, together with all its equipment and properties in California and patents in this country, the company offered to the Government. By an act adopted March 5th, 1942, Congress authorized the Secretary of Agriculture to acquire them and to embark on a 75,000-acre production programme.

As indicated previously, guayule requires certain conditions of soil and climate for successful culture, and a reconnaissance survey of California was made to locate the areas adapted to it. More intensive surveys within these areas are made as required in connection with the leasing programme. In general, the areas are found in the coastal valleys from Monterey County south, along the west side of the Sacramento and San Joaquin valleys, the Imperial Valley, and scattered small areas in Riverside and Imperial counties. Further expansion of the Project is possible in Arizona, New Mexico, and Texas, where adaptable lands are known to exist.

As time goes on, the shrub may be found to be adapted to other areas now considered infeasible for one reason or another, or the plant itself may, by selection and breeding, be adjusted to other conditions. Already a large number of indicator and test plots have been set over the suspected possible range of the plant, and experimentation is under way looking toward producing strains resistant to some of the principal hazards which now prevent otherwise excellent land from being considered for guayule culture.

Production of guayule rubber from plantations has so far been on so small a scale, and costs have been influenced by the developmental character of the operation, that there are no existing figures that would be of much value in forecasting the cost of such rubber under full-scale production. The present Governmental production programme is a war effort, aimed entirely at helping to relieve the critical rubber situation, but it is not beyond the bounds of possibility that it may also result in developing both a permanent at-home source of rubber crop, it is "easy" on land, occasioning less drain on soil resources than many other crops, and since genetic research in connection with the plant itself is really only in its infancy, there is every probability that both its productiveness and its tolerance to growth conditions will be improved.

### MR. C. P. EUGÈNE SCHNEIDER

From *Engineering* (London), November 27, 1942

Very many people in all walks of life in France, and the numerous friends he had in this country, will have learned with deep regret of the sudden death of Mr. Charles Prosper Eugène Schneider, which occurred in Paris on November 17. Mr. Schneider was the grandson of Mr. Joseph Eugène Schneider, the founder of the works at Le Creusot, and was born in that town on October 29, 1868. He had been head of the firm of Messrs. Schneider et Compagnie for over 40 years and we have no doubt that his death was hastened by the fact that all his firm's establishments, at Le Creusot, Chalon-sur-Saône, Paris, Le Havre, Caen and Bordeaux, were occupied by the enemy as a result of the events of June, 1940, and that the works at Le Creusot were subjected to a heavy daylight air attack by the Royal Air Force on October 17. Moreover, he had never fully recovered from the blow caused by the death of his eldest son, Mr. Paul-Henri Schneider, who was killed in 1917 over the enemy lines when serving in the French Air Force. Mr. Schneider's two other sons also served in the war of 1914-18.

Over a period of many years, and mainly under the administration of Mr. C. P. Eugène Schneider, the company greatly extended its scope and kept fully abreast of the times. New Works were built and interests in others, both in France and abroad, were acquired. It is interesting to note that as early as 1876, Messrs. Schneider started the manufacture of all-steel armourplates, while they have been long renowned for the excellence of their artillery. It would, however, be a mistake to consider the firm and its late head as having been employed mainly upon the design and manufacture of munitions of war. This is very far from being the case, since prior to the outbreak of hostilities, at all events, their ordinary industrial products were much more numerous than their manufactures of war material. The former covered a wide range, including the rolling of merchant bars, plates, sheets, and sections, and the construction of bridges, piers, locomotives, electrical machinery and plant, internal-combustion engines, steam turbines and other mechanical and civil engineering work. Moreover, Mr. Schneider and all the members of his family have always appeared to attach as much importance to the benevolent institutions which they established at Le Creusot at their own expense, as to the actual manufacture of iron, steel and the products derived therefrom. These institutions include first-rate arts and crafts schools; a hospital staffed by eminent surgeons, doctors and nurses; dwelling houses at cost price on easy terms; and the provision of pensions, of sports grounds, and of home for the aged and infirm.

Owing to the development of the firm, Le Creusot ceased, some years ago, to be the central governing organization, and Mr. Schneider found it necessary to reside in Paris and to direct the business from the city, but that Creusot benevolent institutions never ceased to function smoothly under the careful attention devoted to them by him and his family. Similar relations exist between master and man in other establishments outside Le Creusot which have been acquired by the firm.

For many years the Creusot works had at their disposal iron mined at no great distance, sufficient to keep the blast furnaces supplied. These iron-ore mines, however, became exhausted some years ago and the blast furnaces gradually ceased to function. The Creusot works had therefore to be adapted to meet the situation, but they have never ceased their activities in all other directions. After the war of 1914-18, Mr. Schneider acquired a controlling interest in the Skoda Works at Pilsen, in Czechoslovakia, a venture which was lost to the firm when Germany seized that country. A few years ago the firm also acquired what might be termed a technical interest in Marine Industries, Limited, of Sorel, in the province of Quebec, Canada. The Canadian company is independent of Messrs. Schneider's establishments, but entered into an agreement with them in regard to technical collaboration, so that Messrs. Schneider sent engineers and technical men to the Sorel works to assist in the design and manufacture of various products.

### INDUSTRIAL SAFETY AND MANPOWER CONSERVATION

From *Mechanical Engineering* (New York), January, 1943

According to a recent statement, since Pearl Harbor 85,000 persons have been killed by accidents in the United States and 7,700,000 have been injured. Of the fatal accidents, 42,000 were to workers; and it is said that only one out of eight industrial establishments is fully covered by a safety programme. Even assuming it would be possible to institute effective safety programmes to guard persons during working hours, there would still remain the hazards of street, home, and recreational pursuits which claim three out of five workers.

Obviously, industrial safety is, in more than one sense, a personal responsibility. No one seriously argues that employers have no responsibilities, but the modern tendency of the public to regard all questions affecting their security and welfare as obligations laid upon others—their government and their employers, for example—and to assume that safety regulations and compensation insurance relieve the individual of the necessity of exercising prudence and caution, is futile nonsense. No one has yet been able to discover all the ways by which a fool may be saved from the consequences of his folly. Safety is still, fundamentally, a personal responsibility.

The toll of accidents which this nation has grown to accept with callous disregard is brought into sharp relief by comparison with recently published figures of civilian casualties in air raids in Great Britain. These casualties, from September, 1939, through September, 1942, totaled 103,379, of which 47,498 represented persons killed. The population of Great Britain is, of course, much smaller than that of the United States. The dramatic background of war and aerial bombardment has greatly emphasized the wastage and tragedy of human lives resulting from air raids. Because we have stupidly grown accustomed to everyday accidents we have no public concern over their importance comparable to what we feel when the casualty lists of war and bombings are made public. Yet the loss resulting from the 42,000 fatalities among workers since Pearl Harbor must be admitted to be a loss of production capacity which affects our nation, for the most part needlessly, at a time when manpower is being used to the limit in the defense of our own way of life.

Industry must assume a large measure of responsibility in the effort to reduce accidents. By intelligent study of hazards to eliminate them as much as possible and by administrative and disciplinary procedures, accidents can be practically abolished. Many plants in the most hazardous industries have gone for years without lost-time accidents because they have made a business of industrial safety.

Management and worker have co-operated to this end and are equally proud of fine records. What has led to the spoiling of some of those records lately has been the increase in production, the change in the kinds of work done, and great numbers of new workers and supervisors that have been employed.

Mounting accident wastage at a time when production facilities and manpower have been strained to the limit has led the President to call upon the National Safety Council "to mobilize its nation-wide resources in leading a concerted and intensified campaign against accidents." Accordingly, the Council has organized the War Production Fund to Conserve Manpower, of which William A. Irvin, former U.S. Steel Corporation president, is chairman and Thomas W. Lamont, of J. P. Morgan and Company, is treasurer. A five-million dollar fund is being raised and a national committee of 600 is being formed. Detailed plans for re-energizing the safety movement have been laid. New safety councils in war-production centres, training programmes in public schools, trade schools, and engineering colleges, and public education by means of the press and the radio are contemplated.

## FAST FIGHTERS

From *The Engineer*, (London), December 11, 1942

So frequently does one read of some new wonderful performance in speed or climbing capacity of the latest fighter aircraft that one cannot but wonder whether the pace can last. It is not merely that speeds have risen since the last war from the neighbourhood of 150 to 400 miles an hour, but that nearly the whole of this immense advance has been concentrated in the last ten years. The increase in engine power alone has not done this, since to force the aeroplane of the day from 150 to 400 miles an hour would require between ten and twenty times the power, whereas the actual improvement, great as it is, would not be much over four to one. Most of the change has been due to improvements in the airframe, partly to the drastic alteration from biplane to monoplane construction, with its absence of struts and therefore of wetted area and of aerodynamic interference in the streamline flow, partly to the use of undercarriages that can be tucked up, and partly to the meticulous cleaning up of all excrescences, including miscellaneous instrumental gear formerly carried outside. In a lecture given before the Lilienthal Gesellschaft just before the present war, Dr. Heinkel, the aircraft designer, estimated that whereas six years earlier nearly 40 per cent of the total drag was caused by struts, exposed landing chassis and the like, by 1938 the whole of this had disappeared. So aerodynamically clean are aircraft now that even the gun mountings and turrets do not usually reduce top speed by more than a few miles an hour.

It is worth considering how much further the aircraft designer can go. Little of such a character as instantly to strike the eye seems left to him, but there is a good deal that is less obvious. Rivet heads, when not finished flush, cause an extra drag that can and must be avoided; new wing shapes in which the air stream follows the contour further back than used to be the case are a vitally important field of study, since success in this direction at once puts down the drag. Bold pioneers, in Germany as well as elsewhere, have experimented with methods of sucking the turbulent air into the wing, or, in the alternative, of blowing it backwards, in order to reduce still further the wing resistance which accounts for some half of the total resistance of the modern aircraft. Engine power is being steadily pushed up at the same time, and the end of that endeavour is far from being in sight. But with all these possible developments and other which cannot be mentioned, and some still no doubt to be discovered, a very steep hedge is being approached. If the drag invariably rose at no steeper rate than the square of the speed, a change from 400 to 600 miles an hour would merely lead to a drag increase in the ratio of 16 to 36, but owing to the close approach of the higher of these two speeds to the velocity of sound—the highest speed at which any sudden disturbance in the air can move itself away—the actual increase in drag, as many wind tunnel tests have shown, is likely to become tenfold, and no ordinary increase of engine power, however substantial in itself, can surmount such a barrier, especially when the airscrew efficiency is known to drop substantially once this range of speed is entered. The search for a way around or over this hedge is assiduous.

The new German fighter, "FW190", has shown a remarkable capacity for climbing fast, and the Junkers "86" has an unusually high ceiling but even these improvements, considerable as they are, have not given either craft appreciably greater safety when in combat with the R.A.F. Many "FW190s" have been shot down and we note that over the African fighting zone at least three Junkers "86s", although flying close to their lofty ceilings, have been engaged and destroyed by our indomitable "Spitfires". An exceedingly high ceiling may indeed be useful for photographic aircraft and well worth striving for, but for bombers hardly at all, since little surplus lifting capacity is possessed by any aircraft built for stratospheric flying. Despite, therefore, the technical skill of the German designers, we have ample reason to feel confidence in our own men—designers, constructors and flyers alike. What the future has in store is always and everywhere carefully concealed, but each time the curtain is drawn slightly aside we realise how effectively each move of the enemy is matched, and more than matched, by our side in this Homeric contest. In air warfare quality counts even more than quantity, but the lead in quality once assured, the advantage of overwhelming numbers is one which steadily mounts. The crisis of the war seems to be close upon us, and as engineers we are justified in feeling as well served in the technical efficiency of our fighting equipment as we are in the Air Force that so confidently uses it. In the severe air fighting that lies immediately ahead the performance of the R.A.F. will, we feel sure, to borrow Mr. Churchill's modest but confident phrase, be "well worth watching"!

## AXIS DEPRIVED OF NORTH AFRICAN GOODS

From *Trade and Engineering* (London), December, 1942

The allied advance in North Africa and the Mediterranean has had some noteworthy economic effects. Not the least important is that between 200,000 and 300,000 tons of merchant shipping will be taken over by the allies. About 120,000 tons were tied up in ports there, and another 120,000 tons represent one-third of the tonnage which is estimated to have been operating between France and North Africa. The enemy will lose not only this useful shipping but also quantities of goods which the vessels helped to bring from North Africa and over three-quarters of which were seized for war purposes

These products included minerals, phosphate rock, vegetable oils and seeds, grain, and other foodstuffs. Hitler increased his imports of iron-ore from North Africa nearly eight-fold in 12 months. It is of special quality with very low phosphoric content and represent about 16 per cent of the total Axis consumption of this high-grade material. While alternative supplies may be available from Sweden, Spain and Norway, the two first-named have a habit, which seems likely to prove awkward for the Germans, of requiring payment. Moreover the journey which Swedish ore has to make is rendered very hazardous by the activities of the Allies. Good quality ore is also available in the Donetz Basin, but not easily, because of shortage of man-power and difficulties of transport. Similarly the cutting off of other products will accentuate Nazi troubles and deficiencies

The new situation in French West Africa should make useful supplies available to the United Nations and deny them to the enemy. Such products include a number of vegetable oils, notably groundnut and palm oil, (reported to have been used in fuelling submarines at Dakar), fibres, gums, hides and skins, rubber, and tapioca.

## LARGE WATER TREATMENT PLANT FOR CHICAGO

From *The Engineer*, (London), December 4, 1942

While Chicago, with 1,500,000 population, has the vast reservoir of Lake Michigan as a source of water supply, the south end of the lake is subject to serious pollution, especially with sewage and industrial wastes from a group of manufacturing cities. As a result of this condition, the city has nearly completed a filtration and treatment plant having a capacity of 320 million gallons daily, and estimated to cost £5,400,000. This will serve only the southern section of the city, and eventually two somewhat similar plants will be required. Two special features are its construction as a pier or structure extending into the lake, and its use of a novel treatment by the sodium-silicate conditioning process. This process, developed in the experimental studies for the plant, serves to toughen or consolidate the coagulated matter, thus making it possible to use smaller settling basins and higher filtration rates, and consequently reducing the cost. Water is taken through shafts about two miles from shore, and pumped to a head of 18 ft. above lake level, there flowing by gravity through the filtration and treatment works. Chemicals are to be added as the water flows through a channel equipped with agitators for rapid distribution, and then a channel so fitted with baffles as to ensure a uniform velocity of flow in the entire depth of the stream of water. The settling basins are of two-storey design. There are eighty filters of 1,400 square feet area, with a depth of 13 ft. 6 in., and each having a capacity of 4,000,000 gallons daily. The gravel, graduated in sizes from 1/12 in. to 2½ in., will be about 20 in. thick, covered with two feet of sand. Chemicals will include alum, iron compounds, lime, ammonium sulphate, activated carbon, sodium silicate, sulphuric acid, and possibly sodium hexametaphosphate. In addition, the chlorination equipment includes fourteen chlorinators having maximum capacities of 300 lb. to 2,500 lb. per twenty-four hours. Beyond the main pumping plant, the works are divided into three identical units.

## THE "AUSTERITY" LOCOMOTIVES

From *The Engineer*, (London), November 27, 1942

Notices have appeared in the Press about the locomotives specially designed by the Ministry of Supply for the use of the British Army, and a few details of a technical character will be welcomed by engineers.

The design is of the most simple description and is governed by the availability of materials and labour. The employment of steel castings is strictly limited, and complicated forgings are avoided wherever possible. Constructional details are reduced in number to the lowest limit consistent with efficient working, and as far as possible renewable parts are duplicate with those of L.M.S.R. standard locomotives.

Materials will be the best obtainable of their respective kinds, and tests are to be in accordance with British Standard Specifications so far as these are applicable. Workmanship will be of the highest standard throughout.

The boiler barrel is parallel and the fire-box casing of the round-topped type. The fire-box is to be of copper, stayed to the outer casing by steel water space stays riveted over on the inside only, and by copper stays in the breaking zone, riveted over both inside and outside. The crown is to be supported by steel direct stays screwed and riveted over at both ends. The boiler as a whole follows good modern practice.

The main frames are to be of steel plate and the stretchers are to be of flanged plates and fabrications, while the smokebox saddle will be of cast iron. The stretchers will be secured to the frames either by turned and tightly driven bolts or by hot steel rivets closed by hydraulic pressure.

The cylinder block is of cast iron, and the slide bars, made of steel, will be of the double overhead type to suit the "Laird" type of crosshead, which is to be a steel casting. The slide blocks will be of cast iron lined with white metal. The pistons will be of the box type, of cast iron, each with three narrow rings of cast iron. The valve gear is to be Walschaerts, operating piston valves arranged for inside admission. Holes with wearing surfaces will be fitted with cast iron bushes, and hand screw reversing gear arranged for left-hand drive is to be fitted.

The driving wheel centers are to be steel castings, and those of the leading intermediate, and trailing wheels of cast iron, all with balance weights incorporated in the castings. Tyres will be fitted to the coupled wheels only.

The springs will be of the laminated type.

Steam brakes will be fitted to the engines, with dual automatic brake apparatus for train working.

Steam sanding will be arranged at the front of leading and front and rear of driving wheels. The boxes are to be of fabricated plate with cast iron lids.

The two-wheel truck at the front end of the engine will be of the three-pin swing-link type. The wheels, which also incorporate the tyre section, will be of disc form and made of steel, forged and rolled.

For lubricating the cylinder barrel and steam pipes a sight-feed lubricator having four feeds will be provided. Other important points requiring lubrication will be siphon fed.

### Tender

The wheels of the tender, which also incorporate the tyre section, will be of disc pattern and made of cast iron chilled on the tread. All the wheels of the tender will be braked by steam and hand brakes, and for train working dual automatic brake apparatus will be fitted. The brake rigging will be compensated.

Leading particulars of the locomotive and tender are given in the accompanying table.

The tank will be of welded construction throughout.

The fuel space will be so arranged as to make the bunker self-trimming.

| Engine | |
|---|---|
| Cylinders | 19 in. dia. by 28 in. stroke |
| Coupled wheels | 4 ft. 8½ in. diameter |
| Front bogie wheels | 3 ft. 2 in. diameter |
| Coupled wheel base | 16 ft. 3 in. |
| Rigid wheel base | 16 ft. 3 in. |
| Total wheel base | 24 ft. 10 in. |
| Heating surface: | |
| Tubes | 1,512 square feet |
| Fire-box | 168 square feet |
| Total | 1,680 square feet |
| Superheater surface | 338 square feet |
| Grate area | 28.6 in. |
| Working pressure | 225 lb. per square inch |
| Tractive force, 85 per cent working pressure | 34,215 lb. |
| **Tender** | |
| Tank capacity | 5,000 gallons |
| Fuel capacity | 9 tons coal |
| Wheels | 3 ft. 2 in. diameter |
| Wheel base | 15 ft. 9 in. |
| **Engine and Tender** | |
| Wheel base | 53 ft. 1¾ in. |
| **Estimated Weights** | |
| Engine in working order | About 72 tons |
| Tender in working order | About 56 tons |
| Approximate weight distribution in working order: | |
| Truck axle | 10 tons |
| Coupled axles | 15½, 15½, 15½, 15½ tons |
| Tender axles | 14, 14, 14, 14 tons |

# From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

## HONORARY MEMBERSHIP FOR PROFESSOR WEBSTER

All those members who had contact with Professor Fred Webster of London, England, during his stay in Canada, will be delighted to know that Council has elected him an Honorary Member of the Institute.

Not many people more adequately meet the requirements for this honour than does Professor Webster. His services in many parts of the world, both in practice and in instruction, have done much to enhance the prestige of the engineer. The wide dissemination in Canada of his expert knowledge on effects of bombing was made possible only by real sacrifices of time and effort on his part.

**Prof. F. Webster, Hon.M.E.I.C.**

Professor Webster's quiet, modest manner did much to conceal from the public the breadth of his experience and the depth of his knowledge and understanding. Even those who were privileged to be with him most found it a rare occasion upon which he talked about himself. One has but to read the following sketchy biography to realize how well he has kept to himself those things which most people are inclined to display on any suitable occasion.

Professor Webster was graduated from the University of Liverpool in 1913 with the degree of Bachelor of Engineering. His early experience was mostly on structural design having to do with harbours and docks in many parts of the world. He became assistant to the chief engineer of the Mersey Docks and Harbour Board, but early in the war left this work to enlist as an engineering officer. He served in France with the B.E.F. as Commanding Officer with the 155th Field Company, R.E. During this service he was awarded the Military Cross. He served for some time as Captain and Adjutant, R.E., of the 16th Division, and afterwards with the 156th Field Company R.E.

After the armistice he was engaged on the restoration of railway lines in Belgium, and late in 1919 he returned to his former work with the Mersey Docks and Harbour Board.

He joined the staff of the University of Liverpool as a lecturer in civil engineering, which position he held until 1930. During this time he did much research work on the failure of concrete structures and on the movements and methods of stabilizing sands on the River Dee tidal basin.

In 1930 he became senior lecturer in civil engineering, and later principal of the government Technical Institute at Burma. In 1931 he joined the civil engineering staff of University College, Rangoon, and by 1938 was professor of engineering, and head of the Engineering Department of the University. The University operated an Honours School of Civil Engineering and Final Schools in Mechanical and Electrical Engineering and Civil Engineering; also diploma courses in mechanical and electrical engineering.

In addition to teaching and administration, he was responsible for the testing and standardization work in the province, and he did much research work.

In 1939 he returned home on leave, and on the outbreak of hostilities, joined the staff of the chief engineer of the Ministry of Home Security, Sir Alexander Rouse, becoming Deputy Chief Engineer, with the special care of structural design and related experimental work for the large programme of civil defence construction undertaken in Great Britain. He has lectured extensively on this subject throughout Great Britain and has been selected for important official missions to other countries.

Professor Webster made many friends amongst Institute members from coast to coast. He spoke to branches at Halifax, Arvida, Montreal, Ottawa, Vancouver, Victoria and Toronto and under Institute auspices, gave a three-day series of lectures on the engineering features of defence against bombing. This series and the complete notes which were subsequently prepared by him for printing constituted a huge undertaking but they were the means by which was made available in Canada the most authoritative and up to date information on this important topic.

It is in recognition of this service and of his own stirling characteristics that the Institute now honours him. In honouring Professor Webster, the Institute is indeed honouring itself.

## INDUSTRIAL RELATIONS AND THE ENGINEERING STUDENT

The Institute's Committee on Industrial Relations has made inquiries at all Canadian universities where engineering is taught, to determine the amount of instruction that is now given in this increasingly important topic. The result shows a great variation, both in content and in degree. All universities canvassed give some time to it, but no one seems to offer a course that is both comprehensive and specifically directed at industrial relations.

The survey indicates clearly that all universities are alive to the changes in our economic existence, that make a study of these matters of prime importance. The real difficulty is to find a place on an already crowded curriculum, that would permit of adequate instruction and study. It has been suggested that the subject should be left for post-graduate study or for extra curricula instruction. Both these suggestions are worthy of study and investigation.

The following letter was sent to Canadian universities by the Institute committee. It is published herewith as a matter of interest to all members:

"To the Universities:

A short time ago we wrote to you enquiring into the course in industrial relations as it applied to the engineering students. At this time we also wrote to a number of other universities and colleges in Canada and we are attaching hereto, a summary of the replies.

This matter has been the subject of extended discussion in the Committee on Industrial Relations of The Engineering Institute of Canada and the committee desires to present to you some thoughts relative to this matter.

The engineer in his work is dealing with materials and the forces of nature, and naturally in the university training, courses are developed to equip him from a theoretical and practical standpoint so that he can solve practical problems as presented to him during his career. There is, however, another phase of the engineer's work that is receiving more and more attention. Whether or not he is placed in administrative work, he must be able to work in the society of other human beings in such a manner as to obtain the best results. If he is placed in a managerial or administrative position as is the case with most senior engineers, he is confronted with all of those problems dealing with the relations of human beings, individually and in groups; also matters dealing with wage scales, and remuneration, methods developed to protect employees in health and to provide for their general security.

In viewing the courses in the universities, we have a feeling that much has yet to be done to equip the young engineer with the necessary fundamentals for dealing with the human phase of his work, which incidentally is as necessary, if not more necessary, than in dealing with the material phase. It has been generally recognized that most of the so-called failures among engineers who do not reach positions of large responsibility and remuneration are due to shortcomings on other than the technical side.

We would also raise the point that not only theoretical phases of psychology and economics are important to the engineer, but that their practical application is of paramount importance. It is felt, therefore, that in presenting these subjects to the undergraduate engineer, the practical application should be kept well to the fore.

We would very definitely draw to your attention the great desirability of giving adequate attention to the subject of industrial relations in courses for undergraduate or graduate engineers and should you desire, this committee would be very happy to have the opportunity of discussing it with you along detailed lines."

## LATE DELIVERY OF JOURNALS

These days one becomes accustomed to the disjointing of routines and habits that have been established over a period of years. Some of these are serious; others are of much less importance. Perhaps among these latter can be included the increasing inconveniences attached to the publishing of *The Engineering Journal*.

Many things continue to retard the monthly appearance of the Journal—shortage of materials and labour being the principal ones. Members have not complained, due doubtless to their appreciation of changing conditions, but nevertheless an explanation is due.

Ordinarily the *Journal* appears not later than the tenth of the month. Recently it has been from one to two weeks late. The January number set a new record, and at the moment of writing it is still not in the mail and the printers cannot give any definite date. The fault seems to be a set of conditions over which there is no control.

The *Journal* is not alone. Other publications, too, are having difficulty, and it is possible that conditions may be worse before they get better. The company doing the printing and mailing is one of the largest and most highly regarded in Canada, and is in as good a position as anyone to overcome or meet the new conditions. Readers may be assured that everything possible will be done to re-establish the schedule but, in the meantime, it is only fair to express appreciation of their patience.

## RESEARCH WORK ENCOURAGED

To encourage research work in chemistry and chemical engineering, the Shawinigan Chemicals Limited has donated four thousand five hundred dollars to the Faculty of Science of Laval University, at Quebec, distributed over the next three years. This grant is to be used to establish nine scholarships of $500 each, and the awards will be known as "The Shawinigan Chemicals and Research Scholarships." The scholarships will be awarded to chemists and chemicals engineers doing post-graduate work at Laval University.

The vital importance of continued research is well utilized by Shawinigan Chemicals Limited, which has two research departments employing over twenty chemists devoted entirely to research. The history and achievements of the company have amply proved the wisdom of its policy.

## WILLIAM KENNEDY, JUNIOR

**Since this article was written, news has come of the death, on January 31st, of Mr. Kennedy. An obituary will appear in the March issue.**

The above title suggests a word of comment because it is not the name of one of our younger members. On the contrary, William Kennedy, Junior, has just celebrated his 95th birthday and is actually a very senior member. On January 25th, he was good enough to receive the General Secretary, the Assistant General Secretary and the Secretary Emeritus, who called upon him at his home in order to present the felicitations and good wishes of the Institute. The deputation was heartily welcomed and found Mr. Kennedy looking well and enjoying his well-earned leisure.

Born near Prescott, Ont., on January 4th, 1848, Mr. Kennedy belongs to a large family many of whose members have long been leaders in engineering progress in Canada. In 1858, his father (the Senior William Kennedy) founded the well-known engineering works at Owen Sound which are still maintaining their reputations for hydraulic machinery of high quality. After working with the firm for some years, William Kennedy, Junior, came to Montreal in 1893 and established a consulting practice. During the following thirty years he planned and supervised the construction of a score of dams, waterworks, and hydro-electric power plants, from Nova Scotia to British Columbia. His work included consultation, advice, reports and valuation on many questions of water power and supply.

In 1886 he took part in the movement which led to the formation of the Canadian Society of Civil Engineers, and with his older brother—who later became Sir John Kennedy—joined that body on its establishment in February of the following year. His long and successful professional career ended with his retirement in 1925. Since then he has travelled widely, and is still a member of the Institute and a resident of Montreal. Institute members hope he will long remain on our membership list.

William Kennedy, Junior, M.E.I.C.

## ENGLISH HOSPITALITY FOR MEMBERS OVERSEAS

The following letter from the secretary of the Institution of Electrical Engineers (London, England) has special interest for those members who are now and who may be later in England, but it will be of general interest to the whole membership. It is a splendid illustration of the cooperative relationships which exist with our sister societies.

THE INSTITUTION OF ELECTRICAL ENGINEERS
Savoy Place
Victoria Embankment, London, W.C.2

22nd December, 1942.

L. Austin Wright, Esq.,
General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Canada.

Dear Mr. Wright:

The arrangements which have been made to place the facilities of The Institution at the disposal of engineers from overseas have recently been under review, with the object of ensuring that the members of sister Institutions abroad and other engineers now stationed in this country, should receive details of the meetings which it is open to them to attend if they so desire.

There has, of course, already been correspondence between us during the war on the subject of the reciprocal extension of facilities for visiting members, and in my letter of the 29th August, 1941, I referred to the Canadian Forces and also to those Canadians who are here in civilian occupations. As to the former an early contact with General McNaughton on his arrival has been followed up and we now have three links at Canadian Military Headquarters to ensure that all those concerned in the various Units will receive our programme of meetings. I have no doubt, therefore, that members of your Institute who are in the services here will be kept advised in this way.

With regard to those of your members who are in Great Britain in a civilian capacity, we are anxious to make sure that they also will be advised of the position and I am wondering whether a note could be published in your Journal drawing attention to the arrangements between the two Institutions and advising any civilian members who may be in this country to get into touch with me. If in addition it would be possible for you to write direct on the matter to those whose addresses here are known to you, then I think we should be on much firmer ground in the effort to make as many contacts as possible.

For my own part, in reference to the reverse operation of the scheme, I enclose a list of our members who have gone to Canada for war work since the list enclosed with my letter of the 29th August, 1941, was drawn up. As previously stated, it is difficult to compile a complete list as the visits of some of our members are regarded with greater secrecy than those of others and we do not always know the nature of their visits. I shall shortly, however, be publishing a reminder in our Journal of the arrangements with the various sister Institutions abroad, and this will serve the purpose not only of bringing the scheme to the notice of our members already in Canada, but also to any others who are likely to go there in the near future.

I should like to take this opportunity of sending to you my very best wishes for 1943 and of expressing the hope that your Institute will have a very successful year.

Yours sincerely,

(*Signed*) W. K. Brasher,
*Secretary*.

Sometime ago negotiations with the three leading engineering societies in England lead to reciprocal arrangements being made whereby the members of the Institute in the Old Country could enjoy the facilities of those institutions, and their members in Canada could enjoy similar facilities with the Institute.

All branches were notified of these arrangements and from time to time, as they were received, names of Old Country engineers were forwarded to the branches concerned. These branches have put the names on their mailing lists, and have assured the visitors of a welcome at all meetings. In some cases it has been possible to render a really special service, and such opportunities are taken up with alacrity and enthusiasm.

Branch officers and members are urged to remind persons going overseas of these privileges. If names of such persons are sent to Headquarters, the information will be forwarded to the Institutions, and every endeavour will be made to see that suitable ar angements are completed. It is a rare privilege for Canadians to visit these old British institutions which are the progenitors of similar societies in all parts of the world.

The institutions at which members of the Institute will be welcomed, in addition to the Institution of Electrical Engineers, are the Institution of Civil Engineers, and the Institution of Mechanical Engineers.

## R.C.E. BAND

During the course of the annual meeting at Hamilton in 1941, a collection was taken to aid the Royal Canadian Engineers at Petawawa in the purchase of instruments for a band. This contribution was a substantial part of the total required, but it was not until some time later that the fund was completed.

For the Institute's part in this worthy objective, a framed photograph of the band has been presented to Headquarters. It is reproduced herewith. The inscription on the plate reads:

"Presented to the Engineering Institute by (A 5) C.E.T.C. of Canada in grateful acknowledgment of the assistance given in forming this band."

Royal Canadian Engineers Band

## BIBLIOGRAPHY ON AUTOMATIC STATIONS

The fourth bibliography of technical literature entitled "Bibliography on Automatic Stations, 1930-1941" is soon to be issued by the American Institute of Electrical Engineers. This publication sponsored by the AIEE committee on automatic stations supplements earlier bibliographies on the subject published previously in AIEE *Transactions*.

The entries in this bibliography are numbered consecutively by sections and listed alphabetically by years. The material is divided into the following sections: general; supervisory and remote control; telemeter and telemetry; automatic and remote-controlled switches and switchgear; automatic features of generating stations using fuels; automatic boiler and combustion control, automatic hydro-electric plants; automatic substations.

The "Bibliography on Automatic Stations, 1930-1941" is a 26-page pamphlet, 8½ x 11 inches. It may be obtained from AIEE headquarters, 33 West 39th Street, New York, N.Y., at 25 cents per copy to Institute members (50 cents to non-members) with a discount of 20 per cent for quantities of 10 or more mailed at one time to one address. Remittances, payable in Yew York exchange, should accompany orders.

Members of the Engineering Institute may obtain copies of the bibliography at 25 cents each from their own Headquarters. This is made possible owing to the exchange arrangements between the Institute and American Societies.

## WASHINGTON LETTER

Our Washington correspondent, E. R. Jacobsen, M.E.I.C., has recently left for Australia on a technical mission which will probably take the better part of the next two months. Preparations for his departure have prevented him from contributing his monthly letter. It is hoped that on returning he will have something of interest to readers of the *Journal.*

Mr. Jacobsen is Engineering and Technical Assistant to the Director, Commonwealth of Australia War Supplies Procurement, at Washington. He is on loan from Dominion Bridge Company, Limited, Montreal, where he was structural designer.

## MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, January 16th, 1943, at ten o'clock a.m.

Present: President C. R. Young in the chair; Vice-Presidents deGaspé Beaubien and K. M. Cameron; Councillors J. E. Armstrong, J. G. Hall, R. E. Heartz, W. G. Hunt, C. K. McLeod and G. M. Pitts; Treasurer E. G. M. Cape; Secretary-Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

The general secretary reported that in accordance with Council's instructions, he had sent to each member of Council, with a request for comments or suggestions, a copy of the proposed Canons of Ethics for Engineers as prepared by a committee of the Engineers' Council for Professional Development (E.C.P.D.). Replies received from seven members of Council indicated a general approval, although there was some feeling that the Canons were too numerous and too detailed. One member of Council had submitted a completely revised draft.

Mr. Pitts suggested that a small committee of possibly three senior members should be appointed to consider the replies received and prepare a memorandum covering the Institute's recommendations for submission to E.C.P.D. After some discussion it was decided to bring the matter up for further consideration at the annual meeting of Council in Toronto on February 10th.

The general secretary read a cablegram from Professor Frederick Webster accepting election as an Honorary Member, and expressing his great pleasure and appreciation of the honour conferred upon him. He also read a letter from Professor Webster extending greetings to the many friends he had made during his recent visit to Canada.

The financial statement for the year 1942, as prepared by the auditors, had been examined by the Finance Committee and approved. The finances of the Institute were in excellent condition in spite of certain substantial expenditures of an unusual nature, such as the Webster lectures. The surplus on the year's operations was the largest that had been recorded for some time, and the collection of arrears of fees, amounting to over $5,000.00 was perhaps the largest ever recorded. It had been decided to set aside from the surplus $2,000,00 towards a reserve for maintenance of the building, and $1,500.00 towards a reserve for a building fund.

A letter from the Canadian Manufacturers Association asking the Institute's approval of the Pay-as-you-Earn Income Tax Plan had been received. The Association is endeavouring to indicate to the government that this plan is approved by a substantial number of citizens so that the government may be influenced accordingly. The recommendation of the Finance Committee that the Canadian Manufacturers Association be given the support requested was approved.

It was unanimously RESOLVED that W. H. Munro, M.E.I.C., of Ottawa, be appointed chairman of a Striking Committee, whose duty it is to make recommendations to Council regarding chairmen for the various Institute committees for the year 1943. It was left with Mr. Munro and the president-elect to name the other members of the committee.

At this point, the president and the general secretary retired from the meeting, and Vice-President Cameron took the chair.

The following resolution was presented from the executive of the Winnipeg Branch.

> "The executive recommends that the American Standard Abbreviations for Scientific and Engineering Terms as approved by the American Standards Association, March, 1941 (ASA-Z101-1941) be adopted by the Winnipeg Branch; and that the Secretary be instructed to write Headquarters recommending these abbreviations for consideration by Council with the view to adoption by the Engineering Institute of Canada."

A letter from the secretary of the Canadian Engineering Standards Association intimated that that body had already adopted the American Standard Abbreviations but that publication had been deferred pending a decision as to whether or not certain items of a purely Canadian or British interest should be added to the lists contained in the A.S.A. standard.

In view of the fact that all Canadian standard specifications are now handled through the C.E.S.A., it was felt that no action was necessary on the part of the Institute Council or any of its branches. However, in order to clarify the situation, it was unanimously resolved that Mr. Durley and Mr. Trudel be asked to review the situation from the time the Institute handled such specifications, and prepare a memorandum for the records and for the information of the Winnipeg Branch.

On returning to the meeting, President Young explained to Council that he and the general secretary had just met in the secretary's office with Mr. James Wilson, president of the Shawinigan Water and Power Company. Mr. Wilson had attended at the president's invitation in order to receive from him a replica of the Julian C. Smith Medal.

The president had made this presentation knowing of the co-operation and assistance given to the Institute by Mr. Wilson and his company, and because of his particular interest in the establishment of the Julian C. Smith Medal. The replica was to serve as a personal record and a keepsake. The inscription read as follows: "Presented to Mr. James Wilson, a friend of the Institute and the immediate successor to Mr. Smith as president of the Shawinigan Water and Power Company."

The president commented on the value of the support given to the Institute by commercial organizations. The establishment by outright contribution or by endowment of worth while objectives such as medals, prizes or scholarships, was very helpful.

The following resolution was presented from the Canadian Institute of Chemistry.

> "That Council of the Canadian Institute of Chemistry is in favour of recommending to the Honourable Minister of Labour that the principle of compulsory transfer for technical personnel should be adopted, and is of the opinion that the views of the Engineering Institute of Canada and the Canadian Institute of Mining and Metallurgy should be sought as to their feelings for the purpose of sending a joint recommendation."

After considerable discussion Council decided that in view of the proposed changes in National Selective Service procedures and the government's policy towards conscription, it would be inadvisable and ineffective to present a resolution along the lines suggested.

The president reported that early in January he had had a conversation with C. S. Kane, president of the Canadian Institute of Steel Construction, in which Mr. Kane outlined a proposal to institute some inquiry relative to the part to be played in post-war reconstruction by the heavy industries. In response to the president's suggestion Mr. Kane had submitted a proposal in writing. This proposal was read to the meeting by the general secretary. It suggested that as the members of the Institute were interested in heavy industry the Institute might care to name a representative to a joint committee that might be established to investigate this proposal.

Mr. Cameron pointed out that on Dr. James' Committee on Post-War Reconstruction there is a member who represents industry. The purpose in having him on the committee is to have a contact with industry so that it might be organized to fit into the other general activities. Mr. Cameron suggested that Mr. Kane might get in touch with this representative to see if his group of industries could work along the same lines as other industries.

It was agreed that this whole proposal be submitted to the Institute Committee on Post-War Problems.

It was noted that the next meeting of Council would be held at the Royal York Hotel, Toronto, on Wednesday, February 10th, 1943, convening at ten o'clock a.m.

A number of applications were considered, and the following elections and transfers were effected:

## ELECTIONS AND TRANSFERS

At the meeting of Council held on January 16th, 1943, the following elections and transfers were effected:

*Members*

**Allan,** John Charles, B.A.Sc., (Univ. of Toronto), asst. industrial control engr., Canadian General Electric Co., Peterborough, Ont.

**Howard,** Ernest E., C.E. & B.S., (Univ. of Texas), D.Eng., (Univ. of Nebraska), senior partner, Howard, Needles, Tammen & Berquedoff, cons. engrs., Kansas City, Mo.

**Lundy,** Homer Shannon, struct'l designer, H. G. Acres & Co., Niagara Falls, Ont.

**Pascoe,** Thomas, (City & Guilds London Institute), senior asst. engr., M.D. No. 13, Suffield Experimental Station, Suffield, Alta.

*Transferred from the Class of Junior to that of Member*

**Allaire,** Lucien, B.A.Sc., C.E., (Ecole Polytechnique), asst. division engr., Highways Dept. of Quebec, Metabetchouan, Que.

**Anderson,** Roderick Victor, B.A.Sc., (Civil), (Univ. of B.C.), chief dftsmn., Welland Chemical Works, Niagara Falls, Ont.

**Baker,** John Arthur, B.A.Sc., (Univ. of B.C.), inspector, Canadian Underwriters' Association, Toronto, Ont.

**Bradford,** George Allen McClean, B.Sc., (Mech.), (Univ. of Sask.), mech. designer, H. G. Acres & Co., Niagara Falls, Ont.

**Brown,** William Edward, B.A.Sc., (Univ. of Toronto), wire rope engr., The B. Greening Wire Co. Ltd., Hamilton, Ont.

**Craig,** William Royce, B.Sc., (Elec.), (Univ. of Alta.), asst. engr., B.C. Sugar Refining Co., Vancouver, B.C.

**Crain,** Harold F., B.Sc., (Queen's Univ.), vice-pres., Crain Printers Ltd. Ottawa, Ont.

**Ehly,** Lucas Joseph, B.Sc., (Chem.), (Univ. of Alta.), res. engr., Dept. of Transport, Lethbridge, Alta.

**Higgins,** Edgar Clarence, asst. engr., Hydro Electric Power Commission of Ontario, Toronto, Ont.

**Johnston,** Orval Ellsworth, B.A.Sc., (Univ. of Toronto), designing engr., Hydro Electric Power Commission of Ontario, Toronto, Ont.

**Marcotte,** Roland, B.S., (Sch. of Engineering, Milwaukee, Wis.), operating engr., Saguenay Power Co. Ltd., Isle Maligne, Que.

**McCann,** William Neil, B.Sc., (Civil), (Univ. of Man.), engr., McColl Frontenac Oil Co., Toronto, Ont.

**Oddleifson,** Axel Leonard, B.Sc. (Elec.), (Univ. of Man.), junior engr., Winnipeg Electric Co., Seven Sisters Falls, Man.

**Stead,** Harry G., chief engr., E. Leonard & Sons, Ltd., London, Ont.

**Tames,** John Alex, B.Sc. (Elec.), (Univ. of Alta.), sales engr., Canadian Westinghouse Co. Ltd., Vancouver, B.C.

**Warkentin,** Cornelius Paul, B.Sc. (Civil), (Univ. of Man.), engr., Imperial Oil Co. Ltd., Sarnia, Ont.

**Willis,** Ralph Richard, B.Sc. (Civil), (Univ. of N.B.), chief engr., Ross Engineering of Canada Ltd., Montreal, Que.

*Transferred from the class of Student to that of Member*

**Peters,** Henry F., B.Sc. (Civil), (Univ. of Man.), (Fl./L.), Works Officer, No. 12 S.F.T.S., R.C.A.F., Brandon, Man.

**Ramsdale,** Donald Osland Dallas, B.Eng. (Elec.), (McGill Univ.), Prob. Sub-Lieut., R.C.N.V.R., Halifax, N.S.

*Transferred from the class of Student to that of Junior*

**Belle-Isle,** Joseph Gérard Gerald, B.A.Sc., C.E., (Ecole Polytechnique), P/O, R.C.A.F., St-Basile-le-Grand, Que.

**Crook,** Donald Gordon, B.Sc. (Civil), (Univ. of Sask.), production engr., Neon Products of Western Canada, Ltd., Vancouver, B.C.

**Dick,** William Arthur, B.Eng. (Mech.), (McGill Univ.), plant engr., American Can Co., Montreal, Que.

**Edwards,** Milton Chalmers, B.Sc. (Elec.), (Univ. of Alta.), F/O, signals officer, R.C.A.F., Winnipeg, Man.

**Ellis,** Gwillym Lionel Townshend, B.Sc. (Mech.), (Univ. of Sask.), asst. engr., Weathermakers (Can.) Ltd., Toronto, Ont.

**Hindle,** Walter, B.Sc. (Univ. of Alta.), erecting engr., Canadian Westinghouse Co., Ltd., Hamilton,

**Hugill,** John Templeton, B.Sc. (Chem.), M.Sc. (Phys. Chem.), (Univ. of Alta.), Capt., R.C.A., chief experimental officer, Experimental Station, Suffield, Alta.

**Ingram,** Wallace Wellington, B.Sc. (Elec.), (Univ. of Man.), foreman, lead and impregnating depts., Phillips Electrical Works, Montreal, Que.

**Jacobs,** Clifford Roy, B.Sc. (Chem.), (Univ. of Alta.), asst. inspector, at Atlas Powder Co. Plant, Joplin, Mo., for Inspection Board of the United Kingdom and Canada.

**Jones,** David Carlton, B.Eng. (Mech.), (McGill Univ.), chief ground instructor and chief link instructor, No. 5 E.F.T.S., High River, Alta.

**Klodniski,** Nicholas Albert, B.Sc. (Elec.), (Univ. of Alta.), engrg. dftsman., Canadian National Railways, Montreal, Que.

**LaRivière,** Marcel Gérard, B.Eng. (Civil), (McGill Univ.), junior engr., Dept. of Public Works of Canada, New Westminster, B.C.

**Marantz,** Oscar, B.Sc. (Civil), (Univ. of Man.), demonstrator, Faculty of Engineering, University of Manitoba, Winnipeg, Man.

**Mercier,** Jules Mathias, B.A.Sc., C.E., (Ecole Polytechnique), meter engr., Canadian General Electric Co., Peterboro, Ont.

**Moule,** Gerald William, B.Sc. (Elec.), (Univ. of Man.), elect'l. engr., Defence Industries Ltd., Montreal, Que.

**McEown,** Wilbert R., inspector of electricity and gas, Dept. of Trade & Commerce, Winnipeg, Man.

**Weston,** Norman Owen, B.Sc. (Elec.), (Univ. of Alta.), illumination engr., Canadian Westinghouse Co., Hamilton, Ont.

**Wright,** Austin Meade, B.Eng. (Elec.), (McGill Univ.), Sub-Lieut., R.C.N.V.R., Overseas.

*Students Admitted*

**Betnesky,** Abraham David, (Montreal Tech. Inst.), dftsmn. Dominion Bridge Co. Ltd., Lachine, Que., 3921 Drolet St., Montreal.

**Gerrard,** James Herbert, (Univ. of N.B.), 263 York St., Fredericton, N.B.

**Heinze,** Laurence Sherwood, (Univ. of N.B.), 752 Union St., Fredericton, N.B.

**Janigan,** George Gregory, (N.S. Tech. Coll.), 705 Barrington St., Halifax, N.S.

**McElwain,** Donald Melvin, (Univ. of N.B.), 618 Brunswick St., Fredericton, N.B.

**Muirhead,** Charles Randolph, (Univ. of Man.), Kingsley Apts., Winnipeg, Man.

**Tod,** James Alexander, (Univ. of Toronto), Lundy Ave., Newmarket, Ont.

**Vaillancourt,** Rosaire, (Ecole Polytechnique), 8131 Berri St., Montreal.

By virtue of the co-operative agreement between the Institute and the Association of Professional Engineers of Saskatchewan, the following election has become effective:

*Member*

**Hay,** Charles Cecil, B.Eng., (Univ. of Sask.), refinery supt., Hiway Refineries, Ltd., (Petroleum Products), Saskatoon, Sask.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Major-General G. R. Turner,** M.C., D.C.M., M.E.I.C., has been made "Companion of the Most Honourable Order of the Bath." He is deputy adjutant and quartermaster-general of the first Canadian Army overseas.

He was born at Four-Falls, N.B., in 1890, and was educated at Andover, N.B. He enlisted at sixteen in the 3rd Field Company, Royal Canadian Engineers, and served in France as a sergeant and sergeant-major, being commissioned in September, 1915. He was promoted to captain a year later. His subsequent appointments included regimental and staff service and in May, 1918, he was promoted to major. He was mentioned in despatches, awarded the Distinguished Conduct Medal and the Military Cross and bar.

In 1920 he was appointed to the permanent force with rank of captain, and studied at the School of Military Engineering, Chatham, England. Returning to Canada, he became instructor in military engineering at the Royal Military College, Kingston. In 1924 he attended the Staff College at Quetta, India, and in 1927 he was appointed district engineer-officer of Military District No. 10, Winnipeg, Man. In 1929 he became assistant director of engineer services, National Defence Headquarters, Ottawa, Ont. In 1938 he attended a course at the Imperial Defence College, London, England, and on his return, in 1939, he was on the General Staff at M.D. No. 11 Headquarters, Esquimalt, B.C.

At the outbreak of this war he went overseas as general staff officer, grade 1, with the 1st Division. He was promoted to colonel and later brigadier, and on formation of the Canadian Corps was appointed deputy adjutant and quartermaster-general of the corps.

**Engineer Rear-Admiral G. L. Stephens,** R.C.N., M.E.I.C., has recently been promoted from the rank of engineer captain and, in the King's new year honours list, he was made "Commander of the Most Excellent Order of the British Empire." His promotion to Engineer Rear-Admiral makes him the first Canadian to hold that rank.

Admiral Stephens was born and received his first naval training in England. He joined the Canadian Naval Force in 1910 as engine-room artificer. His advancement to the commissioned rank came during the Great War and he has since served as senior engineer on both coasts. In 1941 he was appointed engineer in chief of the Royal Canadian Navy and came to Ottawa in the Naval service, in the Department of National Defence.

**Air Vice-Marshal R. R. Collard,** M.E.I.C., has been made a Commander of the Order of the British Empire. He is director of works and buildings at R.C.A.F. Headquarters, Ottawa. Marshal Collard was born at Belmont, Ont., and received his education at Kitchener. In 1906 he joined Warren Bros. Company and rose from the position of foreman to that of general superintendent when engaged on construction work in the western provinces. In 1922-23 he was president and general manager of Warren Bros. Co. at Honolulu, Hawaii. In 1924 he joined the staff of Carter, Halls Aldinger Company Limited at Winnipeg and in 1927 he became vice-president of the firm. In 1933-34 he organized the Acadia Construction Company Limited, Halifax and became managing-director a position which he still holds.

**Major-General G. R. Turner,**
C.B., M.E.I.C.

**Rear Admiral G. L. Stephens,**
C.B.E., M.E.I.C.

**Air Vice-Marshal R. R. Collard,**
C.B.E., M.E.I.C.

**Air Vice-Marshal G. O. Johnson,** M.E.I.C., who was commanding officer at No. 1 Training Command, R.C.A.F., at Toronto, has been named commander of the Eastern Air Command at Halifax.

**Major-General C. R. S. Stein,** M.E.I.C., has recently been promoted from the rank of Brigadier and named to succeed Lieutenant-General E. W. Sansom to the command of a Canadian Armoured Division overseas.

General Stein is an engineer officer of long experience and at 46 is one of the youngest men of his rank in the army. He joined the 6th Field Company of the Canadian Engineers, in the Non-Permanent Active Militia in 1914 as a sapper and after graduating from the Royal Military College was commissioned a lieutenant. From 1917 to 1919 he saw service in France and Belgium.

After the war he served as district engineer officer in M.D. 5 (Quebec); attended the Staff College at Quetta, India; he was promoted to major in 1931, and served at Defence Headquarters. At the beginning of the war he was confirmed in the rank of lieutenant-colonel and appointed to command the engineer training centre. He went overseas in 1940 as an Assistant Adjutant General in personal services. In 1941 he was appointed Adjutant and Quartermaster-General of a Canadian Armoured Division, was made a brigadier commanding a Canadian Armoured Brigade, and then went to the General Staff, an appointment he held until his new promotion.

**George L. Watson,** M.E.I.C., consulting engineer of New York City, has been recalled to active duty in the United States Army as a colonel.

**Paul A. Béique,** M.E.I.C., was elected president of La Chambre de Commerce de Montréal at the annual meeting held last month. Mr. Béique is a native of Montreal and received his early education at Collège Ste-Marie, Montreal, and St. Charles College, Baltimore. He later undertook his engineering studies at the Ecole Polytechnique, Montreal, from which he received the degrees of Civil Engineer and Bachelor of Applied Science, in 1906.

His first work was with a firm of engineers and architects. Subsequently he accepted the position of draughtsman with the Quebec, Montreal and Southern Railway.

In 1907, Mr. Béique joined the staff of Messrs. O'Brien and Mullarkey, railway contractors, in the capacity of inspector, and in the following year he was appointed superintendent for the same company on construction of the Quebec, Montreal and Southern Railway. In 1909, he became associated with a firm of civil engineers and land surveyors who were engaged in private practice. In 1913 he entered consulting work, and in addition to his general practice was acting town engineer for the town of Ville Lasalle, Que., and was a member of the Consulting Board of the Metropolitan Commission of Montreal. He has since carried out a successful practice, specializing in valuation and municipal work. For several years he was a member and later vice-president of the Montreal Tramways Commission.

Paul Béique, M.E.I.C.

Aimé Cousineau, M.E.I.C.

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

**Professor E. G. Cullwick,** M.E.I.C., head of the Department of Electrical Engineering at the University of Alberta has been granted leave of absence from the university in order to assume the position of director of electrical engineering at Canadian Naval Headquarters, Ottawa, with the rank of Commander (Electrical). Commander Cullwick was born in England and educated at Cambridge University. He served his apprenticeship with British Thompson-Houston Company Limited, in England, and after his arrival in Canada, in 1926, he took the test course with Canadian General Electric Company at Peterborough, Ont. In 1928 he was appointed assistant professor of electrical engineering at the University of British Columbia. In the years 1934-1935 he lectured in electrical engineering at the Military College of Science, Woolwich, Eng. He returned to the University of British Columbia, in 1935, as assistant professor of electrical engineering and in 1937 he became professor and head of the Department of Electrical Engineering at the University of Alberta.

**Wing-Commander Denton Massey,** M.P., M.E.I.C., is now overseas. Until recently he had been posted for sometime as Comm nding Officer of No. 3 Initial Training School, R.C.A.F., Victoriaville, Que.

**R. S. Eadie,** M.E.I.C., is the newly elected chairman of the Montreal Branch of the Institute. He is a graduate of McGill University in the class of 1920, his engineering course having been interrupted during his service with the R.C.E. in the last war. In 1922 he received the degree of M.Sc. from McGill. He lectured in the Faculty of Applied Science of McGill until 1924 when he joined the Dominion Bridge Company Limited as a designer. He became designing engineer in 1935 and in 1937 he was appointed assistant chief engineer of the company, a position he still holds.

**Aimé Cousineau,** M.E.I.C., has been appointed director of the City Planning Department of Montreal, replacing H. A. Terreault who died recently. Mr. Cousineau is a graduate of the Ecole Polytechnique of Montreal, of Massachusetts Institute of Technology and Harvard University. He has been active for a number of years in city planning work in Montreal and has lectured for many years on the subject at the Ecole Polytechnique.

**J. C. Aitkens,** M.E.I.C., is now employed in the engineering department of Ford Motor Company of Canada at Windsor, Ont. Since 1937, he had been employed with Madsen Red Lake Gold Mines Limited, at Madsen, Ont.

**E. A. Beman,** M.E.I.C., is chief engineer of the Chesterville Larder Lake Gold Mining Company Limited at Kearns, Ont. He was previously with Pandora Limited at Cadillac, Que.

**Henri Gaudefroy,** M.E.I.C., a member of the teaching staff at the Ecole Polytechnique, has been appointed secretary of the Faculty and assistant to the Dean. Born in Montreal in 1909, Mr. Gaudefroy received his high school education at Mont Saint-Louis College, in Montreal, and then studied engineering at the Ecole Polytechnique from 1929 to 1933, being awarded the degree of Bachelor of Applied Science. After graduating from the Ecole Polytechnique he studied for some time at the Massachusetts Institute of Technology, which conferred upon him the degree of Sc.B., in electricity, in 1934.

From 1935-1939 Mr. Gaudefroy was with the Bell Telephone Company. Since 1939, he has been assistant professor of mathematics at the Ecole Polytechnique. Mr. Gaudefroy is chairman of the Membership Committee of the Montreal Branch of the Institute.

**N. I. Edwards,** M.E.I.C., has joined the Royal Canadian Naval Volunteer Reserve as Engineer Lieutenant. He has been on the staff of Franklin Railway Supply Company of Canada, Montreal, since 1924.

**R. H. Moore,** M.E.I.C., has left his position with Hudson Bay Mining & Smelting Company Limited, Flin Flon, Man., and has joined the staff of Babcock-Wilcox & Goldie McCulloch Limited, Galt, Ont.

**Flying-Officer M. S. Layton,** Jr.E.I.C., was awarded the D.S.O. last December. According to news which reached here recently he was navigator on an aircraft escorting a convoy. The crew fought off, during several hours, enemy submarines and prevented them from attacking the convoy.

**2nd Lieutenant J. E. Beamish,** Jr.E.I.C., has left his position with the Dominion Experimental Station at Swift Current, Sask., to enlist and is at present training with the R.C.E. at Chilliwack, B.C.

**J. M. Thomas,** Jr.E.I.C., lately of Montreal is now located at Pictou, N.S., with Foundation Maritime Limited, Shipbuilding Division.

**G. F. Webster,** S.E.I.C., is at present serving as a lieutenant with the R.C.E. He graduated from the University of Saskatchewan in 1942.

**D. Hutchison, M.E.I.C.**
**The new chairman of the Edmonton Branch**

### VISITORS TO HEADQUARTERS

**R. E. McMillan,** M.E.I.C., Aluminum Company of Canada Limited, Arvida, Que., December 30th, 1942.

**Ls. P. Cousineau,** M.E.I.C., Dufresne Engineering Company, Passe Dangereuse, Que., January 6th, 1943.

**P/O. M. L. Papineau,** Jr.E.I.C., R.C.A.F., Cap de la Madeleine, Que., January 6th.

**Gustave St-Jacques,** M.E.I.C., Public Service Board, Quebec, January 6th.

**P/O. J. A. Lamb,** Jr.E.I.C., Saskatoon, Sask., January 21st.

**Lieutenant Jacques Leroux,** M.E.I.C., Petewawa, Ont., January 21st.

**P/O I. H. Wilson,** School of Aeronautical Engineering Lethbridge, Alta., January 21st.

**J. A. Reynolds,** M.E.I.C., Department of Munitions and Supply, Army Engineering Design Branch, Ottawa, Ont., January 21st.

**Colonel Edward C. Thorne,** M.E.I.C., N.D.H.Q., Ottawa, Ont., January 25th.

**D. S. Thomas,** M.E.I.C., Mining Engineer, Toronto, Ont., on January 26th.

**J. A. Van den Broek,** M.E.I.C., Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Mich., U.S.A., January 26th.

**Lieut. C. W. Elliott,** R.C., Jr.E.I.C., Calgary, Alta., January 30th.

**W. E. Brown,** M.E.I.C., Secretary-Treasurer of the Hamilton Branch of the Institute, Wire Rope Engineer, Sales Department, The B. Greening Wire Company Limited, Hamilton, Ont., January 30th.

# Obituaries

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

**Jacques Nessim Aggiman,** M.E.I.C., died on July 22, 1942, in Washington, D.C. He was consulting engineer and owner of Aggiman Engineering & Construction Company at Ankara, Turkey. Born on March 7, 1892 at Monastir, Turkey, he received his engineering education at McGill University, Montreal, where he graduated as a B.Sc. in 1917. Before attending McGill he worked as a draughtsman from 1911 to 1915 with the St. Lawrence Bridge Company, at Montreal, on the Quebec bridge project. In 1916 and 1917 he was a designer with St. Lawrence Pulp & Lumber Company at Chandler, Que. Upon graduation he joined the Ha-Ha-Bay Sulphite Company at Port Alfred, Que., as superintendent of construction on the pulp mill. In 1919-1920 he was chief engineer of the company.

From 1921-1924 he was chief engineer of construction for the Standard Oil Company of New York in the Near East. In 1924 he established a consulting practice at Constantinople and later founded the contracting firm of which he was still the owner at the time of his death.

During his engineering career in Turkey, Mr. Aggiman was connected with the design and construction of several public buildings such as the palace of the president of the Turkish Republic, several embassies buildings as well as commercial buildings. In particular he was retained as consulting engineer and contractor for the Turkish Parliament, the Ministry of Works and Buildings of Great Britain, various diplomatic missions and the Embassy of the United States. He held decorations from the Government of Yugoslavia and Persia.

Mr. Aggiman joined the Institute as a Student in 1916 and transferred to Junior in 1917. In 1919 he transferred to Associate member and became a Member in 1929.

**Ernest M. Archibald, M.E.I.C.**

**Ernest M. Archibald,** M.E.I.C., died suddenly at his home, at West Palm Beach, Florida, U.S.A., on September 19, 1942. A native of Nova Scotia, he was graduated from McGill University in the '99 Science class, with honours. In 1900 he joined the engineering department of Crocker-Wheeler Company at Ampere, N.J. From 1901 to 1904 he was employed with the American Locomotive Company at Richmond, Virginia, and in 1905 he returned to the Crocker-Wheeler Company at St. Louis, Missouri, as a sales engineer. In 1906 he went to the Dominion Coal Company at Glace Bay, N.S., as electrical engineer and assistant mechanical engineer, at the inception of the electrification of the collieries. He then went over to Europe, where he spent much time studying and investigating the latest developments in industrial power and colliery practice. In 1912, Mr. Archibald turned his attention to general contracting, and carried out a number of important contracts, such as the successful completion of the substructure of the Annapolis Bridge, also the Moncton, N.B., bridge substructure, which was a difficult compressed-air undertaking and carried out under extreme tidal conditions, and said to be one of the most difficult projects ever undertaken. Mr. Archibald also built 100 miles of macadamized highway under contract with the Nova Scotia Highway Board, and carried out the entire paving programme for the city of Halifax for the season of 1922. He then returned to the contracting business, and became associated with the E. F. Power's Construction Company of Saint John, N.B. In 1926 the firm moved to Florida and entered into the construction of highways and bridges throughout the State. From 1928 to 1934 they constructed many miles of levees on the Mississippi River, with the then new electrical dirt moving equipment.

As Power & Archibald Inc. they were engaged in road building, and later in airport construction work throughout the State. At the time of Mr. Archibald's death, Power & Archibald Inc., were constructing an airport at Homestead, Florida.

Mr. Archibald joined the Institute as an Associate Member in 1906. He became a Member in 1940.

C. D. Harrington, M.E.I.C.

**Conrad Dawson Harrington,** M.E.I.C., vice-president and general manager of the Anglin-Norcross Corporation Limited, Montreal, died at the hospital in Montreal, on January 26, 1943, after a short illness. Mr. Harrington was born at Montreal on November 17, 1884, and received his early education at the Montreal High School. He entered the Royal Military College at Kingston in 1902 and completed his engineering studies at McGill University where he was graduated as a B.Sc. in 1907.

He became associated with the Anglin-Norcross concern upon his graduation, when it was known as Byers and Anglin. Later, the firm became known as Anglins Limited and Mr. Harrington was appointed vice-president. When the new firm Anglin-Norcross Corporation Limited was established he became vice-president and chief engineer.

Among the notable engineering projects carried out by the company, under Mr. Harrington's supervision, are the Royal York Hotel in Toronto, the Canadian Bank of Commerce building also in Toronto, the church of St. Andrews and St. Paul in Montreal, the Supreme Court building in Ottawa, the Chateau Frontenac in Quebec and the Imperial Tobacco Company Limited buildings in Montreal.

The firm of which Mr. Harrington was general manager has taken a very active part in the construction programme for industrial expansion in Canada since the beginning of the war. Mr. Harrington has been responsible particularly for the expansion of the Quebec arsenal, and in the words of the Honourable C. D. Howe, Minister of Munitions and Supplies "There is no doubt that his untiring efforts to rush through that important job affected his health."

Mr. Harrington was a former president of the Montreal Board of Trade and of the Canadian Construction Association. He was president of Anglin-Norcross Quebec Limited and Anglin-Norcross Ontario Limited. He also served on the Canadian board of directors of the Yorkshire Insurance Company Limited.

Mr. Harrington joined the Institute as a Member in 1940.

**James Shanly,** M.E.I.C., died suddenly at Kenogami, Que., on December 18, 1942. He was born at Montreal, Que., on January 5, 1897, a son of the late James Moore Shanly, widely-known engineer. Educated first at the local schools, he entered McGill University to study engineering. In 1916, however, he broke off his course to enlist with a unit of the Royal Canadian Engineers, going overseas with the rank of lieutenant.

Returning to Canada in 1919, the late Mr. Shanly entered the service of Price Brothers Company Limited at Kenogami, Que., as a draughtsman. Later he became field engineer on construction and maintenance of the plant and townsite. In 1926 he was appointed assistant to the mechanical superintendent and, in 1931, he became assistant general superintendent. Later he was appointed to the position of manager of the paper division. During his residence at Kenogami he became a strong supporter of all the activities of the community and, at the time of his death, he was head of the Canadian Red Cross Society in the Lake St. John district.

Mr. Shanly joined the Institute as a Junior in 1920 and was transferred to Associate Member in 1933. He became a Member in 1940. He was chairman of the Saguenay Branch of the Institute in 1935.

**Lewis Stockett,** M.E.I.C., died in the hospital at Vancouver, B.C., on December 19, 1942. He was born at Ashland, Penn., U.S.A., on March 31st, 1861. He received his education in the local high school and under private tutors. In 1875 he entered the office of the division engineer of the Lehigh Valley Coal Company for the purpose of studying mining engineering. He remained with this firm until 1882 when he was appointed engineer of the Westmoreland Coal Co. near Pittsburgh, Pa. In 1884 he was appointed superintendent of the Park Collieries in the anthracite region, Park Place, Pa., and in 1887 became chief engineer of the Consolidated Coal Co. at St. Louis. He remained there until 1891 when he went into private engineering practice in Illinois. In 1892 he became secretary-treasurer of the Wabash Mining Company, in Indiana, and held this position until 1895, when he went to the Great Northern Railway as mining engineer. From 1897 until 1904 he was general manager of the Great Northern Coal Mines at Great Falls, Mont. Then he came to the Calgary district in 1905 as manager of the Canadian Pacific Railway's Bankhead coal mines, near Banff.

He was also manager of the company's mines at Hosmer, B.C., and in 1912 he was appointed general superintendent of the coal mines branch of the Department of Natural Resources and came to Calgary to reside.

After his retirement in 1929 he lived for several years at the Ranchmen's Club at Calgary and travelled extensively through England and Scotland, the United States and to Hawaii. He always took a keen interest in community affairs and was a member of the Calgary Board of Trade, of the Ranchmen's Club and the Calgary Golf and Country Club. He went to live at Vancouver in 1932.

Mr. Stockett joined the Institute as a Member in 1916.

**Charles Taylor,** M.E.I.C., died suddenly at his home at Selkirk, Man., on December 11, 1942. He was born in London, England, on June 25th, 1872. From 1896 to 1900 he was employed with Canadian Pacific Railway at Winnipeg and Moose Jaw. From 1901 to 1902 he was engaged in bridge construction with the Canadian Northern Railway. He joined the Department of Public Works of Canada in 1903 and worked on design and construction in Manitoba until 1911 when he was appointed superintendent of dredges for the Department in Manitoba, Saskatchewan and Alberta. In 1920 he was appointed engineer for the town of Selkirk, Man., which position he held until his death.

Mr. Taylor joined the Institute as an Associate Member in 1912 and in 1940 he became a Life Member.

H. E. Wingfield, M.E.I.C.

**Harold Ernest (Pat) Wingfield,** M.E.I.C.—The death of "Pat" Wingfield, on January 14th, 1943, removes from the ranks of the profession, and from the ranks of good citizenship, one of the most likeable and useful persons in Canada. At the age of forty-two, in the midst of a multitude of activities, of which he was an essential part, he succumbed to an illness which for a long time he had hidden from all but a few friends and relatives. Medical authorities had advised him to retire in order to lengthen his days, but he chose to go on to the end, making his contributions to the many causes in which he was interested. Had he chosen otherwise, he would not have been true to himself.

H. E. Wingfield was born in England, and came to Canada at the age of nine. He attended public and high school at Dunnville, Ontario, and entered the University of Toronto in 1919, graduating with honours as a Bachelor of Applied Science in Electrical Engineering with the famous class of '23.

Upon graduation he joined the engineering staff of the Turnbull Elevator Company, Limited, at Toronto, remaining there until 1933, four years of this time being spent at Winnipeg as branch manager. Upon his return to Toronto he was made sales manager of the company. In 1933 he became industrial engineer with the Toronto Industrial Commission. At the time of his death he was vice-president and director of sales, advertising and purchases, with the Imperial Rattan Furniture Company, Limited, Stratford. He was also vice-president of V. H. McIntyre, Limited, of Toronto.

No mere chronological account of education and business experience can give any conception of the full life lived by Pat. Successful in all his business endeavours, he still had time to devote to unselfish interests. To his intelligence, energy and enthusiasm many societies owe much of their success, and his departure will leave them all with an irreparable loss. It is to be hoped that in each instance some person, fired by the inspiration and attainments of his predecessor will arise to carry on the good work. He would wish it so.

Among the varied interests just mentioned can be included the Boy Scouts Association, of which he had been a district commissioner, the Engineering Alumni of the University of Toronto, the Kiwanis Club, and the Church of England. He was buried in the uniform of the Boy Scouts, and Dr. Cody, President of the University of Toronto, assisted in the ceremony.

The Engineering Alumni was particularly fortunate in receiving a large portion of his attention. Many of the good works accomplished within the last ten years, were inspired and carried out under the impetus of his enthusiasm and energy. Starting in 1933 as treasurer, he served in succession as vice-president and president, occupying each office for three years. His conduct of the reunion in November, 1942, was an outstanding performance, and those who saw him then find it impossible to believe that he is gone from us forever.

This man's life and his leaving of it, should be an inspiration to all who remain. A review of the good things he has accomplished, and the friendships he has made should serve as a model for the aspirations of other engineers. The force of his example will carry on for the lifetime of those of us who knew him. His was a brilliant light that burned all too shortly, but in its time both warmed and illuminated those fortunate enough to come within its orbit.

The world is better for his having lived, but he will be missed sadly. The sense of loss experienced by his friends gives them some appreciation of the depth of the bereavement of his wife and son. To them sincere and kindly wishes are extended—and sympathy.—L.A.W.

## COMING MEETINGS

**Ontario Good Roads Association**—Annual Convention at the Royal York Hotel, Toronto, February 24-25. Secretary: T. J. Mahoney, Box 485, Hamilton, Ont.

**Canadian Section, American Water Works Association**—Annual Convention, Royal Connaught Hotel, Hamilton, Ont., April 7-9. Secretary: Dr. A. E. Berry, director of the Sanitary Engineering Division, Ontario Department of Health, Parliament Buildings, Toronto.

**Industrial Accident Prevention Associations**—Annual Convention, at the Royal York Hotel, Toronto, April 12-13. General Manager: R. B. Morley, 600 Bay Street, Toronto.

**American Society of Mechanical Engineers**—1943 Spring Meeting, Davenport, Iowa, April 26-28. Secretary: C. E. Davies, 29 West, 39th Street, New York, N.Y.

**American Society of Mechanical Engineers**—1943 Semi-Annual Meeting, Los Angeles, California, June 12-14. Secretary: C. E. Davies, 29th West, 39th Street, New York, N.Y.

**American Water Works Association**—Annual Meeting, to be known as A.W.W.A. Conference on War-Winning Waterworks Operations, at the Carter and Statler Hotels, Cleveland, Ohio, June 14-17. Secretary: Harry E. Jordan, 22 East 40th Street, New York, N.Y.

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

### BORDER CITIES BRANCH

J. B. Dowler, M.E.I.C. - *Secretary-Treasurer*
W. R. Stickney, M.E.I.C. - *Branch News Editor*

The Border Cities Branch held their annual dinner meeting at the Prince Edward Hotel on Friday, December 11. After the dinner Mr. J. B. Dowler gave the Secretary-Treasurer's Report and Financial Statement, and the chairmen of the various committees then gave their annual reports. Following this, scrutineers were appointed and the following officers elected for the coming year: Chairman, G. G. Henderson; Vice-Chairman, J. B. Dowler; Secretary-Treasurer, W. R. Stickney; Executive Committee, J. F. O. Blowey, A. H. Pask, A. H. MacQuarrie.

Mr. G. E. Medlar then introduced the speaker of the evening, Mr. T. H. Jenkins, Designing Engineer of the Grand Trunk Western Railway, whose topic was **Wartime Railroad Transportation.** At the conclusion of his speech a lengthy and interesting discussion took place and after a vote of thanks to the speaker by Mr. C. G. R. Armstrong the meeting adjourned.

### HAMILTON BRANCH

W. E. Brown, Jr.E.I.C. - *Secretary-Treasurer*

The branch held its annual business meeting and dinner on Wednesday, January 13th, in the Royal Connaught Hotel with Chairman Stanley Shupe presiding. We can report that this was one of the most successful in several years and thoroughly enjoyed by all.

The guest of honour and speaker was our president, Dean C. R. Young, who was introduced by H. A. Cooch. Dean Young spoke on the subject, **The Engineering Profession in War Time.** The Dean gave us a very splendid address pointing out that it is not sufficient that the engineer's role in war-time be purely technological in character. The engineer must develop the whole doctrine of professional competency and make his contribution to all aspects of our national life.

In reporting on the activities of the Institute, the president illustrated how the E.I.C. is making that contribution. The Institute is affiliated with the Engineers' Council for Professional Development, which concerns itself with the broader aspects of professional life. The E.I.C. actively supports the policies of that council, and has representation on three E.C.P.D. committees, namely, Committee of Professional Training, Committee on Professional Recognition and Committee on Principles of Engineering Ethics. Furthermore, the Institute has its own Committee on Welfare and Training of the Young Engineer.

Three important committees of the Institute were appointed this year—Committee on Industrial Relations. Committee on Post-War Problems, and Committee on the Engineering Aspects of Civil Defence, which sponsored and financed the Webster lectures on Structural Defence Against Bombing, in Toronto last April.

The president then went on to speak of the things concerning the profession having a more direct relation to the war effort. The demands on engineers have been very great and many are serving with distinction in the armed forces. At home the engineer has been faced with the problem of vast construction and the provision of plant and equipment for the manufacture of the munitions of war.

There also has been the problem of design modification to save critical materials and reduce the amount of materials used. Plastics and synthetic rubber were mentioned, as well as many other ingenious contributions to the war effort.

Concluding, Dean Young remarked that in the years of peace there was a great future for the engineer and every evidence there would be great technological activity, and the longer the war went on the greater would be the demands. T. S. Glover moved the vote of thanks.

Mayor William Morrison was present and spoke briefly. We were pleased to have the general-secretary with us and to hear his report on interesting Institute activities.

Earlier in the evening the annual reports were received and the various items of business attended to. E. H. Darling moved a vote of thanks to McMaster University and staff for the assistance given to the branch during the past year, to which Chancellor G. P. Gilmour replied.

Presentations were made to the retiring chairman, Stanley Shupe, and A. R. Hannaford, the retiring secretary-treasurer, whose work during the last six years was warmly praised by E. G. MacKay, who made the presentation to him.

T. S. Glover, the new chairman, took over the office and introduced the other officers. The attendance was 78.

### KINGSTON BRANCH

R. A. Low, M.E.I.C. - *Secretary-Treasurer*

The Kingston Branch held a special meeting to welcome the President, Dean C. R. Young, of the University of Toronto on December 8th, at the LaSalle Hotel.

Mr. K. Winslow, chairman of the Kingston Branch, presided at the meeting. Dean Young was welcomed and introduced by Col. Le Roy Grant.

In his address to the Branch, the twenty-third that he has visited during his term of office, the President spoke of the national character of the work that the Institute is doing. It is of much value to the organization for senior officers to visit as many Branches as possible so that the views of members across Canada may be ascertained and may assist in the formulation of policies for the general benefit of the profession.

President Young expressed the view that the engineering societies had a function of particular importance to fill in time of war. There is a great disposition towards narrowing of the training of young engineers into purely technological channels, and efforts should be made to offset this. The meetings of the great engineering societies that have recently been held have all been unusually well attended and in numbers of cases all-time records have been established. The Institute feels therefore that it is eminently justified in holding its annual meeting in the usual form at Toronto, February 11-12, 1943. This is particularly so as the programme will generally gather about the war activities of the Institute.

Speaking of the general and continuing activities of the Institute, the President laid particular stress upon its participation in the enterprises of the Engineers' Council for Professional Development. Representatives of the Institute sit on the more important committees of ECPD. The Institute's Committee on the Training and Welfare of the Young Engineer is working closely in parallel with the ECPD Committees on Student Guidance and Selection and Professional Training. Already, under the guidance of the Institute's Committee, counselling committees have been set up in seventeen of the twenty-five Branches. Nine thousand copies of "The Profession of Engineering in Canada" in English have been distributed and an additional five thousand copies in French have recently been printed.

Strong emphasis was placed by the speaker on the special undertakings of the Institute connected with the war and its aftermath. The Committee on the Engineering Features of Civil Defence, which supervises the general activities of

Branch committees in twenty of the twenty-five Branches, has issued a valuable booklet "Structural Defence against Bombing" and through certain subcommittees is making available to the country generally the expert advice and assistance of the engineer in counteracting the possible effects of bombing and sabotage. The Institute's Committee on Post-War Problems has given important assistance to the Government-appointed Advisory Committee on Reconstruction and is arranging to make available to the one hundred and twenty-five local citizens' committees set up across Canada any assistance that engineers can give to these committees in studying problems of rehabilitation and reconstruction. The Institute's Committee on Industrial Relations is making important progress in drawing the attention of the universities to the need for providing fully adequate instruction to engineering students in this important subject and has arranged for a thorough discussion of the whole matter at the annual meeting in Toronto.

In speaking of the future of the profession, the President expressed the view that the technological advances now being made will ensure the employment of engineers for some time after the cessation of hostilities. A vast demand for the goods and services of peace is being built up which must be satisfied and this will mean not merely the provision of these things according to old time standards but rather according to the best and most modern practices. Out of this desire of the public to profit from the results of discovery and invention a great source of technological employment is sure to arise.

The President spoke strongly of the need for maintaining and extending the professional point of view in the training of young engineers both in college and in the years following graduation. It is imperative that one who is to be a thoroughly qualified member of a learned profession should be characterized by a humanistic outlook and not merely a technological one. Many engineers make the mistake of thinking that all the problems of the world can be solved by a technological approach. A little consideration will show that human advancement comes as a result of many different kinds of workers co-operating to a common end. Each profession and each calling has its own distinctive role to play, and it is the duty of the engineer to realize the necessity of considering many factors other than technological ones when dealing with public questions. To the extent that he acquires a breadth of view his effectiveness as an educated and trained citizen will be advanced.

The speaker was thanked by Dean A. L. Clark, Queen's University.

Following the meeting an informal social hour was spent when members and their guests had the pleasure of meeting Dean Young.

## OTTAWA BRANCH

A. A. Swinnerton, m.e.i.c. - - *Secretary-Treasurer*

At the annual branch meeting, held on the evening of January 14, 1943, at the auditorium of the National Research Laboratories, G. H. Ferguson, chief engineer of Pensions and National Health, was elected chairman for the ensuing year; A. A. Swinnerton, m.e.i.c., was re-elected secretary-treasurer; and W. H. Bevan, m.e.i.c., and J. Byrne, m.e.i.c., were elected to the managing committee to serve two years. Mr. Ferguson succeeds N. B. MacRostie, retiring chairman, who presided at the meeting.

The branch, according to reports presented, held 8 luncheon meetings and 4 evening meetings during the year including the annual meeting, and co-operated in holding 3 more evening meetings with other organizations. Two sets of draughting instruments were donated to the Ottawa Technical School for presentation as prizes for proficiency in draughting and a copy of "Technical Methods of Analysis" by Griffin was sent to the Hull Technical School for presentation to one of its students.

Total membership of the branch increased by 48 during the year, standing at 434 resident and 119 non-resident members. With deep regret the loss by death of two of the members was reported: E. M. Dennis, m.e.i.c., and R. H. Swingler, s.e.i.c.

Co-operation with the committees set up by the Council of the Institute in Montreal was maintained and according to the secretary-treasurer's report "the close of the year finds the Ottawa branch fully organized to co-operate not only with the regular requests for this co-operation but also to lend assistance in special matters such as Air Raid Precautions and Post-War Reconstruction." During the year the managing committee held nine meetings for the transaction of general business.

At the close of the annual meeting proper, the members listened to an address on **Wardens of Power** by Past-President T. H. Hogg of Toronto, chairman of the Ontario Hydro-Electric Power Commission. Dr. Hogg's address was of much public interest and was well reported in the press. It reviewed conditions relating to electric power supplies in Ontario since the commencement of the war and outlined possibilities for further developments.

Light refreshments were served at the close of the evening's activities.

## PETERBOROUGH BRANCH

A. R. Jones, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, s.e.i.c. - *Branch News Editor*

A paper of wide interest "DeCew Falls Power Development" was presented before an audience of about 60 engineers at the December 10th meeting. Mr. O. Holden, the author of the paper and Chief Hydraulic Engineer of the H.E.P.C., was detained so the paper was read by Mr. J. R. Montague, Assistant Chief Hydraulic Engineer H.E.P.C.

Mr. Montague dwelt on the difficulties encountered in the development but stated that experimental work and careful preparation have resulted in good progress which will permit an early completion of the undertaking.

The DeCew Falls site is located on the escarpment along Lake Ontario and adjacent to the old Welland Canal. The 65,000 HP which will be immediately developed and the further block of power available in the near future will be of great importance in easing the power shortage in a critical area.

An important feature of the job relates to war economy. By use of a generator and turbine from the Abitibi Canyon Plant, considerable time will be saved and scarce machinery conserved.

This paper which has great current interest will be published in the near future, sponsored by one of the branches at which it has been presented.

Mr. Sills conveyed the thanks of the meeting to Mr. Montague for an excellent paper and for the entertaining remarks accompanying it. Mr. J. Cameron acted as chairman in the absence of Mr. D. Emery, Branch Chairman.

## SAINT JOHN BRANCH

G. W. Griffin, m.e.i.c. - *Secretary-Treasurer*

The Saint John Branch held a supper meeting on December 29th, at the Admiral Beatty Hotel, at which there were 35 present.

The technical explanation of what aerial bombing does to material in air raid shelters was given in a paper, **The Effects of Aerial Bombing on Structure,** presented at that meeting.

The paper, prepared by Dean I. F. Morrison, professor of applied mechanics, department of municipal and civil engineering, University of Alberta, was illustrated by lantern slides, and was read by David R. Smith, chairman of the Branch. Various designs for shelters were outlined also in the paper.

In addition to members of the branch, guests from the Ottawa and Moncton branches and engineering students of the University of New Brunswick attended the meeting.

### SASKATCHEWAN BRANCH

STEWART YOUNG, M.E.I.C. - *Acting Secretary-Treasurer*

The Saskatchewan Branch, E.I.C., met jointly with the Association of Professional Engineers in the Kitchener Hotel, Regina, on Thursday evening, December 17, 1942. The meeting was preceded by the usual dinner at which the attendance was 25.

Mr. R. T. Blackmore of the Technical Service Department, The British American Oil Company Limited, addressed the meeting on **Fuel and Lubrication Requirements of the Modern Gasoline Engine,** following which Mr. Roy Pugh, Provincial Apiarist, showed a very interesting film on Bees.

Mr. Blackmore reminded his audience that the motive power of the modern mechanized army is the internal combustion engine, which, for the purpose of studying gasolines and how motive power is derived from it, must be considered as a heat engine. The refining of three different types of gasoline was then discussed, the types being straight run, cracked and polymerized gasoline. Automotive Gasolines have a boiling range of from approximately 80 deg. F. to 400 deg. F. Light ends for easy starting, 50 per cent, warm up period, heavy ends for power and economy.

During the past 25 years compression ratios have increased from 4 to 1 to nearly 7 to 1, with consequent greatly increased power output. The increase in compression pressures resulted in detonation or motor "ping", overcome by the introduction into gasoline of tetra ethyl lead. The establishing of an Octane rating on different fuels in a knock motor was illustrated. Spark setting to accommodate No. 1 and No. 2 graded fuels in the modern motor was also covered. For starting purposes both grades of gasoline have equal value, providing distillation ranges are the same and the only difference being in the lead content, No. 1 Gasoline having a higher content than No. 2. Different gasolines for various altitudes and temperatures are necessary.

In the brief discussion of oils Mr. Blackmore ventured the opinion that after the war, all premium priced oils will be of a compounded nature. Compound oils now on the market for diesel and heavy duty gasoline operation are compounded chemically to achieve the following: high detergency, film strength, metal deactivation and oxidation inhibitors.

The illustrated address by Mr. Pugh dealt with the subject of Bees from the larva stage of the honey bee to the final product, honey. The Province of Saskatchewan is the second largest producer of honey in Canada, the total annual output being 5,000,000 pounds (approximately 250 carloads) all of which is consumed in Saskatchewan.

Both addresses proved very interesting and were followed by numerous questions answered respectively by Mr. Blackmore and Mr. Pugh. A hearty vote of thanks was tendered the speakers on motion of Mr. E. W. Bull.

### SAULT STE. MARIE BRANCH

O. A. EVANS, M.E.I.C. - *Secretary-Treasurer*

The annual meeting for the Sault Ste. Marie Branch of the Institute was held on Friday, December 18th, 1942, in the Grill Room of the Windsor Hotel.

Eighteen members and guests sat down to luncheon at 6.45 and enjoyed a tasty meal which was along the traditional Christmas style.

Chairman L. R. Brown called the meeting to order at 8.00 p.m. and asked the secretary to read the minutes of the previous meeting.

The chairman then asked the secretary to bring in his report for the year 1942. The secretary reported a very successful year. The highlights of it were a financial surplus of $71.55 and seven dinner meetings. One distracting feature was the loss in membership in the non-resident areas.

A. E. Pickering then brought in the report of the Papers and Publicity committee. He explained that due to the pressure of business we were unable to obtain a number of papers as some of the speakers had been called from town and were unable to give their papers when they had promised to do so.

The chairman then asked A. M. Wilson to bring in the report of the election of officers for the year 1943.

L. R. Brown then called upon the new chairman N. C. Cowie to assume the chair. In relinquishing the chair L. R. Brown thanked all the people who had helped in making the past year a success and was pleased to see a younger man as chairman.

Mr. Cowie in assuming the chair thanked all those who saw fit to elect him to the position and called upon the members for their co-operation.

The new chairman then called upon the members for a vote of thanks for the outgoing chairman and executive in providing the members with an interesting year.

O. A. Evans the retiring secretary thanked the members and executive for their co-operation during his term of office.

The members then retired to an adjoining room where a social evening was enjoyed by all.

# News of Other Societies

**Items of interest regarding activities of other engineering societies or associations**

### PROFESSIONAL ENGINEERS OF ONTARIO ELECT NEW OFFICERS

R. A. Elliott, General Manager, Deloro Smelting & Refining Co. Ltd., Deloro, has been elected president of the Association of Professional Engineers of the Province of Ontario for the year 1943. Always interested in the affairs of the Association, he took an active part in the legislation programme. In 1938, he was elected councillor in the Chemical Branch and since then has been chairman of the Publicity Committee. He was elected vice-president in 1942 and chairman of the Finance Committee.

Following graduation from Queen's University, Mr. Elliott joined the Copper Queen Mining Co. in 1912 at Bisbee, Arizona, going from there to the engineering staff of the International Nickel Co., Copper Cliff. In March 1915, he was appointed Assistant Chemist of the Deloro Smelting & Refining Co. Ltd. and in the same year was made Superintendent of the Cobalt Oxide Plant and General Superintendent of the Plant in 1917. Mr. Elliott was appointed a Director and General Manager of the Company in 1940.

Mr. Elliott is Reeve of the Village of Deloro and is Vice-President and Treasurer of the Deloro Trading Company. He is a member of the Canadian Institute of Mining and Metallurgy, the American Institute of Mining and Metallurgical Engineers, and the American Society for Metals.

M. J. Aykroyd, Outside Plant Engineer of the Bell Telephone Company, Western Area, has been elected vice-president of the Association of Professional Engineers of the Province of Ontario for the year 1943. He was elected by ballot in 1941 to the Council of the Association, Electrical Branch, and is a member of the Finance and Publicity Committees.

Mr. Aykroyd, a graduate of Queen's University, was with the Imperial Ministry of Munitions during the last war in Toronto, New York and later Montreal. After the war he was engaged in commercial work in Canada, the United States and abroad until 1923, when he joined the Chief Engineer's staff of the Bell Telephone Company in Mont-

R. A. Elliott

real. In 1926 he was transferred to London, Ontario, as Division Plant Supervisor, three years later returning to Montreal as Assistant Division Plant Superintendent. With the formation in 1930 of the western area at Toronto he was made General Plant Supervisor of the area. Since 1934, he has been Outside Plant Engineer.

Mr. Aykroyd is a Director of the General Alumni Association of Queen's University and a Vice-President of the Toronto Branch.

Other members of Council for the year 1943 are as follows: *Past-President:* Warren C. Miller, M.E.I.C., City Engineer, St. Thomas.

COUNCILLORS: *Civil Branch:* G. H. Bryson, Street Supt., City of Ottawa, Ottawa. J. Clark Keith, M.E.I.C., General Manager, Windsor Utilities Comm., Windsor. J. L. Lang, M.E.I.C, Lang & Ross, Sault Ste. Marie.

*Chemical Branch:* J. G. Morrow, Metallurgical Engineer, Steel Company of Canada, Hamilton. E. T. Sterne, Chemicals Controller for Canada, Montreal. H. P. Stockwell, Jr., Chemical Engineer, Ottawa Water Purification Plant, Ottawa.

*Electrical Branch:* E. V. Buchanan, M.E.I.C., General Manager, Public Utilities Commission & London Railway Commission, London. Lieut.-Comdr. C. P. Edwards, O.B.E., M.E.I.C., Deputy Minister, Dept. of Transport, Ottawa. J. H. Smith, Engineer, Elec. Construction Sales, Can. General Electric Co. Ltd., Toronto.

*Mechanical Branch:* C. C. Cariss, M.E.I.C., Chief Engineer, Waterous Limited, Brantford. G. Ross Lord, M.E.I.C., Assistant Professor of Mechanical Engineering, University of Toronto, Toronto. R. M. Robertson, Chief Engr., Babcock-Wilcox & Goldie McCulloch Ltd., Galt.

*Mining Branch:* J. Beattie, Manager, Delnite Mines Ltd., Timmins. G. B. Langford, Professor of Mining Geology, University of Toronto, Toronto. D. G. Sinclair, Assistant Deputy Minister, Ontario Dept. of Mines, Parliament Bldgs., Toronto.

# Library Notes

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**Communication Circuits:**
*Lawrence A. Ware and Henry R. Reed. N.Y., John Wiley and Sons, Inc., 1942. 6 x 9 in., $3.50.*

**Quebec. Statistical Year Book:**
*For the year 1941. Published 1942.*

**Bibliography of the Literature Relating to Constitutional Diagrams of Alloys:**
*Compiled by J. L. Haughton. London, The Institute of Metals (1942). (Institute of Metals Monograph and Report Series No. 2). 5½ x 8½ in. 3s 6d.*

**Handbook of Scientific and Technical Societies and Institutions of the United States and Canada:**
*4th ed. Washington, National Research Council, 1942. 6¾ x 10 in.*

**Wells' Manual of Aircraft Materials and Manufacturing Processes:**
*T. A. Wells. N.Y., Harper and Brothers (c. 1942). 7½ x 10 in. $3.50.*

### PROCEEDINGS, TRANSACTIONS

**The Royal Society of Canada:**
*Transactions, Vol. 36, Section 2.*

### REPORTS

**United States Steel Corporation T.N.E.C. Papers:**
*Comprising the pamphlets and charts submitted by United States Steel Corporation to the Temporary National Economic Committee, 1940. 3 vols. Vol. 1—Economic and related studies. Vol. 2—Chart studies. Vol. 3—Basing point method.*

**Carnegie Corporation of New York:**
*Annual report for the year ended September 30, 1942.*

**Social Insurance and Allied Services:**
*Report by Sir William Beveridge. N.Y., MacMillan Co., 1942. 6 x 9¼ in. $1.10.*

**Aerial Bombardment Protection:**
*Harold Everett Wessman and William Allen Rose. N.Y., John Wiley and Sons, Inc., 1942. 6 x 9 in. $4.00.*

**University of Toronto—School of Engineering Research—Bulletin:**
*Lateral support of steel columns and struts by C. R. Young and W. B. Dunbar. Bulletin No. 170, 1942. (Reprinted from the Canadian Journal of Research Vol. 20, August, 1942).*

**Survey of High Obliques:**
*The Canadian Plotter and Crone's Graphical Solution by Captain L. G. Trorey. Reprinted from the Geographical Journal, Vol. C, No. 2, August 1942.*

**Toronto Harbour Commissioners:**
*Annual report for the years 1939, 1940 and 1941.*

**The Asphalt Institute—Construction Specifications:**
*Emergency revisions of the Asphalt Institute Construction specifications, Dec. 3, 1942.*

**Ohio State University—Engineering Experiment Station—Circular:**
*No. 44—Travel and trade in twentieth century Ohio.*

**University of California—Bulletin of the Department of Geological Sciences:**
*Vol. 26, No. 4—Pliocene vertebrates from Big Spring Canyon, South Dakota, No. 5—Fossil vertebrates from the superjacent deposits near Knights Ferry, California.*

**U.S. Bureau of Standards—Building Materials and Structures—Report:**
*BMS92—Fire resistance classifications of building constructions. BMS93—Accumulation of moisture in walls of frame construction during winter exposure.*

**Stratosphere Flying:**
*Including navigation for emergencies by Captain E. Cecil Evans Fox. Vol. 1. Complete astro-navigation. Toronto, The Aeronautical Institute of Canada (c. 1942).*

## BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.**

### A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS

*Prepared by A.S.T.M. Committee D-2; Methods of Testing, Specifications, Definitions, Charts and Tables, October, 1942, American Society for Testing Materials, Phila., Pa. 442 pp., illus., diagrs., 9 x 6 in., paper, $2.25.*

The 1942 report of the committee on petroleum products and lubricants, the standard and tentative methods of test and specifications pertaining to petroleum are brought together in convenient form.

### A.S.T.M. STANDARDS ON TEXTILE MATERIALS

*Prepared by A.S.T.M. Committee D-13 on Textile Materials; Specifications, Tolerances, Methods of Testing, Definitions and Terms. October, 1942, American Society for Testing Materials, Phila., Pa. 408 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.25.*

This pamphlet contains the definitions and terms, methods of testing and specifications for textiles and related materials at present in force. Seventy-three specifications are given, for cotton goods, glass fabrics, jute, rayon, silk and wool. In addition to specifications, the publication contains photomicrographs of the common textile fibers, a yarn number conversion table and other useful information.

### AIRPLANE DESIGN MANUAL

*By F. K. Teichmann. Pitman Publishing Corp., New York and Chicago, 1942. 440* *pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

This volume outlines an orderly form of procedure in design, covering such subjects as preliminary weight estimating, the three view and the balance diagram. In addition, information is given on wing design, fuselage design, power plant, control, instruments, etc., sufficient to enable the beginner to carry out the design of a new machine, and to supplement works on aerodynamics and structures.

**AMERICAN DIESEL ENGINES, Their Operation and Repair**

*By E. F. Goad. Harper & Brothers, New York and London, 1942. 313 pp., illus., diagrs., tables, 9½ x 6 in., cloth, $2.75.*

Intended as an introductory text for vocational classes, this textbook offers an excellent account of the principles of the diesel engine and of its general design and construction, with practical advice on its operation, maintenance and repair. The book is based on long teaching experience.

**CHEMICAL ENGINEERS' MANUAL**

*By D. B. Keyes and A. G. Deem. John Wiley & Sons, New York, 1942. 221 pp., charts, tables, 6½ x 4 in., cloth, $2.50.*

A compact collection of tables and equations constantly used by chemical engineers, presented in a book of convenient pocket size. The equations relate to fluid flow, heat transfer, diffusional operations and separations. The tables include logarithms, integrals, specific heats, thermal conductivities, vapor pressures, safe loads, etc.

**COMMUNICATION CIRCUITS**

*By L. A. Ware and H. R. Reed. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 287 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

The theory of communication circuits is presented as a first course in communication engineering for those training for civilian duties or for service in our armed forces. The basic principles of communication lines and their associated networks are presented, covering the frequency range from voice frequencies through ultra-high frequencies. Special attention is given to ultra-high frequency transmission.

**DAVISON'S KNIT GOODS TRADE**

*52nd Annual, pocket edition, October, 1942. Davison Publishing Co., Ridgewood, New Jersey, 1942. 729 pp., illus., 8 x 5 in., cloth, $5.50; de luxe office ed., $6.50.*

The 1942 edition of this well-known directory follows the pattern of previous issues and provides a complete, up-to-date register of manufacturers of knit goods, arranged geographically and by products. Spinners, dyers, wholesalers, and chain and large retail stores are also listed.

**ENGINEERING DRAWING**

*By L. M. Sahag. Ronald Press Company, New York, 1942. 394 pp., illus., diagrs., charts, tables, 10½ x 6½ in., cloth, $2.75.*

The aim in this text has been to offer a basic course which will be complete and thorough in subject matter, and also closely articulated with industrial standards and practice. The text is divided into three sections of increasing difficulty, fundamental requirements being taught first. A wide selection of problems is included.

**ENGINEERING MECHANICS, a Text-Book for Engineering Students**

*By B. B. Low. Longmans, Green & Co., London, New York, Toronto, 1942. 252 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.50.*

This book is chiefly concerned with kinematics and dynamics, including instantaneous centers, velocity and acceleration diagrams, analysis of cams, motion of rigid bodies in two dimensions, and vibrations of various kinds. A chapter is devoted to dimensions and dynamical similarity. Although complete in itself, the book is intended as a companion volume to D. A. Low's "Applied Mechanics."

**FERROUS PRODUCTION METALLURGY**

*By J. L. Bray. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 457 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth, $4.00.*

An unusually successful attempt to cover the production of iron and steel in a volume of moderate size is provided by this text. The current processes are described in some detail, and the fundamental theories underlying them are presented. Excellent line drawings are used as illustrations. The treatment is thoroughly up to date. Bibliographic references accompany each chapter.

**(The) FLOW OF HEAT IN METALS**

*By J. B. Austin. American Society for Metals, Cleveland, Ohio, 1942. 144 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

Contains five lectures intended to present the basic principles of heat flow in metals in a non-mathematical way. The nature of heat, the factors that affect the thermal conductivity of metals, the basic laws of heat conduction and the flow of heat are discussed. Each lecture has a bibliography.

**FLUSH PRODUCTION, THE EPIC OF OIL IN THE GULF—SOUTHWEST**

*By G. Forbes. University of Oklahoma Press, Norman, Okla., 1942. 253 pp., illus., maps, tables, 8½ x 5½ in., cloth, $2.75.*

A history of the Gulf-Southwest oil field, telling the story from the early days of the nineteenth century to to-day. The discoveries, the era of rapid production, the question of regulation, stock speculation, the natural gas industry, the social and economic effects of the industry are described. A considerable bibliography is given.

**Great Britain. (Ministry of Labour and National Service Welfare Pamphlet No. 5)**

**VENTILATION OF FACTORIES, 4 ed.**

*His Majesty's Stationery Office, London, 1942 reprint. 40 pp., illus., diagrs., charts, tables, 9½ x 6 in., paper, (obtainable from British Library of Information, 30 Rockefeller Plaza, New York, 45c.).*

This pamphlet presents the principles which should be applied to secure satisfactory atmospheric conditions in workrooms, describes the standards in force in England and discusses the ventilating apparatus and methods available.

**Great Britain. Ministry of Works and Planning, Directorate of Constructional Design**

**TIMBER ECONOMY, No. 3 (FITMENTS)**

*His Majesty's Stationery Office, London, 1942, no pagination, diagrs., charts, tables, 13 x 8 in., paper, (obtainable from British Library of Information, 30 Rockefeller Plaza, New York, 30c.).*

This bulletin discusses the economical use of lumber in the construction of shelving, drawers, storage cupboards and bins, work-benches, kitchen fittings and other storage equipment. Dimensioned drawings are given.

**INDUSTRIAL INSPECTION METHODS**

*By L. C. Michelon. Harper & Brothers, New York, and London, 1942. 389 pp., illus., diagrs., charts, tables, 11 x 8 in., cloth, $3.50.*

A course of instruction prepared for use in training junior inspectors for the War Department. The book describes the principles, construction and uses of the various instruments for dimensional control, for testing physical properties and for surface inspection. A chapter on the organization of inspection departments is included.

**(The) MAN BEHIND THE FLIGHT**

*By A. Jordanoff. Harper & Brothers, New York, 1942. 276 pp., illus., diagrs., charts, tables, 10 x 7 in., cloth, $3.50.*

This book presents some information on mechanical drawing, elementary electricity and hydraulics, mechanics and physics, accompanied by a brief outline of airplane history. It is offered as a ground course for aviation mechanics and airmen.

**MARINE PIPE COVERING**

*By W. W. Godwin. Cornell Maritime Press, New York, 1942. 142 pp., illus., diagrs., 7½ x 5 in., cloth, $2.00.*

A practical manual on the materials used for insulating piping and on methods of installing them on ships. Molded, curved and flat block and canvas coverings, and plastic cements are described. There are also chapters on covering boilers, on molded cork coverings and on hair felt and asbestos rope.

**MECHANICAL DRAWING**

*By E. Kenison, and J. McKinney, revised by T. C. Plumridge. American Technical Society, Chicago, Ill., 1943. 330 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $2.00.*

This textbook offers a practical course, adapted for class use or home study.

**(The) MECHANICAL TESTING OF METALS AND ALLOYS**

*By P. F. Foster. 3 ed. Sir Isaac Pitman & Sons, London; Pitman Publishing Corp., New York, 1942. 317 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, 18s. or $5.00.*

Descriptions of modern testing equipment are coupled with its mode of use and combined with the theory underlying current developments in the testing of metals in a very practical way. The book should be useful for reference.

**ORE DEPOSITS AS RELATED TO STRUCTURAL FEATURES**

**Prepared under the direction of the Committee on Processes of Ore Deposition of the Division of Geology and Geography of the National Research Council, Washington, D.C.**

*Edited by W. H. Newhouse. Princeton University Press, Princeton, New Jersey; Humphrey Milford, Oxford University Press, London, 1942. 280 pp., illus., diagrs., charts, tables, maps, 12½ x 9 in., cloth, $6.50.*

Articles describing the relations of structural features and ore occurrence in over seventy important mines and districts are presented in this volume, the first to be devoted to its subject. The contributors include many prominent geologists, and their opinions as to the relative importance of different structural features in localizing ore vary greatly.

**PRINCIPLES OF STRUCTURAL GEOLOGY**

*By C. M. Nevin. 3 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 320 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

The aim of this text for beginners is to discuss the deformations of the earth as simply as possible. The new edition has been thoroughly revised and brought up to date.

**PROCESS PRACTICES IN THE AIRCRAFT INDUSTRY**

*By F. D. Klein, Jr. McGraw-Hill Book Co., New York and London., 1942. 266 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.75.*

The processes, methods and materials currently used in the aircraft industry are discussed in this book, which is intended as a reference and instruction book for workers in that field. The procurement of raw materials, their marking for identification, the metals, fabrics and organic finishes used are listed in full and described briefly. Methods of processing are discussed at some length. A great deal of information is compressed into a small book.

### QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book I—BOILERS

*Compiled by H. C. Dinger. Marine Engineering and Shipping Review (Simmons-Boardman Publishing Co.), New York, 1942. 168 pp., tables, 8 x 5 in., paper, $1.00.*

During the last twelve years the Marine Engineering and Shipping Review has published answers to readers' questions. This booklet contains a collection of those on the operation of marine boilers and on boiler-room equipment, which answer many problems that arise.

### (The) RADIO AMATEUR'S HANDBOOK 20th ed. 1943.

*American Radio Relay League, West Hartford, Conn. 478 pp., illus., diagrs., charts, tables, 9½ x 6½ in., paper, $1.00 in U.S.A.; $1.50 elsewhere; bound, $2.50.*

The new edition of this well-known manual of high-frequency radio communication follows the model of earlier ones, but has been revised and expanded to meet current conditions. A special new feature is a chapter on the War Emergency Radio Service. The book provides a simple, non-mathematical text on the theory, design and operation of radio communication equipment, with full information on the construction of apparatus.

### RADIO TO-DAY, the Present State of Broadcasting. (Geneva Studies, Vol. XII, No. 6, July, 1942)

*By A. Huth. Geneva Research Centre, c/o Graduate Institute of International Studies, 132 rue de Lausanne, Geneva, Switzerland, 1942. 160 pp., tables, 8½ x 5½ in., paper, 1.75 Swiss frs. or $0.40.*

The author first discusses the organization and financing of broadcasting, the method of transmission, the programmes offered and the number of listeners. Following this, he describes the broadcasting available throughout the world, and closes with a brief account of recent developments. The study gives an excellent survey of the whole field, with emphasis upon its permanent problems and the solutions that have been devised.

### ROGERS' INDUSTRIAL CHEMISTRY, 2 Vols.

*Edited by C. C. Furnas. 6 ed. D. Van Nostrand Co., New York, 1942. 1721 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth, $17.00.*

The new edition of this Manual will be welcomed by students and manufacturers. Like its predecessors, it offers rapid surveys, prepared by specialists, of the essential features of the most important branches of chemical industry. Without being encyclopedic, these surveys meet ordinary requirements and are accompanied by references to sources of further information. The result is a valuable reference book.

### SEVEN-PLACE VALUES OF TRIGONOMETRIC FUNCTIONS FOR EVERY THOUSANDTH OF A DEGREE

*Compiled by Dr. J. Peters. D. Van Nostrand Co., New York, 1942. No pagination given, tables, 9½ x 7 in., cloth, $7.50.*

These tables are admirably suited for large scale computations with calculating machines. Tables are provided for sines, cosines, tangents and cotangents. Supplementary tables are given for converting minutes and seconds into decimal parts of degrees, and vice versa, and for converting degrees to time and time to degrees.

### SHIPBUILDING BLUEPRINT READING

*By J. L. Tomlinson. American Technical Society, Chicago, Ill., 1942. 208 pp., (answers, 27 pp. extra), diagrs., blueprints, charts, tables, 11 x 8½ in., stiff paper, spiral binding, $3.00 with answers, $2.75 without answers.*

The information needed by shipyard workers is presented in a practical way, beginning with the basic arithmetical data and covering methods of projection, relation of views, scales, symbols, etc. Typical drawings, with question sheets, are included. The course emphasizes the reading of ship drawings, rather than the making of them.

### STEEL AND TIMBER STRUCTURES

*Compiled by a Staff of Specialists; Editors-in-Chief, G. A. Hool and W. S. Kinne, revised by R. R. Zipprodt and D. M. Griffith. 2 ed. rev. and enl. McGraw-Hill Book Co., New York and London, 1942. 733 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $6.00.*

This book is one of a series of six designed to be a reference work on the design and construction of structures. It deals with steel and timber buildings, roof trusses, short span steel bridges, timber bridges and trestles, steel tanks, chimneys, and discusses detailing, fabricating, erecting and estimating, and materials. The treatment is thorough and detailed. This edition has been thoroughly revised and brought up to date.

### ULTRA-VIOLET LIGHT AND ITS APPLICATIONS

*By H. C. Dake and J. De Ment. Chemical Publishing Co., Brooklyn, N.Y., 1942. 209 pp., illus., 9 x 5½ in., cloth, $3.25.*

Some of the uses to which ultra-violet light has been put in criminology, warfare, advertising, medicine, etc., are briefly described in non-technical language.

### WITHOUT FAME, the Romance of a Profession

*By O. Eisenschiml. Alliance Book Corp., Chicago and New York, 1942. 368 pp., illus., 9½ x 6 in., cloth, $3.50.*

The autobiography of a chemical engineer who came to America as a young man. His career is traced from his first job in a Pittsburgh steel mill to his final success as executive of his own oil plant in Chicago. The story is full of incident, told in interesting fashion.

### CAN OUR CITIES SURVIVE? an ABC of urban problems, their analysis, their solutions, based on the proposals formulated by the C.I.A.M. (Congrès Internationaux d'Architecture Moderne, International Congresses for Modern Architecture)

*By J. L. Sert. Harvard University Press, Cambridge, Mass.; Humphrey Milford, Oxford University Press, London, 1942. 259 pp., illus., diagrs., charts, maps, tables, 12 x 9½ in., cloth, $5.00.*

This important new book on city planning is based upon many years of study and an analysis of thirty-three American and European cities of varied types. The problems of a modern city are approached from both a realistic and a human point of view. The four elementary functions—dwelling, recreation, work and transportation—are examined with reference to the cultural, social and political needs of large groups, and safeguards against repetition of past errors. Diagrams and illustrations are strikingly used to present the subject.

### CHEMISTRY OF ENGINEERING MATERIALS

*By R. B. Leighou, rewritten by the following members of the Chemistry Faculty of the Carnegie Institute of Technology: J. C. Warner (Editor), T. R. Alexander, P. Fugassi, D. S. McKinney, H. Seltz, G. H. Stempel, Jr., and K. K. Stevens. 4th ed., McGraw-Hill Book Co., New York and London, 1942. 645 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

The chemical properties of materials are discussed from the viewpoint of the user, to aid in their intelligent selection and use. This edition has been rewritten by a group of teachers and has been enlarged by new chapters on protective coatings, the shaping of metals, abrasives, glass and organic plastics, and alloys.

### (The) ELECTRICAL FUNDAMENTALS OF COMMUNICATION

*By A. L. Albert. McGraw-Hill Book Co., New York and London, 1942. 554 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

Intended as an elementary text for students of communication engineering, including telegraph, telephone and radio, this book presents the electrical fundamentals upon which these forms are based. The explanations and illustrations used are taken from the communication industry itself, and not from the power industry, as is usually done.

### METEOROLOGY AND AIR NAVIGATION, Air Pilot Training

*By B. A. Shields. 2 ed. McGraw-Hill Book Co., New York and London, 1942. 285 pp., illus., diagrs., charts, maps, tables, 9½ x 6 in., cloth, $2.25.*

This is a revision and expansion of parts three and four of the author's previous book, "Air Pilot Training." It contains a course in meteorology and air navigation which covers these subjects sufficiently to prepare one for the written examinations for a private and commercial pilot's certificate. The information is presented in a simple, non-technical style which calls for no advanced educational equipment.

### MODERN BUILDING INSPECTION

*"The Building Inspector's Handbook," with text by C. N. Dirlam and others, compiled, edited and arranged by R. C. Colling, sponsored by the Pacific Coast Building Officials Conference, Los Angeles, Calif., published by R. C. Colling and Associates, 124 West 4th St., Los Angeles, Calif., 1942. 404 pp., illus., diagrs., charts, tables, blueprints, 9½ x 6 in., cloth, $5.00.*

This is an admirable handbook on the organization and administration of building inspection and on the technical problems that arise in the work. The first section describes the organization and work of an inspection department, the drafting of codes, the forms, fees, reports, etc. Section two is a concise course in structural engineering for the inspector, which includes a chapter on resistance to wind and earthquake forces. The final section deals with legal problems in connection with the enforcement of building codes. Appendixes contain suggested forms of ordinances and procedures, an extensive bibliography and a directory of publications and technical associations.

### N.A.M. HANDBOOK ON WAR PRODUCTION

*Compiled and published by National Association of Manufacturers, Washington, New York, San Francisco, August, 1942. 184 pp., charts, tables, 8½ x 11 in., paper, $1.00.*

This handbook for manufacturers brings together the information needed by those having war contracts or seeking them. How to go after a contract, how to sell to the Government, and the principles of cost determination under Government contracts are explained. The organization and functions of the War Production Board are described in detail, and the functions of the various agencies set forth. The priorities regulations are given in full, and there is a list of priorities orders, forms, etc.

## NATIONAL RESEARCH COUNCIL SERVES WAR DEPARTMENTS (*Continued from page 61*)

Equipment was installed and a staff assembled in the National Research Laboratories for the inspection of gauges used in the production of guns, shells, fuses, bombs and other mechanical items which are now being made in mass production.

Another important activity of the Army which is built on science is chemical warfare. From a small co-operative effort between the National Research Council and the Army, this activity has developed rapidly and is now a highly co-ordinated project operating as a Directorate of the Department of National Defence, but under a Director General who is a civilian scientist on the staff of the National Research Council. Of the active personnel about one-half are civilian scientists and the rest are uniformed officers and men.

Indicators for war gases and chemicals for other war services have been synthesized and studied. The rubber laboratory has investigated for production purposes or improvements, products used by almost every branch of the Armed Forces including surgeons' gloves, ground sheets, gas-mask components, artillery and tank parts, crash and steel helmets. In addition, the laboratory has made numerous acceptance tests on contract deliveries. Recently, much attention has been given to rubber conservation problems and to the study of synthetic rubber processes. Commercial production of fuse-powder charcoal was carried on until recently by the National Research Council; manufacturing has now been turned over to a commercial concern.

Activities in the textile laboratory have been largely in connection with acceptance test work and specifications. Special problems included an investigation of methods to reduce weathering of canvas duck, a study of thermal transmission of blankets, colour analyses of certain types of textile products and work on respirator pads.

Inspections have been made and advice given as to the suitability of a variety of leathers for different military purposes. Examination has been made of numerous dressings and waterproofing compounds for leathers. Tensile strength tests on leathers, and wear-resistance tests, chiefly on composition-sole materials were carried out for the Department of National Defence.

Component parts of certain anti-aircraft protection devices were constructed. Transport sheet resins for military purposes have been tested against specifications; vulcanized fibre identification discs and other objects have been examined, and general consideration has been given to the substitution of plastics for metals in a number of articles and parts related to war materials.

Preservative coatings for use on military vehicles and other equipment for war purposes have been developed. A surprising variety of finishes is required in this field and many of the materials are comparatively new to Canadian industry.

Mention should be made of the establishment of an explosives laboratory to carry out testing required under the Explosives Act and to conduct research on explosives and related compounds. This laboratory is under the joint administration of the National Research Council and the Department of Mines and Resources.

### FOR THE AIR FORCE

Establishment of the new aeronautical laboratories just outside of Ottawa has provided improved facilities for research on the multitude of problems arising from modern trends in aviation. Closest co-operation is maintained between the Royal Canadian Air Force and the Council's laboratories through the Associate Committee on Aeronautical Research, the chairman of which is the Air Member for Aeronautical Engineering, R.C.A.F. Much of the work in progress relates to problems that have been suggested by Air Force authorities in Canada, the United Kingdom or the United States.

Horizontal and vertical wind tunnels enable tests to be made on model aircraft of all kinds to determine their characteristics, good or bad, which are likely to affect their behaviour in flight. These studies are very important in the development of superior fighting machines and in working out all possible safeguards for the flying personnel who use them. In the engine laboratory, dynamometer rooms are provided for the testing of aircraft engines, while in the gasoline and oil laboratory complete equipment is provided for physical and chemical testing of aviation fuels and lubricants. A structures laboratory provides for the fabrication of prototypes of aircraft and for the test of component parts.

Experimental work required in connection with scientific problems under investigation in the National Research laboratories is often carried out co-operatively with the Royal Canadian Air Force Test and Development Establishment which is really a full-scale experimental flying station. In this way it has been possible to correlate in a most effective way the results of laboratory and model experiments with full-scale tests and to bring together on a common project civilian scientists and Service operating personnel.

During the year the Radio Section continued to work on the development of secret radio locator equipment with considerable success. There are already in the hands of the Services numerous different equipments which have been developed in the National Research Laboratories. Some of these have already been used successfully against the enemy.

### FOR WAR INDUSTRIES

Industrial requirements for war materials have created many new problems on which the National Research Council has been invited to lend its assistance.

The Division of Applied Biology has rendered valuable assistance in the fitting of temporary refrigerators on merchant vessels. The successful transport of perishable foodstuffs demands refrigerated shipping space or the conversion of the material to a less perishable form that can be carried in ordinary stowage. This problem is most acute for bacon which goes forward in large volume. The shortage of refrigerated space has also affected other perishable commodities.

Considerable work has been done on the treatment of shell eggs to avoid deterioration during shipment at ordinary temperatures. All export eggs, however, are now shipped in powder form and the work of this group of investigators is now directed towards the development of methods for assessing quality and developing drying processes capable of producing a dried egg material of high quality.

Dehydration of meat, chiefly pork and cured ham, has been studied and an acceptable quality of product has been obtained. Closely related to food studies on products for shipments overseas is the development of containers in which a substitute for tin plate has been used. Packages based primarily on fibre and wax combinations have been found useful. Dehydrated products require packaging in waterproof materials.

The need for magnesium, the lightest of all metals, for example, led to intensive research and resulted in the development of a process well suited to Canadian conditions of production. A plant of ten-tons capacity per day, built by the Department of Munitions and Supply to use this process, is in operation, while plants totalling about 100 tons per day capacity are being built in several centres in the United States.

The shortage of natural rubber, which is so important for military purposes in this age of mechanization, has stimulated research on the possibility of producing rubber from plants that can be grown on the American continent. Synthetic rubbers of various types are being developed and tested, and plants are being established for the production of the more useful types. In this work and in hundreds of other industrial problems the scientists on the staff of the National Research Council are playing an important part.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

January 25th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the March meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

**The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.**

**FOR ADMISSION**

AUBERT—MARCEL A., of Montreal, Que. Born at Montreal, Jan. 24th, 1905; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1928; 1924, dam location, Quebec Streams Commn.; 1925, power line constrn., Southern Canada Power Co.; 1926, Dominion Water & Power Bureau; 1927, road location and timber estimating; 1928, mine engrg., A. Mailhiot, consltg. engr.; 1928-30, asst. engr., new bldg., 1930-35, chief engr., supervising bureau, Univ. of Montreal; 1935-36, bridge designer, Quebec Public Works Dept.; 1936, gen. engrg., F. J. Leduc & Associates; 1936-38, surveying, road location, and constrn., L. Bernardin, C.E.; 1938-39, concrete and gen. civil engrg., Archer & Dufresne, Quebec; 1939-40, bldg. design, roads, L. Bernardin; 1940, road engr., Quebec Roads Dept.; July 1940 to date, gen. civil engrg., Aluminum Co. of Canada, and professor, Montreal Technical School.

References: J.-A. Lalonde, L. Trudel, D. G. Elliot, S. R. Banks, L.-A. Duchastel, E. Prévost.

BLAIS—ROBERT, of Ottawa, Ont. Born at Ottawa, Nov. 18th, 1888; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1912; with Dept. of Public Works, as follows: 1909-12, engrg. student, 1912-21, asst. engr., 1921-36, senior asst. engr., 1936-37, engr., grade 1, 1937-41, engr., grade 2, 1941 to date, suptg. engr., Chief Enginner's Branch.

References: K. M. Cameron, R. deB. Corriveau, F. G. Goodspeed, J.-A. Lalonde J.-E. St-Laurent.

DUNCAN—ALLAN S. E., of Montreal, Que. Born at Toronto, Ont., June 10th, 1917; Educ.: B.Sc. (Chem.), Queen's Univ., 1940; 1939-40 (summers), asst. inspr., airport constrn., Dartmouth, N.S.; 1941 (Jan.-June), chem. control, nitro-cotton mftre.; June 1941 to date, plant mgr., Oxygen Co. of Canada Ltd., Montreal, Que.

References: W. E. Patterson, L. M. Arkley, L. T. Rutledge, D. S. Ellis, A. Jackson.

DUQUETTE—ROLAND R., of 262 Outremont Ave., Outremont, Que. Born at Montreal, Oct. 17th, 1907; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1932; R.P.E. of Que.; 1931-32, with Villeneuve, Bernier & Leblanc, cons. engrs.; 1933, asst., hydraulic lab., Ecole Polytechnique; 1933, with Ricard & Royer, cons. engrs.; 1934, member of firm, Ricard, Royer, Brillon & Duquette, cons. engrs.; 1935-42, partner, deGuise & Duquette, cons. engrs.; 1942 to date, with McDougall & Friedman, Montreal, as supervising engr., at Dominion Arsenal plants.

References: J.-A. Lalonde, H. Gaudefroy, L.-A. Duchastel, L. Trudel.

GARDNER—DONALD, of 540 Charlotte St., Peterborough, Ont. Born at Calgary, Alta., Feb. 20th, 1910; Educ.: B.Sc. (Elec.), Univ. of Alta., 1941; 1941-42, test course, Aug. 1942 to date, student engr., industrial control, Can. Gen. Elec. Co. Ltd., Peterborough, Ont.

References: D. V. Canning, A. L. Malby, W. T. Fanjoy, H. R. Sills, J. Cameron

GARDNER—CYRIL JAMES, of 252 James St. South, Hamilton, Ont. Born at Birmingham, England, Dec. 16th, 1907; Educ.: B. A. McMaster Univ., 1935. M.Sc., London Univ., 1940; 1921-25, ap'tice toolmaker, Turner Tool Mfg. Co., Birmingham, England—1922-25, Central Technical Institute, Birmingham; 1927-31, machinist toolmaker, Hamilton Bridge Co.; 1935-38 with British War Office as follows: 1935-36, dftsman., tools and guages, 1936-37, dftsman in charge drawing office, army ordnance shops, Woolwich Arsenal, and 1937-38, engrg. asst.; 1940-42, Dept. of Munitions & Supply—officer i/c mach. tools section, asst. to chief of divn., mach. tools, guages and plant records, administrative and technical asst. to the director-general of industrial planning branch, also part time asst. to the director general, army engrg. branch; at present, manager of production planning dept., Hamilton Bridge Works, Hamilton, Ont.

References: W. F. Drysdale, H. J. A. Chambers, A. Love, W. B. Nicol, A. W. Sinnamon.

HUNTER—DAVID, of 158 Portage Ave. East, Winnipeg, Man. Born at St. Andrews, Scotland, Jan. 20th, 1908; 1924-25, consltg. engr's. office asst.; 1925-26, house wiring and storekeeper; 1926-27, substation operator, Nipigon system, H.E.P.C. of Ont.; 1927-31, ap'tice elec. machinist, 1929-34, elec. machinist on installn. of elec. equipment in power projects across Canada, and 1934-35, time study man, rate dept., Canadian Westinghouse Co. Ltd.; 1935-36, pumping station operator, City of Hamilton; 1936-41, diagnosing of trouble and making repairs to large elec. apparatus, and at present, sales engr., Canadian Westinghouse House Co. Ltd., Winnipeg, Man.

References: H. L. Briggs, E. E. Orlando, W. L. McFaul.

JANE—ROBERT STEPHEN, of 6 Holmdale Road, Hamsptead, Que. Born at Cornwall, England, Dec. 27th, 1898; Educ.: B.Sc., Univ. of B.C., 1922. M.Sc., 1923, Ph.D., 1925, McGill Univ.; 1919-22 (summers), Topogl. Survey, Dom. Govt.; 1922-24, demonstrator in chemistry, McGill Univ., 1925-27, demonstrator in physics, Sir John Cass Technical Institute, London; 1928-36, chem. engr., research and development work, 1936-42, research and development work and also patent dept., Shawinigan Chemicals Ltd.; at present, director, electro-metallurgical research dept., Shawinigan Water & Power Company, Montreal.

References: J. B. Challies, F. S. Keith, J. A. McCrory, J. Morse, P. S. Gregory.

JANELLE—WALDECK ALEXIS, of 610 Champagneur St., Outremont, Que. Born at St. Philippe de Laprairie, Que., Nov. 7th, 1899; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1924 R.P.E of Que.; 1920-24 (summers), Quebec Streams Commn.; 1927-33, lab. technician, testing and research in pulp and paper lab., Bonaventure Pulp & Paper Co., Chandler, Que., 1936-40, insptg. engr., on road constrn., Prov. of Quebec, Dept. of Mines & Resources, Ottawa; 1940-41, asst. to supervising engr. on constrn. for Allied War Supplies Corp., Montreal; at present, lab. technician, testing and research, concrete lab., Aluminum Co. of Canada, Ltd., Shipshaw, Que.

References: W. H. Norrish, W. F. Campbell, C. Miller, J.-P. Chapleau, J.-A. Lalonde, J.-P. Lalonde, F.-J. Leduc, R. Sauvage.

LANCASTER—WALLIS JOHN, of 1176 St. Mark St., Montreal, Que. Born at Fassette, Que., March 1st, 1909; Educ.: 3 years, maths. and trig., and 1 year structl. design, Montreal Technical Evening School. Special 5 year evening course conducted by V. R. Davies, M.E.I.C., incl. maths., strength of materials, mechanics, thermodynamics, hydraulics; 1924-28, ap'tice in mech. engrg., 1928-32, dftsman (industrial machinery), 1932-36, dftsman (platework and boiler design), Canadian Vickers Ltd.; 1936 to date, designer of power plant equipment for Combustion Engineering Corporation Ltd., Montreal, Que.

References: J. G. Hall, L. H. Birkett, V. R. Davies, P. F. Stokes, R. M. Calvin, G. Agar, R. C. Flitton.

LEY—ALBERT GEORGE, of 4353 Wilson Ave., Montreal, Que. Born at Louisburg, N.S., Oct. 24th, 1905; Educ.: B.Sc. (E.E.), N.S.Tech. Coll., 1930; 1919-22 (summers), ap'tice, machine shop; 1924-27 (summers), fireman, tow boat, 1922-23, chemist, Dominion Iron & Steel Co.; 1929 (summer), electrician's helper; 1930-37 and Nov. 1937 to Feb. 1938, distribution engr., N.S. Light & Power Co.; 1937 (June-Nov.), acting gen. supt., Demerara Electric Company; Feb. 1938 to date, engr., assigned as asst. to supervisor, northern properties, Montreal Engineering Company, Montreal, Que.

References: G. A. Gaherty, G. H. Thompson, J. T. Farmer, D. Stairs, J. B. Hayes.

McKENNA—JOSEPH VICTOR, of 300 Arthur St., Oshawa, Ont. Born at Hamilton, Ont., Jan. 1st, 1916; Educ.: B.A.Sc. (Mech.), Univ. of Toronto, 1942; 1939-40-41 (summers), tool repair Ford Motor Co., locomotive mtce., Algoma Steel Corpn., tool inspection, Otis-Fensom Elevator Co.; at present, Junior layout man and engr., General Motors of Canada, Oshawa, Ont.

References: C. R. Young, R. W. Angus, E. A. Allcut, J. J. Spence, W. J. W. Reid.

MOFFATT—EDWARD HOPKINS, of 4870 Cote des Neiges Road, Montreal, Que. Born at Newcastle, Pa., U.S.A., April 6th, 1894; Educ.: S.B., Harvard Univ., 1920. Extension courses, New York Univ., Toronto, and McGill; 1921-22, dftsman., physics dept., Univ. of Toronto; 1922-37, various jobs, principally radio engrg. (industrial research), bio-physics (vitamin D. and pharmaceuticals), with three years social settlement work; 1937 to date, research engr., i/c research and control labs., aeronautical divn., Canadian Car & Foundry Co. Ltd., Montreal.

References: W. S. Atwood, D. Boyd, E. F. Viberg, H. J. Roast, B. Collitt.

*(Continued on page 110)*

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

MECHANICAL ENGINEER, junior, to act as assistant to engineer in charge of maintenance in one division of plant, or other related work such as mechanical installation. Apply to Box No. 2615-V.

CHEMICAL ENGINEER, supervisor to take care of experimental and development work in connection with alumina plants. Apply to Box No. 2616-V.

MECHANICAL, CIVIL, MINING, METALLURGICAL OR CHEMICAL ENGINEER, for development and control work probably leading to supervisory capacity if required ability is proven in potrooms. Apply to Box No. 2617-V.

ELECTRICAL ENGINEER with at least five years experience. Design and layout (on draughting board at least part of time) of power and lighting for industrial plant. Apply to Box No. 2618-V.

MECHANICAL ENGINEER. Either capable of making mechanical repairs to shovels, tractors, etc., or willing to learn. Apply to Box No. 2619-V.

GEOLOGIST. To undertake exploration for bauxite under supervision of chief geologist. Apply to Box No. 2620-V.

METALLURGICAL ENGINEER. Technical control and development of light alloy casting procedures. Apply to Box No. 2621-V.

### SITUATIONS WANTED

CIVIL ENGINEER, 38, experienced in all types of building construction and in industrial layout work. Wants permanent or temporary position in charge of design or construction. Present location, Montreal. Apply to Box No. 576-W.

ENGINEERING MANAGER, B.A.SC., M.E.I.C., Registered Professional Engineer, Canadian, married, 20 years' thorough experience in industrial management; mechanical and electrical construction and development, production planning, precision manufacturing, very well versed in organization methods. At present in complete charge of an extensive programme now nearing completion by a large company of designers formed in Toronto about a year ago. Really responsible position with well-established company desired. Available immediately. Will go anywhere. Apply to Box No. 2437-W.

## REQUIRED IMMEDIATELY

Chemical, Civil, Electrical,
Mechanical and
Metallurgical Engineers

**DOMESTIC AND FOREIGN ASSIGNMENTS**
**ESSENTIAL WAR WORK**

Apply to Box No. 2622-V
The Employment Service Bureau
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

**TRANSITS, LEVELS** and accessories for rent. Apply to Ralph Kendall, M.E.I.C., 49 Granville Street, Halifax, N.S.

## PRELIMINARY NOTICE *(Continued from page 109)*

NOAKES—FRANK, of Toronto, Ont. Born at Edmonton, Alta., Oct. 13th, 1913; Educ.: B.Sc. (E.E.), Univ. of Alta., 1937. M.S., 1937, Ph.D. (E.E.), 1940, Iowa State College; R.P.E. of Ontario; 1935-36-37 (summers), rodman, Geol. Survey, road constrn., Jasper Banff Highway, survey asst., Dept. of Transport; 1939-40, research asst., engr. experiment station, Ames Iowa; 1940, lecturer in elec. engrg., Univ. of Toronto; 1941 (summer), engr., design office, Ferranti Electric, Toronto; 1942 (summer), engr., National Research Council, Univ. of Toronto; at present, lecturer in elec. engrg., University of Toronto, Toronto, Ont.

References: C. R. Young, R. S. L. Wilson, E. A. Allcut, W. E. Cornish, R. F. Legget.

TYLEE—ARTHUR KELLAM, of 150 Argyle Ave., Ottawa, Ont. Born at Lennoxville, Que., April 24th, 1887; Educ.: B.Sc., Mass. Inst. Tech., 1907; 1907-30 (with exception of 1914-20—R.A.F.), with George T. McLaughlin Company, Boston, Mass., various duties, incl. supt., chief engr. and director in charge of production and engrg., at present supervisor, overhaul and repair divn., aircraft branch, Dept. of Munitions & Supply, Ottawa, Ont.

References: C. D. Howe, E. P. Murphy, K. M. Cameron, D. Stairs, L. C. Jacobs.

WOERMKE—ORVILLE R., of Buckingham, Que. Born at Arnprior, Ont., Oct. 25th, 1916; Educ.: B.Sc. (Chem.), Queen's Univ., 1939; R.P.E. of Que.; 1934-35, lumber mills of Gillies Bros., Braeside, Ont.; 1934 (winter), highway constrn., Dept. Nor. Development; 1939-40, soapmaker, United Chemical Co., Montreal; 1940, instructor, Queen's Univ.; 1940, dftsman., and 1941 to date, plant designing engr., Electric Reduction Co. of Canada Ltd., Buckingham, Que.

References: R. M. Prendergast, A. Jackson, N. Malloch, A. N. Ball.

### FOR TRANSFER FROM JUNIOR

FERRIER—JOHN ALEXANDER, of Renfrew, Ont. Born at Renfrew, May 27, 1909; Educ.: B.Sc., Queen's Univ., 1937; 1935-36 (summers), Ford Motor Co.; 1937-38, Bailey Meter Co.; 1938-40, i/c automatic control equipment, and 1940-42, foundry mtce. and planning, Ford Motor Co.; 1942 to date, base engineer, special branch, R.C.N.V.R., H.M.C. Dockyard, Halifax, N.S. (Jr. 1939).

References: W. Mitchell, J. E. Daubney, B. R. Spencer.

HOOD—GEORGE LESLIE, of 29 Hardy Street, North Bay, Ont. Born at Minnedosa, Man., Apr. 17th, 1910; Educ.: B.Sc. (Elec.), Univ. of Man., 1932; 1934-37, elect'l. mtce., Howey Gold Mine; 1937-38, demonstrator, Univ. of Toronto; 1938 (2 mos.), dftsmn., Toronto Harbour Commission; June 1938 to date, asst. meter and relay engr., H.E.P.C. of Ontario, testing, mtce. and inspection of meter, relay and control equipment. (St. 1930; Jr. 1940).

References: E. P. Fetherstonhaugh, N. M. Hall, H. Robertson, L. G. Scott, S. H. deJong, J. A. Aeberli.

JONES—ARTHUR R., of 5 Anne St., Peterborough, Ont. Born at Wessington, Alta., Sept. 7, 1905; Educ.: B.Sc. (Elec.), Univ. of Alta., 1928; 1928, mine surveying and equipment installn.; 1929, test course, 1930-31, A.C. Engrg., and 1931 to date, asst. to induction motor engr., Canadian General Electric Co., Peterborough, Ont. (Jr. 1930).

References: A. L. Malby, D. V. Canning, V. S. Foster, W. T. Fanjoy, H. R. Sills.

THURSTON—ARTHUR MONROE, of 149 Cornwall Ave., Town of Mount Royal, Que. Born at Toronto, July 7, 1912; Educ.: B. Eng., McGill Univ., 1936; R.P.E. Quebec; 1936-38, student apprentice, 1938-40, engr., Shawinigan Water & Power Co., Montreal; 1940 to date, with Dom. Electric Protection Co. as follows; 1940-42, special products engr., i/c production of aircraft instruments for Dominion Govt., and 1942 to date, plant mgr., responsible for installn. and mtce. of central station apparatus and installns. through Dominion. Also responsible for engrg. office and test lab. staffs, also acting as technical adviser to mfg. dept. and responsible for special products instrument inspection staff. (Jr. 1939).

References: R. E. Heartz, F. S. Keith, G. D. Hulme, J. M. Crawford, G. R. Hale, L.-A. Duchastel, C. F. Christie, R. W. Hamilton, G. E. Templeman.

WHITE—WALTER EDMUND, of 146 Manor Rd. East, Toronto. Born at Stouffville, Ont., Aug. 9, 1905; Educ.: B.A.Sc., 1928, E.E. 1936, M.A.Sc. 1941, Univ. of Toronto; B.Sc. (economics) Univ. of London, England, 1939 (external degree); summers as follows: 1925, Ford Motor Co., Detroit; 1926, Western Electric Co., Chicago, 1927, Western Electric Co., Kearney, Ont.; 1928-29, meter engr. H.E.P.C. of Ontario; 1929-39, development engr., responsible for design of testing equipment, Northern Electric Co. Ltd., Montreal; at present, test engr., radio division, Research Enterprises Ltd., Toronto. (Jr. 1931).

References: H. Miller, W. H. Eastlake, W. C. M. Cropper, N. L. Morgan, A. B. Hunt, C. R. Young.

### FOR TRANSFER FROM STUDENT

BOURBONNAIS—GEORGE VALOIS, of Dorion, Quebec. Born at Quebec City July 11, 1915; Educ.: B.Eng. (Civil), McGill Univ., 1940; 1940-41, asst. camp engr. officer, 1941-42, camp engr. officer, and 1942 to date, 2nd i/c B. Company, 3rd Battalion, R.C.E., Canadian Army Overseas, with rank of Captain. (St. 1938).

References: W. S. Lawrence, E. Brown, R. E. Jamieson, L. Trudel, R. DeL. French.

McARTHUR—DONALD SMITH, of 27 Heney St., Ottawa, Ont. Born at Gilbert Plains, Man., Jan. 14, 1918; Educ.: B.Sc. 1939, M.Sc. 1941, Univ. of Sask.; 1939-40 (summers), supt., Hi-Way Refineries; 1941-43, junior research engr., National Research Council, Ottawa. (St. 1938).

References: J. H. Parkin, C. J. Mackenzie, N. B. Hutcheon, I. M. Fraser.

OLAFSON—MAGNUS JOSEPH, of Park Road P.O., Ontario; born at Leslie, Sask., Dec. 22, 1912; Educ.: B.Sc. (Mech.), Univ. of Sask., 1939; 1939-40, dftsmn., 1940-41, chief dftsmn., Steel Co. of Canada, Hamilton; Jan. 1942 to date, asst. machine tool engr., Modern Tool Works, Toronto. (St. 1939).

References: C. J. Mackenzie, I. M. Fraser, N. B. Hutcheon, R. A. Spencer, W. A. T. Gilmour.

RICHARDSON—GEORGE WILLIAM, of Riverside, Ont. Born at Montreal, July 7, 1914; Educ.: B.Eng., McGill Univ., 1942; 1936-41, apprentice (machinist), C.N.R.; 1942 (May-Nov.), junior research engr., National Research Council; at present, chassis engr., dept. of automotive engrg., Ford Motor Co. of Canada, Windsor, Ont. (St. 1940).

Reference: C. M. McKergow, A. R. Roberts, E. Brown, R. DeL. French.

RING—ALFRED JACKSON, of 8606 Drolet St., Montreal. Born at Fredericton, N.B., July 31, 1913; Educ.: B.Sc. (Civil), Univ. of N.B., 1940; 1937-39, (summers), with Canadian Copper Refineries, Montreal, Currier Constrn. Co., Fredericton, and Geological Survey of Canada; with Defence Industries Ltd. as follows; 1940-41, dftsmn., engrg. dept., Montreal; 1941-42, mtce. engr., Pickering, Ont.; at present foreman, Montreal Works. (St. 1940).

References: A. B. McEwen, C. H. Jackson, M. S. Macgillivray, J. W. LeB. Ross J. Stephens, E. O. Turner, A. F. Baird.

SUTHERLAND—DONALD BOYD, of 57 Atlantic St., Halifax, N.S. Born at Macleod, Atla., May 3, 1913; Educ.: B.Sc., Engrg. Dip., Dalhousie Univ., 1934. Completed 3rd year mining, Queen's Univ., 1939; 1934-35, asst. to engr., assayer, storekeeper, and 1935-38, engr., responsible for underground and surface surveys, direction of development programmes, design of bldgs., etc., Guysborough Mines, Ltd., Goldenville, N.S.; 1938-39, geologist, Ventures Ltd.; 1940-41, geologist, Canadian Malartic Mines; 1941-42, engr., Guysborough Mines Ltd., and Tungsten Mines Ltd., Indian Path, N.S.; also some work on Dom.-Prov. Rehabilitation Project at Fifteen Mile Stream, N.S.; at present Prob. Sub.-Lieut., R C.N.V.R. (St. 1932).

References: W. P. Copp, G. V. Douglas, A. E. Cameron, W. E. Neelands, A. E. Flynn.

ZWEIG—IRVING ISRAEL, of 361 Wilbrod St., Ottawa, Ont. Born at Montreal, Aug. 14, 1916; Educ.: completed 1st year engrg., McGill Univ.; B.Sc., Sir George Williams College, 1942; 1936-38, cost accountant, credit mgr. and asst. in production and plant management, Knit-Craft Mills, Montreal, Que.; 1939-42, clerk, Montreal Engrg. Branch, Marine Service divn. Dept., of Transport (Dom. Govt.), i/c office work under supervn. marine supt. and chief dftsmn.; at present, senior research asst. Divn. of Physics and elect'l engrg , optics section, National Research Council. (St. 1941).

References: R. W. Boyle, J.-E. St. Laurent, R. S. Eadie, R. M. Robertson, J. B. Phillips, E. Brown.

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### MONOFILAMENT NYLON BRUSH BRISTLES

Canadian Industries Limited, Plastics Division, Montreal, Que., have prepared a 15-page bulletin describing the development of "Nylon" and its use in monofilament form for brush bristles. In addition to describing the features of these bristles in different applications, their general physical and chemical properties when used for industrial brushes are tabulated; illustrations show different types of brushes employing "Nylon bristles.

### CENTRIFUGAL PUMPS

Bulletin 41-C, 15 pages, recently issued by Darling Brothers Limited, Montreal, Que., features the "Darling" Class B motor driven centrifugal pump, and contains cross-sectional drawings with descriptions of all principal parts. Steam turbine, V-belt motor and gasoline driven pumps are illustrated and described and in addition to specifications, dimensional and rating tables and other data, a number of typical pump installations are shown.

### LUBRICATING SERVICE EQUIPMENT

"Alemite Service Equipment" is the title of a 48-page catalogue recently issued by Stewart-Warner-Alemite Corp. of Canada Ltd., Belleville, Ont. This catalogue contains innumerable photographs with specifications and other descriptive matter covering the company's extensive line of lubricating equipment. Many new and exclusive features that have been incorporated in these products are shown. These include the "Super De Luxe" high and low pressure, air and hand operated barrel pumps, the "Master" and "Advance" lines of pumps, "Alemiter" cabinets, centre stands, oil bars and departmental service units. Other items include barrel pumps, transfers, loaders, air operated and electric hand and foot operated powerguns and specialized guns and lubrication equipment, etc.

### CARTON STITCHERS

Acme Steel Company of Canada, Ltd., Montreal, Que., have for distribution a 6-page folder describing in detail the various standard and special types of "Silverstitcher" carton stitchers available to shippers of war products. Detailed specifications, numerous illustrations depicting special features and various uses are shown.

### WORKMAN'S WARTIME PLEDGE CARD

Canadian Koebel Diamond Tools Limited, Windsor, Ont., as part of a continuing programme of tool conservation, has just published a Canadian Workman's Wartime Pledge Card, which stresses the theme "When you extend the life of a tool for a single hour or make that tool do better work, you are making a worthwhile contribution to Canadian ideals and to Canada's future." Cards are available to industry in any quantity, free of charge, upon request to the Company.

### WOOD PARTITIONS

An 8-page bulletin being distributed by The Mills Company, Cleveland, Ohio, is fully illustrated with photographs and mechanical drawings, describing a new type of wood partition for offices, cubicles, toilets and factories. These are streamlined in design and are said to be sturdy, rigid and long lasting, and combine the advantages of inter-changeability, movability, etc. All office door sections with frames are inter-changeable with 42" wide panel units and the partitions contain ample wiring connections in their bases, posts and cornices; for toilets, each wood panel is ready to erect being prefabricated from ¾ in., five-ply plywood.



### PLANNING AND SPECIFYING LIGHT

Curtis Lighting of Canada Ltd., Toronto, Ont., have issued an 8-page bulletin in the form of a handbook for the planning and specifying of lighting equipment for war production. It contains complete information covering distribution curves, performance tables, dimensions and details of installation and features particularly the company's "X-Ray" reflectors and fluorescent industrial fixtures with "Fluratex" (non-metallic) reflectors and the Curtis "Tranquilux" twin fluorescent luminaire.

### AUTOMOBILE AND TRUCK SPRINGS

McRobert Spring Service Limited, Montreal, Que., have for distribution a catalogue, with 1942 supplement, which lists replacement springs for every type of automobile and truck. The data it contains is arranged under the name of each type of vehicle, first for fronts and then for rears, giving stock and manufacturers numbers, models of cars, year of manufacture, number of leaves, length of short and long ends, free arch and bushings.

### THE PLASTIC FOR THE TASK

A 4-page bulletin prepared by Duplate Canada Limited, Oshawa, Ont., illustrates and describes the plant facilities and numerous and varied products of this company. It stresses the complete plastic service offered by the company to Canadian manufacturers. It also features the plant of Duplate Tool & Die Limited, a subsidiary company, fully equipped for gauge, jig and fixture making with special equipment for plastic moulds.

### SAFETY CLOTHING AND EQUIPMENT

Catalogue No. 45, 64 pages, of The Safety Clothing & Equipment Company, Cleveland, Ohio, illustrates and describes the Company's extensive line of equipment manufactured for the industrial safety field. Variations of each product, the different materials, sizes and styles in which each is available and its particular uses are included under the following headings; hats and helmets; hoods and masks; aprons; asbestos clothing; fireproofed clothing; rubber clothing; leather clothing; gloves; mittens; leggings; face shields; shoes; safety belts; guards; magnifiers; lamps and lanterns; stretchers and litters; skin protective creams and liquids; fire extinguishers; and miscellaneous safety devices and first aid supplies.

### MACHINE TOOLS

An 8-page bulletin just issued by Jefferson Machine Tools Company, Cincinnati, Ohio, describes this Company's "Bulldog" precision milling machines; milling machine attachments; conversion attachments for lathes; endless belt sanding machines; swing frame grinding and polishing machines and the gyratory foundry riddle for screening, moulding and core sands, also for fine, medium and coarse dry materials. Each piece of equipment is illustrated and fully described.

### REFRACTORY LABORATORY WARE

Norton Company of Canada, Ltd., Hamilton, Ont., have issued a 12-page bulletin which is devoted to the description of various refractory products made from "Alundum"-electrically fused alumina. After describing the source and method of producing the basic product, this bulletin gives the properties of (crystalline) alumina and the properties of "Norton" refractories (Alundum ware). Various shapes are illustrated and tables of stock sizes are included. Among these are crucibles, ignition capsules, melting crucibles, flame collars, filtering devices and combustion boats.

### ARC WELDING TECHNIQUE

A booklet recently issued by The Steel Company of Canada, Ltd., Montreal, Que., and Hamilton, Ont., describes an amazingly simple technique in electric arc welding which eliminates the wastage of electrode stub ends, thus conserving critical materials, saving time and reducing costs.

### MATERIAL HANDLING AND OTHER EQUIPMENT

"Industrial Time and Money Savers" is the title of a 4-page bulletin recently issued by S. A. Armstrong Limited, Toronto, Ont., featuring the "Reco-Barrett" line of lift trucks and portable elevators. The bulletin also contains illustrations and details covering the company's portable cranes, drum storage racks, two-wheel hand trucks, pressure reducing and regulating valves, pull hoists, electric hoists, automatic combustion control equipment and heat exchangers.

### RUBBER STAMPS AND MARKING DEVICES

Dominion Marking Devices Reg'd., Montreal, Que., have prepared a catalogue, 104 pages, which is a comprehensive list of the extensive line of rubber stamps and marking devices handled by this company and included are a great many stamping devices of standard design which have been on the market for years but in which have been incorporated the latest improvements. Among the specialties are various types of time stamps, ticket punchers, lead seals and presses, stencil plates, bronze plates, key tags, and badges of various kinds.

### SPRUE CUTTERS

A 4-page bulletin, No. 320-B, by Canadian Blower & Forge Company, Ltd., Kitchener, Ont., illustrates and gives specifications for the "Buffalo" sprue cutters which are built in single and double end types. The ends can be removed permitting other tools to be used for different work. Frames are electrically welded, gears are cut from solid steel blanks, pinions are nickel steel, shafts are chrome nickel steel and bronze bearings are used throughout. These machines are furnished with an "Alemite" lubrication system and equipped with a 10-h.p. motor giving a flywheel speed of 250 r.p.m. with 32 strokes of plunger per minute.

# PURCHASERS' CLASSIFIED DIRECTORY

## A SELECTED LIST OF EQUIPMENT, APPARATUS AND SUPPLIES

FOR ALPHABETICAL LIST OF ADVERTISERS SEE PAGE 38

A

**Acids:**
Canadian Industries Limited.

**Accumulators, Hydraulic:**
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.
Smart-Turner Machine Co. Ltd.

**Alloy Steels:**
Algoma Steel Corp. Ltd.
The Steel Co. of Canada, Ltd.

**Ammeters and Voltmeters:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
Crompton Parkinson (Canada) Ltd.

**Angles, Steel:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Apparatus Bushings:**
Can. General Electric Co. Ltd.
Canadian Ohio Brass Co. Ltd.

**Asbestos:**
Can. Johns-Manville Co. Ltd.

**Ash Handling Equipment:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
United Steel Corp. Ltd.

**Asphalt:**
Barrett Co. Ltd.
Imperial Oil Ltd.

B

**Ball Mills:**
Canadian Allis-Chalmers Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
Foster Wheeler Ltd.

**Balls, Steel and Bronze:**
Can SKF Co. Ltd.

**Barking Drums:**
Can. Ingersoll-Rand Co. Ltd.
Horton Steel Works Ltd.

**Barometers, Indicating:**
Taylor Instrument Cos. of Cda. Ltd.

**Barrels, Steel:**
Smart-Turner Machine Co. Ltd.

**Bars, Steel and Iron:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
Canadian Car & Foundry Co. Ltd.
The Steel Co. of Canada, Ltd.

**Bearings, Ball and Roller:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Belting, Transmission, Conveyor, Elevator:**
Canadian Allis-Chalmers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Dominion Rubber Co. Ltd.
Gutta Percha & Rubber Ltd.

**Billets, Blooms, Slabs:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Bins:**
Canada Cement Co. Ltd.
Canadian Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.
Horton Steel Works Ltd.

**Blasting Materials:**
Canadian Industries Limited.

**Blowers, Centrifugal:**
Can. Ingersoll-Rand Co. Ltd.
Northern Electric Co. Ltd.
Reavell & Co. (Canada) Ltd.

**Blue Print Machinery:**
Montreal Blue Print Co.

**Boilers:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Vickers Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.
Vulcan Iron Wks. Ltd.

**Boilers, Electric:**
Can. General Elec. Co. Ltd.
Dominion Engineering Co. Ltd.
English Electric Co. of Canada Ltd.

**Boilers, Portable:**
Foster Wheeler Ltd.
United Steel Corp. Ltd.

**Boxes, Cable Junction:**
Northern Electric Co. Ltd.

**Braces, Cross Arm, Steel, Plain or Galvanized:**
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.

**Brackets, Ball Bearings:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Brakes, Air:**
Canadian Controllers Ltd.
Can. Westinghouse Co. Ltd.

**Brakes, Magnetic Clutch:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.

**Bridge-Meggers:**
Northern Electric Co. Ltd.

**Bridges:**
Canada Cement Co. Ltd.
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.

**Bucket Elevators:**
United Steel Corp. Ltd.

**Building Materials:**
Canadian Johns-Manville Co. Ltd.

**Buildings, Steel:**
Canadian Bridge Co. Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.

C

**Cables, Copper and Galvanized:**
Can. General Electric Co. Ltd.
Canadian Telephones & Supplies Ltd.
Northern Electric Co. Ltd.

**Cables, Electric, Bare and Insulated:**
Can. General Elec. Co. Ltd.
Canadian Telephones & Supplies Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Caissons, Barges:**
Canadian Bridge Co. Ltd
Dominion Bridge Co. Ltd.
Horton Steel Works Ltd.

**Cameras:**
Associated Screen News Ltd.

**Capacitors:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Castings, Aluminum:**
Aluminum Co. of Canada Ltd.

**Castings, Brass:**
Canada Metal Co. Ltd.
Dominion Engineering Co. Ltd.
The Superheater Co. Ltd.

**Castings, Iron:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Dominion Engineering Co. Ltd.
Foster Wheeler Ltd.
The Superheater Co. Ltd.
Vulcan Iron Wks. Ltd.

**Castings, Steel:**
Canadian Car & Foundry Co. Ltd.
Vulcan Iron Wks. Ltd.

**Catenary Materials:**
Can. Ohio Brass Co. Ltd.

**Cement Manufacturers:**
Canada Cement Co. Ltd.

**Chains, Silent and Roller:**
Can. Fairbanks-Morse Co. Ltd.
Hamilton Gear & Machine Co.
Lyman Tube & Supply Co. Ltd
United Steel Corp. Ltd.

**Channels:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Chemical Stoneware:**
Doulton & Co. Ltd.

**Chemicals:**
Canadian Industries Limited.

**Chemists:**
Milton Hersey Co. Ltd.

**Chippers, Pneumatic**
Can. Ingersoll-Rand Co. Ltd.

**Circuit Breakers:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd
Northern Electric Co. Ltd.

**Clarifiers, Filter:**
Bepco Canada Ltd.

**Clutches, Ball Bearing Friction:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Clutches, Magnetic:**
Bepco Canada Ltd.
Northern Electric Co. Ltd.

**Coal Handling Equipment:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
United Steel Corp. Ltd.

**Combustion Control Equipment:**
Bailey Meter Co. Ltd.

**Compressors, Air and Gas:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Can. Ingersoll-Rand Co. Ltd.
Reavell & Co. (Canada) Ltd.
Smart-Turner Machine Co. Ltd.
Swiss Electric Co. of Can. Ltd.

**Concrete:**
Canada Cement Co. Ltd.

**Condensers, Surface:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Can. Ingersoll-Rand Co. Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.
Smart-Turner Machine Co. Ltd.

**Condensers, Synchronous and Static:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Conditioning Systems, Air:**
Can. General Electric Co. Ltd.

**Conduit:**
Can. General Elec. Co. Ltd.
Can. Johns-Manville Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.
Phillips Electrical Works Ltd.

**Conduit, Underground Fibre, and Underfloor Duct:**
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.

**Controllers, Electric:**
Amalgamated Electric Corp. Ltd.
Canadian Controllers Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Controllers, Temperature:**
Taylor Instrument Cos. of Cda. Ltd.

**Controls, Thermostatic:**
Taylor Instrument Cos. of Cda. Ltd.

**Conveyor Systems:**
Mathews Conveyer Co. Ltd.
United Steel Corp. Ltd.

**Couplings:**
Dart Union Co. Ltd.
Dresser Mfg. Co. Ltd.
The Steel Co. of Canada, Ltd.

**Couplings, Flexible:**
Canadian Controllers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
Dresser Mfg. Co. Ltd.
Hamilton Gear & Machine Co.
Peacock Bros. Ltd.
United Steel Corp. Ltd.

**Crane Girders:**
Canadian Bridge Co. Ltd.

**Cranes, Hand and Power:**
Canadian Bridge Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.
Herbert Morris Crane & Hoist Co. Ltd.

**Cranes, Shovel, Gasoline Crawler, Pillar:**
Canadian Vickers Ltd.

**Crowbars:**
B. J. Coghlin Co. Ltd

**Crushers, Coal and Stone:**
Canadian Allis-Chalmers Ltd.
Can. Ingersoll-Rand Co. Ltd.

**Culverts, Corrugated:**
Canada Ingot Iron Co. Ltd.
Pedlar People Ltd.

D

**Dimmers:**
Northern Electric Co. Ltd.

**Disposal Plants, Sewage:**
United Steel Corp. Ltd.

**Ditchers:**
Dominion Hoist & Shovel Co. Ltd.

**Drawing Pencils:**
Dixon Pencil Co. Ltd.
Eagle Pencil Co. of Canada, Ltd.
Eberhard Faber Pencil Co. Canada, Ltd.
Venus Pencil Co., Ltd.

**Drills, Pneumatic:**
Can. Ingersoll-Rand Co. Ltd.

**Dynamite:**
Canadian Industries Limited.

E

**Economizers, Fuel:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Ltd.
Peacock Bros. Ltd.

**Elbows:**
Dart Union Co. Ltd.

**Electric Blasting Caps:**
Canadian Industries Limited.

**Electric Railway Car Couplers:**
Can. Ohio Brass Co. Ltd.

**Electrical Supplies:**
Can. General Elec. Co. Ltd.
Can. Ohio Brass Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Electrification Materials, Steam Road:**
Can. Ohio Brass Co. Ltd.

**Engines, Diesel and Semi-Diesel:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
English Electric Co. of Canada Ltd.
Ruston & Hornsby Ltd.

**Engines, Gas and Oil:**
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
English Electric Co. of Canada Ltd.

**Engines, Steam:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Vickers Ltd.

**Evaporators:**
Foster Wheeler Ltd.
Peacock Bros. Ltd.
United Steel Corp. Ltd.

**Expansion Joints:**
Dresser Mfg. Co. Ltd.
Foster Wheeler Ltd.

**Explosives:**
Canadian Industries Limited.

F

**Feed Water Heaters, Locomotive:**
The Superheater Co. Ltd.

**Finishes:**
Canadian Industries Limited.

**Fire Alarm Apparatus:**
Northern Electric Co. Ltd.

**Floodlights:**
Amalgamated Electric Corp. Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Flooring, Industrial:**
Canadian Johns-Manville Co. Ltd.

**Floor Stands:**
Jenkins Bros. Ltd.

**Flooring, Rubber:**
Dominion Rubber Co. Ltd.

**Floors:**
Canada Cement Co. Ltd.

**Foil, Aluminum:**
Aluminum Co. of Canada Ltd.

**Forcite:**
Canadian Industries Limited.

**Forgings:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Foundations:**
Canada Cement Co. Ltd.

G

**Gaskets, Asbestos, Fibrous, Metallic, Rubber:**
Anchor Packing Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Johns-Manville Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Robb, Joseph, & Co. Ltd.

**Gasoline Recovery Systems:**
Foster Wheeler Ltd.

## Purchasers' Classified Directory

**Gates, Hydraulic Regulating:**
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
**Gauges, Draft:**
Bailey Meter Co. Ltd.
Bristol Co. of Can. Ltd.
**Gear Reductions:**
Dominion Engineering Co. Ltd.
Hamilton Gear & Machine Co.
Peacock Bros. Ltd.
United Steel Corp. Ltd.
**Gears:**
Dominion Bridge Co. Ltd.
Dominion Engineering Co. Ltd.
Hamilton Gear & Machine Co.
United Steel Corp. Ltd.
**Generators:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.
**Governors, Pump:**
Bailey Meter Co. Ltd.
Peacock Bros. Ltd.
**Governors, Turbine:**
Canadian Allis-Chalmers Ltd.
Dominion Engineering Co. Ltd.
**Gratings:**
Canada Ingot Iron Co. Ltd.
Dominion Bridge Co. Ltd.

**H**

**Hangers, Ball and Roller Bearing:**
Can. Fairbanks-Morse Co. Ltd.
Can. SKF Co. Ltd.
United Steel Corp. Ltd.
**Headlights, Electric Railway:**
Can. General Elec. Co. Ltd.
Can. Ohio Brass Co. Ltd.
Can. Westinghouse Co. Ltd.
**Heat Exchange Equipment:**
Foster Wheeler Ltd.
Horton Steel Works Ltd.
United Steel Corp. Ltd.
**Heaters, Convection:**
Chatham Malleable & Steel Products Ltd.
**Heaters, Unit:**
Chatham Malleable & Steel Products Ltd.
**Hoists, Air, Steam and Electric:**
Can. Ingersoll-Rand Co. Ltd.
Canadian Vickers Ltd.
Mathews Conveyer Co. Ltd.
United Steel Corp. Ltd.
**Hose, Rubber:**
Dominion Rubber Co. Ltd.

**I**

**Indicator Posts:**
Jenkins Bros. Ltd.
**Industrial Electric Control:**
Canadian Controllers Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.
**Injectors, Locomotive, Exhaust Steam:**
The Superheater Co. Ltd.
**Inspection of Materials:**
Milton Hersey Co. Ltd.
**Instruments, Electric:**
Bepco Canada Ltd.
Bristol Co. of Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.
**Insulating Materials:**
Can. General Electric Co. Ltd.
Canadian Industries Limited.
Can. Johns-Manville Co Ltd.
Spun Rock Wools Ltd.
**Insulators, Porcelain:**
Can. General Electric Co. Ltd.
Can. Ohio Brass Co. Ltd.
Northern Electric Co. Ltd.
**Intercoolers:**
Foster Wheeler Ltd.

**J**

**Journal Bearings and Boxes, Railway:**
Can. SKF Co. Ltd.

**L**

**Lacquers:**
Canadian Industries Limited.
**Lantern Slides:**
Associated Screen News Ltd.
**Leading Wire:**
Canadian Industries Limited.
**Library Films:**
Associated Screen News Ltd.
**Lighting Equipment, Industrial and Street:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.
**Lightning Arresters:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.
**Line Materials:**
Can. General Electric Co. Ltd.
Can. Ohio Brass Co. Ltd.
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.
**Liners and Linings, Rubber:**
Dominion Rubber Co. Ltd.
**Linings, Brake and Clutch:**
Atlas Asbestos Co. Ltd.
Ferodo Limited.
J. C. McLaren Belting Co. Ltd.
**Locomotives, Electric:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co. of Canada Ltd.
**Lubricants:**
Imperial Oil Ltd.

**M**

**Machinery, Hydraulic:**
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.
**Magnetic Separators:**
Bepco Canada Ltd.
Northern Electric Co. Ltd.
Peacock Bros. Ltd.
**Material Handling Equipment:**
Can. Fairbanks-Morse Co. Ltd.
Mathews Conveyer Co. Ltd.
United Steel Corp. Ltd.
**Mats and Matting, Rubber:**
Dominion Rubber Co. Ltd.
**Meters, Boiler and Coal:**
Bailey Meter Co. Ltd.
Peacock Bros. Ltd.
**Meters, Electric:**
Bristol Co. of Can. Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.
**Meters, Flow:**
Bailey Meter Co. Ltd.
Bristol Co. of Canada Ltd
Neptune Meters Ltd.
Peacock Bros. Ltd.
**Meters, Liquid (Hot or Cold):**
Bailey Meter Co. Ltd.
Bristol Co. of Canada Ltd.
Neptune Meters Ltd.
Peacock Bros. Ltd.
**Mine Cars:**
Canadian Vickers Ltd.
**Mining Machinery:**
Canadian Allis-Chalmers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
United Steel Corp. Ltd.
**Motion Pictures:**
Associated Screen News Ltd.
**Motors, Electric:**
Bepco Canada Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.
Swiss Electric Co. of Can. Ltd.
**Moulded Goods, Rubber and Asbestos:**
Can. Johns-Manville Co. Ltd.
Dominion Rubber Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Gutta Percha & Rubber Ltd.

**O**

**Oil Burning Equipment:**
Bethlehem Steel Export Corp.
Peacock Bros. Ltd.
**Oil Refining Equipment:**
Foster Wheeler Limited.
Horton Steel Works Ltd.
United Steel Corp. Ltd.
**Ornamental Iron:**
Vulcan Iron Wks. Ltd.

**P**

**Packings, Asbestos, Cotton and Flax, Metal, Rubber:**
Anchor Packing Co. Ltd.
Atlas Asbestos Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Johns-Manville Co. Ltd.
Dominion Rubber Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Gutta Percha & Rubber Ltd.
Robb, Joseph, & Co. Ltd.
**Paints, all purposes:**
Canadian Industries Limited.
**Paving Materials:**
Barrett Co. Ltd.
**Pencils:**
Dixon Pencil Co. Ltd.
Eagle Pencil Co. of Canada Ltd.
Eberhard Faber Pencil Co. Canada Ltd
Venus Pencil Co. Ltd.

## Purchasers' Classified Directory

**Penstocks:**
Canadian Allis-Chalmers Ltd.
Canadian Vickers Ltd.
Hamilton Bridge Co. Ltd.
Horton Steel Works Ltd.

**Photographs, Commercial and Portrait:**
Associated Screen News Ltd.

**Piling, Steel Sheet:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.

**Pillow Blocks, Plain, Ball and Roller Bearing:**
Can. Fairbanks-Morse Co. Ltd.
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Pinions:**
Dominion Engineering Co. Ltd.
Hamilton Gear & Machine Co.
United Steel Corp. Ltd.

**Pipe, Clay, Vitrified:**
Alberta Clay Products Co. Ltd.
Clayburn Co. Ltd.
National Sewer Pipe Co. Ltd.
Standard Clay Products Ltd.

**Pipe, Iron, Corrugated:**
Canada Ingot Iron Co. Ltd.
Pedlar People Ltd.

**Pipe, Steel:**
Horton Steel Works Ltd.
The Steel Co. of Canada, Ltd.

**Pipe Coils:**
The Superheater Co. Ltd.

**Pipe Couplings and Nipples:**
Dart Union Co. Ltd.
The Steel Co. of Canada, Ltd.

**Plates, Steel:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Pneumatic Tools:**
Can. Ingersoll-Rand Co. Ltd.

**Pole Line Hardware:**
Can. General Electric Co. Ltd.
Can. Ohio Brass Co. Ltd.
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.

**Polishes:**
Canadian Industries Limited.

**Powder, Black and Sporting:**
Canadian Industries Limited.

**Power Switchboards:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Preheaters, Air:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.

**Presses, Hydraulic:**
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.
United Steel Corp. Ltd.

**Projectors:**
Associated Screen News Ltd.

**Pulleys:**
United Steel Corp. Ltd.

**Pulleys, Ball Bearings, Loose:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Pulleys, Magnetic:**
Bepco Canada Ltd.

**Pulp and Paper Mill Machinery:**
Can. General Elec. Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Can. Westinghouse Co. Ltd.
Dominion Engineering Co. Ltd.
Canadian Vickers Ltd.
English Electric Co. of Canada Ltd.
Hydraulic Machinery Co. Ltd.
United Steel Corp. Ltd.

**Pulverized Fuel Systems:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Bethlehem Steel Export Corp.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.

**Pump Valves, Rubber:**
Garlock Packing Co. of Can. Ltd.

**Pumps:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Bepco Canada Ltd.
Canadian Allis-Chalmers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Dominion Engineering Co. Ltd.
Canadian Vickers Ltd.
Foster Wheeler Ltd.
Hydraulic Machinery Co. Ltd.
Northern Electric Co. Ltd.
Smart-Turner Machine Co. Ltd.

**Pyrometers, Electric, Indicating:**
Taylor Instrument Cos. of Cda. Ltd.

R

**Radiator Air Vents and Traps:**
Jenkins Bros. Ltd.

**Radiator Valves:**
Can. Ohio Brass Co. Ltd.
Jenkins Bros. Ltd.

**Radio Masts:**
Canadian Bridge Co. Ltd.

**Radio Receiving Sets:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Rail Bonds:**
Can. Ohio Brass Co. Ltd.

**Rail Braces and Joints:**
B. J. Coghlin Co. Ltd.

**Rails and Rail Fastenings:**
Algoma Steel Corp. Ltd.
The Steel Co. of Canada, Ltd.

**Railway Equipment:**
Can. General Elec. Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Can. Ohio Brass Co. Ltd.
English Electric Co. of Canada Ltd.
Hydraulic Machinery Co. Ltd.

**Receivers, Air:**
Can. Ingersoll-Rand Co. Ltd.
Horton Steel Works Ltd.

**Recorders:**
Bailey Meter Co. Ltd.
Bristol Co. of Can. Ltd.
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.
Peacock Bros. Ltd.

**Refractories:**
Atlas Asbestos Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Canadian Johns-Manville Co. Ltd.
Canadian Refractories Ltd.

**Refrigerating Machinery:**
Can. General Electric Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.

**Regulators, Feed Water:**
Bailey Meter Co. Ltd.
Peacock Bros. Ltd.

**Regulators, Temperature, Time-Vacuum:**
Taylor Instrument Cos. of Cda. Ltd.

**Reinforcing Bars:**
Algoma Steel Corp. Ltd.
The Steel Co. of Canada, Ltd.

**Reservoirs:**
Canada Cement Co. Ltd.
Horton Steel Works Ltd.

**Riveted Pipe:**
Dominion Bridge Co. Ltd.
Horton Steel Works Ltd.

**Roads:**
Canada Cement Co. Ltd.

**Road Machinery:**
Can. Fairbanks-Morse Co. Ltd.
United Steel Corp. Ltd.

**Rock Wool:**
Canadian Johns-Manville Co. Ltd.
Spun Rock Wools Ltd.

**Rods:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Roll Covers, Paper Mill:**
Dominion Rubber Co. Ltd.

**Rollers, Inking:**
Dominion Rubber Co. Ltd.
Gutta Percha & Rubber Ltd.

**Rolls, Paper Machine:**
Dominion Engineering Co. Ltd.

**Roofing Materials:**
Barrett Co. Ltd.
Canadian Johns-Manville Co. Ltd.

**Roofing, Prepared:**
Barrett Co. Ltd.

**Roofs, Built-up:**
Barrett Co. Ltd.

**Rope, Wire:**
Dom. Wire Rope & Cable Co. Ltd.

**Rubber Liners and Linings:**
Dominion Rubber Co. Ltd.
Gutta Percha & Rubber Ltd.

S

**Scales:**
Can. Fairbanks-Morse Co. Ltd.
Peacock Bros. Ltd.

**Screening Equipment:**
Canadian Allis-Chalmers Ltd.
Can. Ingersoll-Rand Co. Ltd.
Foster Wheeler Ltd.
United Steel Corp. Ltd.

**Separators, Electric:**
Northern Electric Co. Ltd.

**Sewers:**
Canada Cement Co. Ltd.

**Sheets, Aluminum:**
Aluminum Co. of Canada Ltd.

**Shingles, Prepared Asphalt:**
Barrett Co. Ltd.

**Shovels — Powered, Electric or Gasoline:**
Canadian Vickers Ltd.

## Department of Labour
## National War Labour Board
## GENERAL ORDER

The Dominion Bureau of Statistics has found that the cost of living index number for January 2, 1943, is 117.1 (adjusted index 116.2) as compared with the cost of living index number for July 2, 1942, of 117.9 (adjusted index 117).

The Wartime Wages Control Order, P. C. 5963, provides in Section 48 (iv):

> "the amount of the bonus shall not be changed unless the cost of living index number has changed one whole point or more since the last general order of the Board requiring an increase or decrease in the amount thereof."

The index number not having changed by one whole point or more since July 2, 1942, pursuant to the provisions of P. C. 5963 as stated, the National War Labour Board orders that the terms of its General Order dated August 4, 1942, shall continue to apply for the period February 15, 1943, to May 15, 1943, subject to the right of employers or employees to apply to a War Labour Board for authorization of payment of such an amount of cost of living bonus as a Board may determine to be "fair and reasonable," under the provisions of the Order.

HUMPHREY MITCHELL
Chairman, National War Labour Board

Ottawa, Canada
February 4, 1943

## Purchasers' Classified Directory

**Smokestacks:**
Canada Cement Co. Ltd.
Canadian Vickers Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.

**Sporting Powder:**
Canadian Industrial Limited.

**Springs — Automobile, Railway, Wire:**
B. J. Coghlin Co. Ltd.

**Stains:**
Canadian Industries Limited.

**Steam Plant Equipment:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Allis-Chalmers Ltd.
Combustion Engineering Corp. Ltd.
English Electric Co. of Canada Ltd.
Foster Wheeler Limited.
Harland Eng. Co. of Can. Ltd.

**Steel Flooring:**
Canada Ingot Iron Co. Ltd.

**Steel Plate Construction:**
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.
United Steel Corp. Ltd.

**Steel Steps:**
Canada Ingot Iron Co. Ltd.

**Stokers:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.

**Stoneware, Chemical:**
Doulton & Co. Ltd.

**Structural Iron and Steel:**
Algoma Steel Corp. Ltd.
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.
United Steel Corp. Ltd.
Vulcan Iron Works Ltd.

**Superheaters:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Foster Wheeler Limited.
The Superheater Co. Ltd.

**Switchboards, Power Lighting:**
Amalgamated Electric Corp. Ltd.
Bepco Canada Ltd.
Canadian Controllers Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

T

**Tanks:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canada Cement Co. Ltd.
Canada Ingot Iron Co. Ltd.
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.
Vulcan Iron Wks, Ltd.

**Tees:**
Dart Union Co. Ltd.
Horton Steel Works Ltd.

**Telegraph Line Material:**
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.

**Thermometers, Indicating, Recording:**
Taylor Instrument Cos. of Cda. Ltd.

**Thermometers, Recording:**
Bailey Meter Co. Ltd.
Bristol Co. of Can. Ltd.
Peacock Bros. Ltd.

**Tiles:**
Canada Cement Co. Ltd.

**Tinplate:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd

**Towers, Cooling, Fractionating:**
Foster Wheeler Limited.
Horton Steel Works Ltd.

**Track Tools:**
B. J. Coghlin Co. Ltd.

**Transformers, Instrument Testing, Distribution:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Transformers, Lighting and Power:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Transmission Poles and Towers:**
Canadian Bridge Co. Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.

**Trolley Materials:**
Can. Ohio Brass Co. Ltd.

**Tubes, Aluminum:**
Aluminum Co. of Canada Ltd.

**Tubes, Boiler, Lapwelded, Steel and Iron:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Vickers Ltd.

**Tubes, Rubber, Ventilating**
Dominion Rubber Co. Ltd.

**Tubes, Steel, Electrically Welded:**
Standard Tube Co. Ltd.

**Turbines, Hydraulic:**
Canadian Allis-Chalmers Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
English Electric Co. of Canada Ltd.

**Turbines, Steam:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
English Electric Co. of Canada Ltd.
Harland Eng. Co. of Can. Ltd.
Swiss Electric Co. of Can. Ltd.

**Turbo-Generators:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co of Canada Ltd.
Northern Electric Co. Ltd.
Swiss Electric Co. of Can. Ltd.

**Turntables:**
Canadian Bridge Co. Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.

U

**Unions**
Dart Union Co. Ltd.

V

**Valve Controls:**
Northern Electric Co. Ltd.

**Valve Discs, Rubber:**
Dominion Rubber Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Jenkins Bros. Ltd.

**Valves:**
Can. Fairbanks-Morse Co. Ltd.
Can. Ohio Brass Co. Ltd.
Crane Limited
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.
Jenkins Bros. Ltd.
Peacock Bros. Ltd.
Smart-Turner Machine Co. Ltd.

**Valves, Diaphragm:**
Taylor Instrument Cos. of Cda. Ltd.

**Valves, Relief:**
Crane Limited
Neptune Meters Ltd.
Smart-Turner Machine Co. Ltd.

**Varnishes:**
Canadian Industries Limited.

**Ventube:**
Canadian Industries Limited.

W

**Washers, Air:**
Can. Ingersoll-Rand Co., Ltd.

**Water Cooled Furnaces:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.

**Welding Machines, Electric and Accessories:**
Can. General Elec. Co. Ltd.
Can. Ohio Brass Co. Ltd
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.

**Wheels, Fly and Gear:**
Hamilton Gear & Machine Co.
United Steel Corp. Ltd.

**Winches, Stop-log and Headgate:**
Canadian Vickers Ltd.
United Steel Corp. Ltd.

**Wire:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Wire, Electric, Bare and Insulated:**
Can. General Elec. Co. Ltd.
Northern Electric Co. Ltd.
Phillips Electrical Works Ltd.

**Wire Rope:**
Dom. Wire Rope & Cable Co. Ltd.

**Wire Springs:**
B. J. Coghlin Co. Ltd.

**Wood Preserving:**
Osmose Wood Preserving Co. of Canada Ltd.

**Worm Gears:**
Hamilton Gear & Machine Co.
Peacock Bros. Ltd.
United Steel Corp. Ltd.

## INDEX TO ADVERTISERS

## PROFESSIONAL CARDS

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, MARCH 1943 | NUMBER 3

"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."

★ ★ ★

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.



# CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont.
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont
*G. McL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que.

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que.

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PAPERS**
L. F. GRANT, *Chairman*

**PUBLICATION**
J. A. LALONDE, *Chairman*

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
A. C. D. BLANCHARD
T. H. JENKINS
V. A. McKILLOP

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
J. B. deHART
A. O. DUFRESNE
A. E. MacRAE

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**STUDENTS' AND JUNIORS' PRIZES**
**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. Murdoch, *Chairman*

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
L. GAGNON
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
G. McL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
A. M. REID
W. J. W. REID

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. McL. PITTS
P. M. SAUDER
D. C. TENNANT

# THE ENGINEERING JOURNAL

**VOLUME 26** | **MARCH 1943** | **NUMBER 3**

**"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."**

## *MESSAGE FROM THE NEW PRESIDENT*

YOU HAVE conferred on me one of the greatest honours that can come to a Canadian engineer, and I am deeply conscious not only of the honour but of the trust you have placed in me. The honour and trust I feel I share with my colleagues in the Government service.

Every emphasis has been placed on the weight of the Institute and its membership being wholeheartedly, unreservedly and unselfishly devoted to the one objective, to win this war. From Lieutenant-General A. G. L. McNaughton, the able and inspirational commander of the Canadian Army, down through all the ranks of the profession in civilian as well as in service life, the evidence that this task has been accepted by all is unquestionable. The engineering profession in Canada has every reason to be proud of its accomplishments. It is determined to relax no effort. It is firm in its resolve to maintain its contribution. It is unalterably determined to exceed all past performance.

We entered this last year of Institution activities under circumstances which called for an all-out and united effort. That effort was put forth. We now begin to see the effect and are inspired to put forth those supreme exertions which will advance and assure the day of final victory. There must be no let up.

If we wish to retain our self-respect, if we expect from our fellow citizens respect for our profession, if we are to keep faith with our colleagues on active service, we can do no other.

With this determination, and with faith in final victory, we face the great task which lies ahead. In peace, as in war, the engineer's job is never done. The fruits of his ingenuity, developed for the betterment of mankind, have been diverted into the abominable ways of the Nazi ideology. However, with the indomitable spirit of the free peoples of the world, they will be turned on the aggressor, and they will destroy him. Together, they will assure continued peace.

Always in the forefront of man's advancement, the engineering profession must take its place in preparing the way for that better world security, which will ensure enduring peace and prosperity, with freedom. The end must be kept steadily in mind. No opportunity to advance must be missed, no delay tolerated. We must keep faith with those who place their trust in us. There must be no relaxation.

To these tasks the Engineering Institute and its members are pledged. They are conscious of their responsibilities and will discharge them with all honour. We go forward into the future with heads high, and enthusiasm undimmed.

*President.*

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville, Ont.

**CALGARY**
*Chairman,* H. J. McEWEN
*Vice-Chair.,* J. G. MacGREGOR
*Executive,* J. N. FORD, A. GRIFFIN, H. B. SHERMAN
*(Ex-Officio),* G. P. F. BOESE, S. G. COULTIS, J. B. deHART, P. F. PEELE
*Sec.-Treas.,* K. W. MITCHELL, 803—17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* D. HUTCHISON
*Vice-Chair.,* C. W. CARRY
*Executive,* B. W. PITFIELD, E. R. T. SKARIN, J. A. ALLAN, E. ROBERTSON, J. W. JUDGE
*(Ex-Officio),* E. NELSON, R. M. HARDY
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B. STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE, S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON, R. J. G. SCHOFIELD, NORMAN EAGER, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, STANLEY SHUPE, A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN, 427 Concession Street, Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN, J. R. CARTER, J. D. LEE
*(Ex-Officio),* T. A. McGINNIS, L. F. GRANT, A. JACKSON
*Sec. Treas.,* R. A. LOW, Dept. of Civil Engineering, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* MISS E. M. G. MacGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL, R. B. CHANDLER, S. E. FLOOK, O. J. KOREEN, S. T. McCAVOUR, W. H. SMALL, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER, H. G. O'LEARY
*Sec. Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* F. T. JULIAN
*Vice-Chair.,* T. L. McMANAMNA
*Executive,* F. C. BALL, V. A. McKILLOP, H. F. BENNETT, A. L. FURANNA, R. S. CHARLES
*(Ex-Officio),* R. W. GARRETT, J. A. VANCE
*Sec.-Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* H. J. CRUDGE
*Vice-Chair.,* J. A. GODFREY
*Executive,* A. S. DONALD, E. R. EVANS, E. B. MARTIN, H. W. HOLE, G. C. TORRENS
*(Ex-Officio),* F. O. CONDON, G. L. DICKSON
*Sec. Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R., Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE, R. C. FLITTON, G. D. HULME, G. E. GELINAS, K. G. CAMERON, G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD, J. E. ARMSTRONG, R. E. HEARTZ, W. G. HUNT, J. A. LALONDE, G. McL. PITTS, E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* C. G. CLINE
*Vice-Chair.,* G. E. GRIFFITHS
*Executive,* A. G. HERR, R. T. SAWLE, G. F. VOLLMER, W. D. BRACKEN, J. W. BROOKS, J. H. TUCK, D. S. SCRYMGEOUR
*(Ex-Officio),* A. L. McPHAIL, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 1870 Ferry Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY, G. A. LINDSAY, R. YUILL, W. H. B. BEVAN, J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY, K. M. CAMERON, N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON, Dept. of Mines & Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* D. J. EMERY
*Executive,* C. R. WHITTEMORE, F. R. POPE, I. F. McRAE, R. L. DOBBIN, A. J. GIRDWOOD
*(Ex-Officio),* J. CAMERON, H. R. SILLS
*Sec.-Treas.,* A. R. JONES, 5, Anne Street, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldgs., Quebec, Que.

**SAGUENAY**
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER, J. FRISCH, B. BAUMAN, G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS, N. F. McCAGHEY, J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, P.O. Box 33, Arvida, Que.

**SAINT JOHN**
*Chairman,* D. R. SMITH
*Vice-Chair.,* A. O. WOLFF
*Executive,* H. P. LINGLEY, C. D. McALLISTER, C. C. KIRBY
*(Ex-Officio),* F. A. PATRIQUEN, V. S. CHESNUT, J. P. MOONEY, G. G. MURDOCH
*Sec.-Treas.,* G. W. GRIFFIN, P.O. Box 220, Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* VIGGO JEPSEN
*Vice-Chair.,* J. H. FREGEAU
*Executive,* E. BUTLER, R. D. PACKARD, A. C. ABBOTT, R. DORION, H. J. WARD, E. T. BUCHANAN, J. JOYAL, H. G. TIMMIS
*(Ex-Officio),* A. H. HEATLEY, H. J. WARD
*Acting Sec.-Treas.,* VIGGO JEPSEN, Consolidated Paper Corporation, Grand'Mère, Que.

**SASKATCHEWAN**
*Chairman,* A. P. LINTON
*Vice-Chair.,* A. M. MACGILLIVRAY
*Executive,* F. C. DEMPSEY, N B. HUTCHEON, J. G. SCHAEFFER, R. W. JICKLING, H. R. MacKENZIE, B. RUSSELL
*(Ex-Officio),* A. M. MACGILLIVRAY
*Sec.-Treas.,* STEWART YOUNG, P. O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK, C. R. MURDOCK, G. W. MacLEOD, K. G. ROSS, H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG, A. E. PICKERING, L. R. BROWN
*Sec. Treas.,* O. A. EVANS, 159 Upton Road.

**TORONTO**
*Chairman,* W. S. WILSON
*Vice-Chair.,* W. H. M. LAUGHLIN
*Executive,* D. FORGAN, R. F. LEGGET, S. R. FROST, F. J. BLAIR, E. G. HEWSON, C. F. MORRISON
*(Ex-Officio),* C. R. YOUNG, T. H. HOGG, N. MacNICOL, H. E. BRANDON, J. J. SPENCE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD, R. E. POTTER, I. C. BARLTROP, E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT, C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD, A. N. ANDERSON, F. C. GREEN, J. H. BLAKE
*(Ex-Officio),* E. W. IZARD, A. S. G. MUSGRAVE
*Sec. Treas.,* R. BOWERING, 41 Gorge Road West, Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING, N. M. HALL, B. B. HOGARTH, R. H. ROBINSON, R. A. SARA
*(Ex-Officio),* W. P. BRERETON, J. W. SANGER, D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY, 55 Princess Street, Winnipeg, Man.

# THE DAYS AHEAD

C. R. YOUNG, M.E.I.C.

*Dean of the Faculty of Applied Science and Engineering, University of Toronto; President of The Engineering Institute of Canada for 1942.*

**Presidential address delivered at the Annual General Meeting of The Engineering Institute of Canada, at Toronto, Ont., on February 11th, 1943**

For three and a half years the engineers of this country have been engaged in a task at once more extensive and more exacting than any other that has ever confronted them. They have put into the doing of it all of the energy, thought, and initiative that they possess. There has been little time for relaxation and although the way has been long and hard it has been travelled with pride and deep inner satisfaction.

At this time, when our armed forces are entering upon a new phase of the world struggle and when we of the Institute are surveying the work accomplished during the past year, it is not inappropriate that we should attempt to draw aside at least a little the curtains of the unknown. What lies ahead of the engineer? Where is he going, what service can he render in the remaining months or years of the war, and what is the role that he is to play in the days of peace?

## I—The Way We Have Come

Risking, perhaps, the charge of indulging in professional self-approbation, let us examine the basis for the intensive demand that has arisen for the services of the engineer in these crucial war years.

There is, of course, the obvious ground of professional knowledge and skill. But that is not all. Added unto it is the exploratory faculty of imagination and the ability to devise remedies for old situations and the means of meeting and coping with new ones. Significant although these may be, they are no more than qualities of the intellect. Whatever eminence the engineer may have achieved heretofore is due as much to other characteristics, often of greater import. Colonel H. G. Prout has well said that the engineer reaches the limit of his usefulness from defects of character rather than from want of technical attainments.

The engineer must, of necessity, be a quick and accurate analyst of new problems. Although this faculty may often be shared by the pure scientist, the engineer, faced with the need for rendering decisions upon which immediate and far-reaching programmes must be launched, is often forced to deviate from theoretical exactness and drive straight towards the solution that limitations of time, urgency of the need, or imperfections of materials and workmanship will dictate. It is a case of what is practicable in the circumstances. Here, in war, as in peace, he continues to be a co-ordinator of many sciences, techniques, and arts to the attainment of a desired objective.

The engineer is adaptable. His ordinary employment makes it essential for him to be so. Emergencies confront him daily in the course of any normal enterprise. He must quickly change front, devise remedies, and marshal men, materials, and equipment at the threatened point. In the development of a project, no plans and no specifications are sacrosanct. They are ruthlessly cast aside if a better way of attaining the desired end appears.

In all this the engineer remains imperturbable. He is accustomed to work under pressure and in the midst of distractions. If one who aspires to a place in the profession cannot function in these circumstances with efficiency, he had better seek another calling. The characteristic ability to cut resolutely through obstacles and confusion which differ only in degree from those of actual combat peculiarly fit him for wartime tasks.

It is not strange, therefore, that demand for the services of the engineer has been very great in this war and continues unabated. That demand has rested not only upon his scientific equipment or mastery of techniques. His practical sense, ability to secure willing and loyal service from those under his direction, and proficiency in whatever of art there is in the practice of engineering has cast him in vital roles. And so he not only provides the technical leadership for normal and wartime industry, but has at the same time taken his place in the armed forces to an extent beyond that which might in the circumstances be expected of him.

In what has the engineer made his chief contribution to the amazing development of war industry in Canada?

With the fall of France in 1940, it was but natural that the engineer should be called upon for intensive service in the sphere of planning and design. Plant locations had to be selected quickly, structures designed, utilizing a minimum of materials, particularly in the case of those that would be in intensive demand for combat, and machinery had to be selected and installed. In the actual production of war equipment itself, design services are still required. Although the original designs have generally been prepared outside of Canada, many revisions have had to be made in order to secure standardization and to facilitate manufacture in this country. As has been pointed out by Mr. H. J. Carmichael, Co-ordinator of Production, Department of Munitions and Supply, ingenious modifications of parts have been made that lessen weight and often replace scarce materials by others that can be more readily obtained. Moreover, original designs of great importance, about which it is not yet permitted to speak, have been made in this country and are serving their purpose with high effectiveness.

As a supervisor or director of construction, either in the role of skilled adviser of a client or employer, or as the technical representative of a construction organization, the engineer has played a vital part in the building of the 125 new airfields in Canada and in the construction of the formidable array of new plants for war industry. These two represent an outlay of over $300,000,000. He has had a determining hand in the spending of nearly $750,000,000 of government money on the building, extending, and equipping of war plants. But what is even more stirring than the prodigious expenditure is the speed with which these enterprises were carried out. It has been a case of planning operations as thoroughly and carefully as a military operation in the field.

The engineer has shown his originality and resourcefulness in the modification and improvement of the processes of industry.

Old as is the art of metal casting, striking improvements have been shown to be possible. During the past year a new technique of casting steel by a centrifugal process has been developed. Not only is the quality of the metal markedly improved, but an important saving in the quantity of it has been effected, the amount of labour required is reduced, vital machine-tool hours have been lessened and the production has been increased.

From the days of the classic researches of Frederick W. Taylor, the art of cutting metals has bulked large in the determination of industrial processes. That art has received a new impetus through the development of carboloy, the cemented metallic carbide that has revolutionized the machining of metals and the drawing of brass shells and cartridge cases. Due to it the production of shells has been speeded up from three to five times.

The technique of machining has been vastly improved, thanks to engineering inventiveness. In one plant the machining of a supercharger housing took 224 minutes, proceeding according to traditional methods. By arranging eight machines radially, working on the housing simultaneously, the time was cut to 24 minutes.

Following keenly on the trail of the research worker, the engineer has been able to bring about impressive improvements in manufacturing processes by enlisting the aid of electronics. In the newer rolling mills the reversal of the motors driving the rolls is effected by electronic devices with a gratifying speeding up of output. Rectification of alternating current to direct current is made possible without the use of heavy and expensive rotary equipment. Counting, sorting, and the discarding of imperfect or off-colour products is now being effected by electronic wizardry.

Necessity, born of the war, has forced the engineer so to alter his designs as to utilize substitute materials in large measure. Timber and concrete have been made to lift much of the burden off steel. Plastics or phenolic laminates have been mobilized in substitution for scarce metals with dramatic success. Some of our finest aircraft are in part fashioned of these materials. Even aircraft gasoline tanks have been constructed of them. They have been widely adapted to the manufacture of parts of fire control instruments. Out of plastics an impressive mileage of pipes and tubing has been produced.

With the fall of Malaya our source of tin was largely cut off. Confronted with the impossibility of obtaining the standard gear bronze, one of the members of this Institute, a proprietor of an important metal-working industry, set to work to devise a substitute. After extensive investigation and experimentation, he announced the discovery of a tin-free gear bronze of properties superior to those of the material that had hitherto been employed. And what is of particular significance to this professional body, he freely contributed the results of his enquiry to his competitors for the general benefit of those who fight under the banners of the United Nations.

## II—The Way Ahead

And now that engineers have passed, I hope, through the most difficult years of the war with high credit, what of the way that lies ahead?

There is no ground for anxiety so far as technological employment is concerned. The stage is set for its continuance. Unless all our post-war planning is to go for nought, there will be an impressive volume of construction undertaken in the early years of peace. Such forms an important ring stone in the arch of post-war stability that is now being designed. Moreover, a vast and ever-growing backlog of demand is being built up for the goods and services of peace. The longer and more drastic is the restriction of private expenditure, the more vigorous will be the rebound.

The country will be technologically well prepared for the upsurge when it comes. We shall have a well-trained and widely experienced body of qualified engineers. There will be an immense reservoir of men trained in the trades, particularly those of the mechanical type, many of whom but for the war would have remained totally unskilled. We shall still have, despite the heavy production of the war years, vast natural resources, if not in all of the traditional materials then in others that form the basis of effective substitutes. There will at the same time be an excess of available power. The Honourable C. D. Howe has said that ninety per cent of the great war plant built up in Canada will be susceptible to adaptation for peaceful industry.

The circumstance that is most likely to put the breath of life into this tableau is the existence of a formidable backlog of tested discovery and invention ready to be taken in hand by vigorous and enterprising men. Some of it was ready for commercial exploitation when the war broke upon us and some has come as a by-product of intensive war research and development. Indeed, Dr. C. E. Inglis, immediate past-president of the Institution of Civil Engineers, has expressed the opinion that in "mechanical, electrical, aeronautical, and shipbuilding engineering, at least fifteen years of normal progress has been crowded into the past three years."

Moreover, the inventive spirit, vigorously excited by the war, will carry through into the peace. Scientific building stones have been quarried in days of storm and tempest which may now be used to erect vaster and more amazing edifices than we have yet seen. Sir Louis Beale is right in his view that the engineer will hold a large place in a coming world that will present alluring prospects to the adventurous spirit of man.

Great as will be the urge to produce speedily those things of which we shall have immediate need after years of deprivation, the rehabilitation of industry will be based much more upon new products than upon old and standard ones. Once having had a glimpse of the possibilities flowing from new discovery and invention, we are never going to be satisfied with old models, types, or styles. The new will drive out the outmoded and inferior. We shall never go back to pre-war notions of what was adequate.

Consider, for example, the future course of plastics. Dr. Inglis has expressed the view that this group of materials will reduce the ferrous metals to a position of secondary importance. Just as humanity has passed through the ages of stone and bronze, he believes that we are now nearing the end of the iron and steel age.

To the rude jolt thus administered by plastic materials is added the impact of the light metals. The amazing increase in our capacity to produce aluminum and magnesium is bound to have permanent and far-reaching effects.

After bearing the hurried and intense burden of wartime traffic for years, our whole transport system will need overhauling. It is unthinkable that reconstruction and re-equipment will be in close conformity to pre-war standards. The forced and intensive developments of war will profoundly influence the programme. We are not going to overlook the contributory value of light metals and new fuels. Nor can it be doubted that commercial air transport will be vastly important in the new transport order.

There will be widespread re-equipment of buildings. Fluorescent lighting is bustling in. There are some who think they can see the glow of cold light just over the horizon. The firefly had better look to his laurels. Air-conditioning, just nicely started when war came, will grow apace.

Television is coming. It is probable that most of those now here assembled will in their time find it as commonplace as we now find the telephone or the moving pictures.

We have been afforded a glimpse of the amazing field of electronic devices. It has been said that the new industrial god is electronics and the vacuum tube is his messiah. In view of what has already been achieved in devising and putting to work contrivances that see, feel, and hear, it is not unreasonable to look for wizardry around almost any scientific corner. For example, Raymond F. Yates asserts that Russian engineers have perfected a new automatic lathe which operates in obedience to an electronic scanning device that translates the lines on a blueprint into the behaviour of a cutting tool on metal. The control mechanism may be used on one lathe or on a number of them working simultaneously.

Comforting although this appraisal of the post-war material prospects of engineers may be, it constitutes a source of only limited gratification. The engineering profession will be advanced only in a technological sense by such activities. We must not forget that our science, however effective, does not present the whole solution to human problems. We should do well to reflect on the words of Sir Louis Beale:

"From dull, laborious toil, the engineer does save, can save, and will save humanity. He will lead humanity to happier, nobler, and freer lives by his conquest over Nature. He will open up a realm of peaceful living as yet undreamt of. But he will not control the world. He will not mechanise the human soul. He will realise that there is more to life than creature comforts, that man is ever striving toward the Infinite, toward a higher goal than the mere satisfaction of his bodily desires."

It should be the solemn obligation of every engineer here to do what he can to further the concept of the engineer as a thoughtful and conscientious member of a great and learned profession, in all that that implies. He should endeavour to envisage a fair and spacious field of service in which he, as a loyal and devoted member of society, will play his full part.

In this forereaching we ought to remember, as F. L. Mayer has put it, that

"Nothing really worth while can ever be done except under the inspiration of something much greater than material achievement or personal gain—'Except the Lord build the house, they labour in vain that built it'."

---

# THE ALASKA MILITARY HIGHWAY

BRIGADIER-GENERAL C. L. STURDEVANT
*Assistant Chief of Engineers, U.S. Army, Washington, D.C.*

**Luncheon address delivered at the General Professional Meeting of The Engineering Institute of Canada, at Toronto, Ont., on February 11, 1943**

On Monday, February 2, 1942, the author was informed by the War Department that a decision had been reached to undertake the construction of a highway to Alaska. A route connecting a series of airfields from Fort St. John, British Columbia, to Big Delta on the Richardson Highway in Alaska was to be selected and the Chief of Engineers was to carry out the project. A plan for surveys and construction was submitted on February 4th and a formal directive to proceed with the project was received on February 14th.

Permission was promptly obtained to send survey parties into Canada and a formal agreement with the Canadian Government was reached on February 26th which, among other things, provided that the United States would pay for the construction and that rights-of-way would be furnished by the Canadians. On March 9th and 10th, Quartermaster and Engineer troops began arriving at the end of the railroad at Dawson Creek, British Columbia, in subzero weather.

The plan submitted to the War Department was necessarily quite general in character but it was apparent at once that the main impediment to rapid progress was the fact that there were only four practicable points of access by land to the entire 1,600-mile route; namely, at the two extremities, at Whitehorse, and at some undetermined point on Teslin River or Teslin Lake which could be reached by steamer from Whitehorse. A fifth and difficult route of access to Watson Lake by way of the Stikine and Dease Rivers was considered but discarded as impracticable.

The magnitude of the project, the need for speedy construction and the limited accessibility indicated the necessity for a two-phase construction programme, the operations in the first phase to provide with utmost rapidity a rough minimum road to make possible the early and extended distribution of many additional crews which in the second phase would improve and complete the road.

Engineer troops are trained and equipped for rapid road construction. Moreover, troops were available for prompt dispatch, whereas a part of the season would probably be lost if civilian forces only were to be utilized. Consequently, engineer regiments were given the mission of building the access road which has been generally referred to as the pioneer road. The specifications for the pioneer road were very brief and were included in the instructions of the Chief of Engineers to troop commanders as follows:

"A pioneer road is to be pushed to completion with all speed within the physical capacity of the troops. The objective is to complete the entire route at the earliest practicable date to a standard sufficient only for the supply of troops engaged on the work. Further refinements will be undertaken only if additional time is available."

It may be stated at this point that all troops did actually work enthusiastically to the limit of their physical capacity and the capacity of their equipment and without regard to hours. The clearing operations at the heads of columns set the pace and were practically continuous. They did complete their assignments in one short season to a standard far higher than was believed possible when the above instructions were issued.

The Public Roads Administration at the request of the Chief of Engineers employed contractors to improve the pioneer road in rear of troops, to construct certain mileage without the aid of troops and to furnish various engineering services.

### Winter March of 35th Engineers

From the railhead at Dawson Creek to Fort St. John there was a provincial dirt road passable in winter and dry weather. From Fort St. John to Whitehorse along the proposed route are nearly 1,000 miles of wilderness inaccessible for heavy equipment except over frozen trails in the winter months. There existed such a winter trail from Fort St. John to Fort Nelson, a distance of about 265 miles. This trail is generally on low, swampy ground and becomes impassable with the spring thaw which may occur in early April. It was decided to send a regiment over this trail to Fort Nelson before the thaw with supplies sufficient for four months and to have the regiment work northwestward from Fort Nelson. In this manner another point of access was established, thus cutting off 265 miles from the longest inaccessible section of the route.

Selected for this difficult mission was the 35th Engineer regiment commanded by Colonel Robert D. Ingalls, Corps of Engineers. The regiment, equipped with special arctic clothing, began arriving at Dawson Creek on March 10 and after many difficulties and hardships in weather 35 degrees below zero reached Fort Nelson on April 5th with all equipment and some 900 tons of supplies. For men inexperienced in such winter operations, this 325-mile march was a remarkable performance. Accomplishment of its mission by the 35th Engineers furnished the key to the early opening of the road to traffic.

### Route Location

The second problem requiring early solution was the general location of the route. Although the road was to serve specified airports the main road did not necessarily have

**A heavy fill over a deep culvert.**

to touch them as they could be supplied if necessary by branch roads. Thus there was considerable latitude in location. Both the army and the Public Roads Administration sent in exploring parties in February by automobile, airplane and dog teams. Joint parties were organized in several cases. It was soon apparent that the route of the winter trail to Fort Nelson was impracticable for an all-year road and that the higher ground to the west would have to be used, but, having reached this decision, this section remained the most difficult for detailed location as much of the route was in rolling, heavily forested country and did not always follow well defined ridges or streams.

Between Fort Nelson and Watson Lake there were apparently two possible routes: one starting northwest through a considerable stretch of swampy country, and another starting westward, through mountainous terrain. Lack of airplanes and bad weather prevented final decision for some time, but it was finally decided in June to follow a series of water courses through the Rocky Mountains. Following the Tetsa River to Summit Lake, 102 miles west of Port Nelson, is found the highest point on the entire road at an elevation of approximately 4,212 ft. On the west slope of the Rockies the road follows down MacDonald Creek and Racing River and up the Toad River Valley to a low divide which it crosses to the Muncho Lake Drainage. From Muncho Lake it follows down the Trout River to its confluence with the Liard River and follows the north bank of the Liard River to the vicinity of Watson Lake.

After the general location as far as the Liard River had been decided, a great deal of reconnaissance was conducted

**Rough grading sufficient to permit passage of truck traffic in weather not too wet.**

in an effort to find a suitable route to the vicinity of Lower Post following the south bank, thus eliminating the necessity for an additional major bridge over the Liard. (Access to Watson Lake airport requires one crossing of the Liard). A location on the south bank was found impracticable because of excessive rock excavation, frozen ground and swampy areas. On the other hand the north bank is gently rolling usually with dry gravelly soil and the tributary streams to be crossed are of approximately equal magnitude on both banks.

In the beginning the most uncertain part of the entire route was between Watson Lake and Whitehorse. The air route maps available indicated that any reasonably direct route would have to cross a mountainous plateau not less than 6,000 ft. above sea level which might prove impassable due to heavy snowfall in winter. This was freely predicted by critics who exhausted every means to upset the plans of the War Department. Prior to sled and airplane reconnaissance it was thought that the road might have to be built via Dease River and Lake, Telegraph Creek and Atlin which would have increased its length by nearly 500 miles. However, airplane reconnaissance soon discovered a fairly direct route entirely through forest growth which in this latitude does not exist far above elevation 4,000. This meant

**"Drifters" drilling holes for blasting charges.**

that the summit was not much over 4,000 ft. above sea level. It turned out to be less than 3,500 ft. high. This route was apparently unknown to any of the local inhabitants and its discovery was an important factor in the early completion of the road. This section between Watson Lake and Whitehorse also follows stream lines for most of the distance —up the Rancheria to the divide between the Mackenzie River and Yukon River drainage basins, thence down the Swift River and across a low divide to the Morley River which it follows to Lake Teslin. It crosses the Teslin River near the foot of the lake and continues southeast along an old trail to Marsh Lake and then follows that lake and the Lewes River into Whitehorse.

For locating the road northwest of Whitehorse to the Richardson Highway in Alaska better maps and reconnaissance reports previously made by the Alaskan International Highway Commission and the Alaska Road Commission were available. After considerable exploration of other possible routes the location recommended by the Alaskan International Highway Commission was adopted with certain minor exceptions. This route follows an old trail to Kluane Lake, 150 miles west of Whitehorse, thence along the south shore of that lake and the south bank of Kluane River to a crossing of the White River at Lower Canyon, thence northwestward on the north bank of the Tanana River to the mouth of the Tok River, and thence along the south bank of the Tanana to a junction with the Richardson Highway near Big Delta.

The general route having been selected, the detailed location became a matter for the decision of regimental commanders on the ground with the assistance of airplane photographs. Generally, no more elaborate instruments than the compass and hand level were used. An early effort was made to have the Army and Public Roads Administration engineers work together on detailed location in order that, insofar as practicable, the pioneer road might follow directly upon the location selected for the final improved road. This effort was soon abandoned because of the impossibility of supplying elaborate survey parties sufficiently in advance of the clearing operations to prevent delay in the latter. The army units therefore located the pioneer road by reconnaissance methods, and even so had great difficulty in keeping ahead of the bulldozers in many localities. Time-consuming obstacles were usually avoided, a course which resulted in some crookedness and excessive grades to be eliminated in the final location. For these reasons the Public Roads Administration surveys usually followed in rear of the army units and obtained data for relocations and grade corrections. In spite of the rapid methods used, the army pioneer road was so well located that the bulk of its mileage will be improved directly to the standard of the final road.

**Carry-all moving earth to a fill.**

### Mobilization and Tasks

Except for the early dispatch of survey and administrative personnel and the 35th Engineers for the special reasons previously indicated, there was nothing to be gained by sending in additional construction troops before the passing of severe weather. The 35th Engineers although on the ground on April 5 did not build much road during April, May and early June because of heavy rains, floods and the low wet ground extending west of Fort Nelson for 50 miles to Steamboat Mountain. After July first, however, this regiment averaged three miles per day and on September 24 had reached a point 305 miles from Fort Nelson where it met the 340th Engineers working eastward from Teslin Lake.

Because the 35th Engineers would be inaccessible except by airplane until a road was opened to Fort Nelson every possible effort was made to push a road through from Fort St. John. Two regiments, each with a strength of 1,290 officers and men, were assigned to this section. The 341st, under Colonel Albert L. Lane, arrived about May first and lead the way to Fort Nelson which was reached on August 26, the bridge across the Muskwa near Fort Nelson being completed by detachments of a pontoon company and the 35th Engineers almost exactly on the hour of the arrival of the regiment from the south. The 95th Engineer Regiment (coloured), under Colonel David L. Neuman and later

**Crew engaged in ditching and corduroying.**

under Colonel Heath Twichell, arrived about June first and backed up Colonel Lane's regiment by culvert construction, and grading and drainage work thus permitting the leading regiment to advance rapidly without too much danger of having its supply line bogged down.

The 18th Engineer Regiment, under the command of Colonel E. G. Paules, arrived at Skagway, Alaska, and after some delay due to the small capacity of the narrow-gauge railway, arrived at Whitehorse on April 29 with part of its equipment and was assigned the mission of building the road northwest of Whitehorse. This regiment advanced rapidly until about August first for a distance of about 220 miles after which it encountered very difficult going to October 25 when it met the 97th Engineers working southward from Alaska at a point 313 miles northwest of Whitehorse. The cause of this difficulty was permanently frozen ground which required special treatment.

Two other regiments, the 93rd and 340th, also arrived at Skagway in April. They were not originally scheduled to arrive so early but an unusual opportunity permitted the men and light equipment to be forwarded. As shipping was very limited it was necessary to take advantage of this opportunity. However, both regiments remained in Skagway until June awaiting arrival of their road building equipment.

The 93rd Engineers (coloured), under the command of Colonel Frank M. S. Johnson, then moved to Carcross and at the end of July had constructed 99 miles of difficult road from that point to Nisutlin Bay of Lake Teslin. Part of the regiment then dropped back to improve its own pioneer road and the remainder improved the road constructed in the meantime by the 340th regiment.

**Building a bridge over Morley River.**

**Rancheria River crossing.**

The 340th Engineers, commanded by Colonel F. R. Lyons, moved in part via Carcross, over the road under construction by the 93rd Engineers and across country to Teslin River and thence by boat to Morley Bay of Lake Teslin where it set up its base camp. The remainder of the regiment with its heavy equipment moved by steamer and barge down the Lewes River and up the Teslin River to Morley Bay. This regiment began work at this point late in June with part of its equipment. Working in both directions it constructed the nine miles of road between Morley and Nisutlin Bays and by September 24 had crossed the Liard River near Watson Lake and had met the 35th Engineers at "Contact Creek," 240 miles east of Nisutlin Bay. It then dropped back to improve its own road.

The 97th Engineers (coloured), under the command of Colonel S. C. Whipple and later under Lieut. Col. L. E. Robinson, landed at Valdez, Alaska, in late May but could not get over Thompson Pass on the Richardson Highway until the middle of June. It then assisted the Alaska Highway Commission in repairing the Richardson Highway and moved to Slana on the Gulkana-Nebesna road where it began construction of a road through Mentasta Pass in the Alaska Range at the end of June. This regiment proceeded through the pass with considerable difficulty due to frozen ground and down the Tok River to the Tanana River. Crossing the Tanana it opened up the road along the north bank of the Tanana, crossed the international boundary and met the leading elements of the 18th Engineers on October 25 in the vicinity of Beaver Creek, which is 194 miles from the starting point at Slana.

The Public Roads Administration was assigned all construction on the 114-mile section of the main route between the mouth of the Tok and Big Delta and also the 50 miles section between Whitehorse and Jakes Corner.

### Supervision

For supervision and administration, two sector headquarters were established, one at Fort St. John controlling work southeast of Watson Lake, and the other at Whitehorse controlling the remainder of the work. Brigadier General William M. Hoge organized both offices and supervised all activities until June 6, when Colonel James A. O'Connor assumed charge of the southern sector. Both sector commanders reported directly to the Chief of Engineers until the virtual completion of a route practicable for truck traffic. Enlarged plans for such traffic and extension of other projects in the region led to the organization of the Northwest Service Command under General O'Connor, who assumed charge in September.

### Equipment

All the seven regiments assigned to this project were similarly equipped, although in some cases delivery of complete equipment to the job was delayed. The principal items of interest included, for each regiment, twenty D-8 diesel tractors and bulldozers; twenty-four D-4 and R-4 tractors with bulldozers and trailers for their transportation; three motor patrols; from fifty to ninety dump trucks; various cargo trucks; eleven to twenty ¼-ton trucks (jeeps); twelve pick-up trucks; two ½-yd. gas shovels; one truck crane; six 12 cu. yd. carry-alls; six tractor-drawn graders; one portable sawmill; and two pile drivers. In addition, each regiment carried the normal assortment of small tools, water purification equipment, and electric lighting plants. Each company was provided with a radio receiving and sending set mounted in a jeep.

Nearly all of the foregoing equipment was new, which proved very fortunate as spare parts were often unobtainable and repair facilities were inadequate. Much ingenuity was displayed in keeping equipment in operation but at the end of the season much of it was on the dead line awaiting repairs or parts.

### Operations

In the typical operations of a regiment engaged in breaking new trail through the forest, we find in the lead, of course, the locating party which indicated the centre line by blazes or pieces of cloth. The clearing crew with three shifts of tractor operators followed. One large bulldozer ran along the marked centre line clearing a narrow trail. Other large machines were then assigned tasks along this trail. Pushing the trees laterally to both sides they made a clearing from 60 to 90 ft. wide. Having finished a task a bulldozer would leap-frog forward to its next similar task. On much of the route the forest growth was dense but the trees were usually not large nor deeply rooted. Where the ground was firm, ten or twelve bulldozers could clear two to three miles through solid forest each day. The smaller bulldozers were used to follow the large tree movers, cleaning off moss, muck and lesser debris. The clearing crew was generally several miles beyond the reach of trucks and had to be supplied by pack train or tractor drawn sleds or trailers. The men slept in pup tents and moved camp nearly every day.

A crew consisting generally of a company followed the clearing crew constructing log culverts and small bridges and was followed in turn by another crew engaged in ditching, corduroying if necessary, and rough grading sufficient to permit passage of truck traffic in weather not too wet.

The remainder of the regiment, perhaps two or three of the six companies, might be distributed along the road thirty to forty miles in rear of the clearing crew and be engaged in widening the narrow places, reducing the worst grades, gravelling soft spots and smoothing with motor patrols. This operation completed the pioneer road which was generally 18 to 24 ft. wide. As means permitted later

**A typical bridge over Aishinik River.**

in the season, still further improvements in grade and alignment were undertaken both by Army and Public Roads Administration forces and the entire road has now received a light surfacing with gravel.

Two light pontoon companies each equipped with 675 ft. of floating bridge material were parcelled out to the regiments. The pontoon detachments promptly put in floating bridges over streams that could not be forded, or ferries where available material was insufficient for bridges. Pile or trestle bridges were constructed as soon as possible to release the pontoon equipment.

### Rate of Progress

The rate of progress is best indicated by mileage under construction at the end of each month since the road was usable for supply purposes in a very short time after clearing was completed. Such progress is indicated in Table I.

TABLE I

Mileage Under Construction

| *To Date Indicated* | *Miles* | *Remarks* |
|---|---|---|
| April 30 | 8 | By 35th Engineers |
| May 31 | 95 | By four regiments |
| June 30 | 360 | By seven regiments |
| July 31 | 794 | By seven regiments |
| August 31 | 1186* | Fort Nelson reached August 26 |
| September 30 | 1479* | Road passable to Whitehorse September 24 |
| October 25 | 1645* | Road passable to Fairbanks |

* Includes Public Roads Administration construction.

In conclusion it is believed that nobody can really appreciate the volume of work accomplished without actually making a trip over the road. The main difficulty proved to be supply rather than construction. Progress would have been still better except for lack of adequate water transportation to Alaska which delayed the start of effective work in the Whitehorse area. Much delay was also due to the scarcity of certain supplies resulting from war conditions, particularly spare parts for transportation and construction equipment.

**Completed road 40 miles east of Teslin.**

The credit for pushing this road through the wilderness in the short span of one working season belongs first and foremost to the ten-thousand-odd American soldiers who took their fine equipment and did the job. This statement does not overlook the excellent and necessary work accomplished by the civilian forces of the Public Roads Administration in following up the troops and improving the Army road.

These soldiers of ours worked early and late. Neither heat nor cold nor all the challenges of the pathless wilderness could stop them. During March the men braved bitter winds and temperatures of 35 below. In July and August, gloved and swathed in netting against swarms of mosquitoes, flies and other insects, they sweltered under 90-degree heat. The rainy weather found them slogging through bottomless mud. They threw into their job the same spirit and the same courage that their comrades-in-arms have thrown into the operations in Algiers, in Morocco and at Guadalcanal. Yes, America can well take pride in the way its soldiers have performed in the building of the Alaska Highway.

# INDUSTRIAL RELATIONS

**Proceedings of the session held during the Fifty-Seventh Annual General Professional Meeting of The Engineering Institute of Canada, at Toronto, Ont., on February 11th, 1943, under the auspices of the Institute Committee on Industrial Relations. Mr. Wills Maclachlan, M.E.I.C., chairman of the Committee, presided.**

## THE ROLE OF THE INDUSTRIAL RELATIONS EXECUTIVE IN COMPANY MANAGEMENT

BRYCE M. STEWART

*Industrial Relations Counselors, Inc., New York, N.Y.*

*From 1940 to 1942 Deputy-Minister of Labour for Canada*

### Importance of Industrial Relations Management

At the outset, it might be appropriate to refer to the increasing significance of industrial relations in the conduct of industry and for the general social welfare. Different groups—politicians, business men, trade unions—become one after another the most powerful factors in our society. Since the early thirties trade unions have been increasing in strength and influence, and business has lost prestige since it was regarded as responsible for most of our economic ills. For this reason, industrial relations men also lost prestige in some quarters because of their part in business management. However, during the war period, business has played its proper role well; it has achieved production objectives that were regarded as impossible and is winning a higher place in public esteem. It is now becoming quite respectable to be an industrial relations executive and those entering the field at this time have that advantage.

Mr. Walter Lippmann said recently that in the United States, "there is no governing class which has a social position and political power superior to that of the business community. That is why the American business men who manage the greatest industrial plant on earth are in a unique position. That is why their future cannot be discerned by reading analyses and predictions made by thinkers in lands where there is a quite different social structure. And that is why the working philosophy of the American business man is destined to play so decisive a part—for weal or for woe—not alone in his future but in that of this republic and of the world."

One may venture the assertion that in the years ahead the working philosophy of the business man with reference to the relationship between management and workers will have greater social import than his thinking in any other field. It is the function of the industrial relations executive to shape management's philosophy in this area. Mr. Lippmann in the article just quoted raised the question whether in these trying times American business men will assume necessarily "heavy burdens in order to continue to lead our industrial society." He suggests that they must not be diverted from "the conviction that they have a great mission to perform." Surely, therefore, the industrial relations man must exert himself to the utmost to see that the part the industrialist is destined to play in this important field of the relationship between management and employees is for weal and not for woe. What other profession has a greater responsibility or opportunity?

Many trade unions have been inclined to look askance at company industrial relations departments, and many employers have regarded trade unionism as not very constructive, to say the least. In Great Britain and on the Continent, since the turn of the century, unions have been the major factor in shaping the industrial relations policies of management, and, in general, company industrial relations programmes have had a minor part. In America the reverse condition has obtained. The labour movement had a slow growth over a period of half a century and only a minority of companies had signed union agreements. In these circumstances the most progressive firms developed their own industrial relations policies, practices and departments. In this field American business stands supreme. However, with a marked increase in union membership in the United States and Canada in the last decade the unions now have a much greater influence in the determination of management's labor policies. Interestingly enough, while the rate of growth of trade unionism has been speeding up in America the war has accelerated the development of company industrial relations programmes in Great Britain. What we know as industrial relations management is now receiving greater emphasis in that country. Ernest Bevin, the Minister of Labour and National Service, who before becoming a member of the Cabinet was the general secretary of the Transport and General Workers' Union, has said:

> "In the layout of our war effort, sufficient attention was not paid to the personnel problem . . . The longer the war goes on, the more necessary it becomes to pay greater regard to this personnel side of industry. The absence of a proper understanding of the problem has been one of our greatest handicaps in this great struggle. Hence my additional plea for the personnel manager, who should be specially trained to have an equal position in industry with other members of the executive. Indeed, I am sure—and I would emphasize this—that our post-war position will be materially helped and the future prospects of British industry enhanced by a full appreciation of this important fact."

Acting on this view, the British government is giving financial assistance for training in personnel management. Since early in 1942 the Department of Labour of Canada has sponsored and financially aided practical courses in this field at five Canadian universities. Can there be any better evidence of the necessity and importance of company industrial relations policies and of capable industrial relations executives than the action of these governments under the stress of war? This development is a sufficient answer to those trade unionists, employers and others who have held that with increasing determination of management's labour policies by the action of governments and unions, the field of company industrial relations activities and the role of the company industrial relations executive are being progressively restricted and ultimately may disappear. One is surprised and alarmed at the number of employers who in these days take the view that if labour standards are to be established by legislation or union dictation, management should comply submissively and make no effort to develop and promote its own labour policies. This mistaken attitude serves notice on employees that they must compel employers to make concessions either directly through collective bargaining or indirectly through legislation. It tends to destroy any sense of partnership between management and employees and militates against co-operative effort in the promotion of the enterprise. In short, when management washes its hands of responsibility in these matters it affirms the Marxian thesis that employers and workers are distinct classes whose interests are in no sense identical and that a political dictatorship of the proletariat is the worker's only method of securing better conditions.

Progressive employers can oppose this contention by demonstrating orderly improvement in labour standards on their own initiative. They must prove that more can be gained by peaceful methods than by force, that as co-operative effort makes the enterprise more successful employees will share accordingly. Such employers will always be in the vanguard of the movement for improved conditions of work since collective bargaining and labour legislation must compromise to meet the necessities of marginal firms.

These managements are likely to profit by their foresight. Employees like other humans are prone to co-operate with any regime under which their conditions improve. Further, it pays to anticipate the compulsory standards of the future. A company that has a long established and well financed pension plan does not suddenly have to assume a new burden of costs when a governmental retirement system is introduced. Nor is employee good-will likely to be generated by action taken under compulsion. There can be no doubt that, if the management is imbued with this philosophy, the status of the industrial relations executive will broaden in this time of war and will continue to grow in the post-war period of readjustment as he is confronted with old problems in larger proportions, new problems and new frontiers. This conception of industrial relations is found to have a larger part in the art of industrial leadership.

### The Industrial Relations Executive as the Proponent of Democracy in Industry

Democracy stands for progressive realization of freedom for the individual and his acceptance of his proper share of responsibility for the general well-being. In democratic countries a considerable measure of individual liberty has been achieved, as in freedom of speech, religion and politics. Full enjoyment of these rights by the citizen is conditioned by his measure of economic independence. If his family is starving he is prone, regardless of his convictions, to join the church, political party or labour organization that will help him most. The worker depends on the income from his job and its adequacy by way of rates and continuity, for decent independent living. In short, the hungry man cannot be free. Here and now we are striving for this new freedom, designated in the Atlantic Charter as freedom from want. The major long-term function of the industrial relations executive is to assist his management in the progressive realization of this objective for its employees.

Planned orderly progress in this sector, gauged to the capacity of the business to assume the burden, is the only alternative to direct action by the employees of the plant and to violent change that will shake the foundations of our society. Employees are securing better working conditions, better and steadier incomes, and more leisure through the voluntary action of employers, collective bargaining and labor legislation. The more that this can be accomplished by management with the assistance of a well-equipped industrial relations department, the better. Indeed, it probably is not an overstatement that the future status of industry in the national economy depends upon its achievements in this direction.

Perhaps, at this point, a word of caution is in order. The industrial relations executive is the proponent of democracy in industry but he should have a clear understanding of that term. In industry both management and employees have their rights and duties. It is not suggested here that either should trespass upon the territory of the other. Management is responsible to the owners for the successful functioning of the business at a fair profit. It must safeguard the investment in the enterprise. Its social obligation is to secure the greatest possible production at the lowest possible cost consistent with fair wages and working conditions. To these ends management has the right and duty to select, allocate, transfer, promote, demote, discipline and dismiss employees. It should be so anxious, however, to ensure the fairness of its policies in these matters that it should stand ready at all times to discuss them with, and have them challenged by, the employees. It should stand ready to modify the policy announced in so far as the suggested changes do not hamper the responsible executives in the discharge of their proper functions. But the final responsibility must rest with management, and management must resist any encroachment upon its prerogatives. Similarly the employees should have complete freedom within their own sphere—for example, to join or not to join any labor organization as they choose. Democracy in industry means that each of the parties stands on its own ground, maintaining its own rights and performing its own duties in a spirit of mutual respect and co-operation for the success of the business upon which the welfare of each is dependent. Especially in these times the industrial relations executive will do well to have this definition of his field of activity constantly in mind.

### The Day-to-Day Duties of the Industrial Relations Executive

Having dealt with the long-term objectives of the industrial relations executive, we may now turn to his day-to-day activities. At the outset he must assist the management in the formulation of an industrial relations programme and in the development of the techniques involved, and must supervise the application of the policy throughout the business. The need for a written statement of industrial relations policy for every management available to all employees cannot be over-emphasized, nor can the industrial relations executive work effectively in the absence of such a policy. One may express the conviction that no industrial relations man worth his salt will accept a position with a company unless the management is willing to formulate its labour policy and reduce it to writing.

Nor, of course, should the executive identify himself with the company unless he believes that the policy is fair and workable in the circumstances of the enterprise. Not a few industrial relations men have accepted new positions during the war period only to resign a few months later. They have found the managements according to their own statements too busy with production to develop an industrial relations programme. Such managements think, apparently, that the executive should be an opportunist and deal with cases individually. They refuse to be bothered with the establishment of a grievance procedure, for example, but they would not operate any other department of the business on such a hit-or-miss basis. The industrial relations executive joining a new company should make sure that it has a labour policy with which he is in accord, that the management is keen for its fullest application and will support him to that end.

In its practical managerial aspects industrial relations has been defined for the Scribner's Dictionary of American History by Mr. C. J. Hicks, chairman of the board of Industrial Relations Counselors, Inc., as follows:

> *Industrial relations*, as the term is commonly understood in the United States, is concerned primarily with the position of the worker in relation to his employer and includes whatever is involved in the employee's selection for and relation to his job.

The term *industrial relations* as distinguished from welfare work has grown to include all contacts between labour and all grades of management, connected with or growing out of employment. Specifically it covers items usually classified as personnel work, such as recruiting, hiring, placement, transfer, training, discipline, promotion, layoff, and termination of employees, together with proper service records; also all of the financial relationships such as wages and salaries, overtime rates, bonuses and profit sharing, savings and thrift and stock plans; also education, health, safety and sanitation, recreation, housing and employees' service activities; hours of labour and other working conditions, including days of rest and vacations; reasonable provision to help meet the common economic hazards involved in temporary or total unemployment, sickness, accident, old age, disability and death; also methods used to adjust differences and to promote co-operation between employees and management.

Many of these items have been gradually covered by state and federal legislation, starting with sanitation, accident compensation and safety measures, later dealing with child labour, hours and minimum wages especially for women and minors and more recently extended to include federal legislation on hours and wages.

The dictionary article just referred to contains the following statement concerning the *industrial relations* executive:

Personnel work, which was at first a mere incident in the day's work of the foreman or superintendent, has gradually been broadened into an *industrial relations* programme with increasing emphasis on standardization. The responsibility for developing a uniform company policy and practice as to all *industrial relations* activities in the individual company is increasingly being placed in the hands of an *industrial relations* executive, with the rank of vice-president or responsible to some high official of the company, and having a staff relation to those directly responsible for both employee relations and production.

A number of important factors must be considered in planning the organization for industrial relations administration in a company:

1. The plan of organization must be related to the size and character of the business.

2. The head of the industrial relations department should report to the chief executive of the company.

3. The industrial relations head should have a staff relationship to the line executives and respect their final authority and responsibility.

4. Line executives should consult the industrial relations department in their interpretation and application of the company's industrial relations policy.

5. The industrial relations department should supervise the administration of the company's industrial relations policies and should interpret the viewpoint of employees to the management.

It was stated above that the industrial relations executive should make certain that the management he serves has proven its interest in his field of work by the formulation of a written industrial relations policy. The role of such an executive in a business may be elucidated by the following brief outline of the essentials of an industrial relations programme.

1. An organization plan, accompanied by a full and detailed explanation, that clearly defines departmental functions and relationships, channels of communication and the respective authority and responsibility of line supervisors.

2. The persistent application of the consultative method of administration whereby, through the line organization, supervisors and employees participate in the formulation of policies and decisions vitally affecting their interests.

3. The formulation, reduction to writing and announcement to the whole organization of a definite company policy with respect to personnel relations, so that everyone knows the rules under which the game is being played.

4. The assignment of responsibility for directing administration of the labour policy and for advising management regarding industrial relations to a staff officer who reports directly to the chief executive of the company.

5. Recognition of the line responsibility of supervisors toward their own personnel and delegation of adequate authority to them for the execution of this responsibility.

6. A training programme that will assure the sincere and fair interpretation of the company's labour policy by the supervisory force.

7. Payment of the prevailing rates of wages, establishment of wage differentials or methods of compensation that reflect differences in relative responsibilities, skills and performance, and assurance of the effective administration of this system by the periodic review of individual earnings.

8. A procedure for the consideration and review of grievances that provides channels of appeal to the highest executive of the company for the correction of injustice to the individual employee.

9. A persistent effort, through research, planning and co-ordination, based upon adequate personnel records, to assign each employee to the job for which he is best fitted and to increase stability of employment.

10. Recognition of the social obligations and economic value of providing safeguards against the major hazards of industrial employment such as disability, superannuation and unemployment.

### The Industrial Relations Executive as a Staff Official

Industrial relations executives too often err by assuming line functions, a step which usually results in conflict and weakens them in the discharge of their proper duties. It may be well, therefore, to give further attention to industrial relations as a staff function. This conception of industrial relations is predicated upon the ultimate responsibility of the line executives of the company for direction of the labour policies as well as the financial, sales and operating phases of the business. Within the limits of his authority, each member of the executive organization—from the president, vice-presidents and department managers down to the district or plant managers, superintendents and foremen—shares the responsibility for personnel relations. If responsibility for action and results is to be definite and fixed in an organization, there can be no division or delegation of this responsibility. The authority of each executive must of necessity be commensurate with the responsibility conferred upon him and cannot be divided.

The modern industrial relations department in large business organizations has originated out of the need on the part of chief executives for assistance in carrying on the responsibility for personnel relations. The provision of a special assistant does not alter the fact that the chief executives still carry the responsibility and must make the decisions. This is true not only in the field of employee relations, but in engineering, research and other phases of the business.

The head of the industrial relations department is, therefore, a staff assistant, directly responsible to the president, advising and aiding management in the formulation and administration of policies affecting employees. In co-operation with the operating staff his duties involve the co-ordination of personnel activities, the development of efficient procedures and their uniform application so far as practicable throughout the company. It is also the function of the industrial relations director to assist in bringing to top management the viewpoint of the employees so that, in the development and application of personnel policies, their suggestions and ideas may be given due consideration and their interests may be adequately represented.

It should be clearly understood that the fact that there is a staff assistant to give direction and help to the management with respect to employee relations involves no departure from the established policy of supervisory authority and responsibility for these matters. The execution of personnel policies and the maintenance of co-operative employee relations must continue to be one of the primary duties of each department head, plant manager and supervisor.

Though the industrial relations department must recognize and respect the final authority of the department executives, there is a corresponding and equally binding obligation upon the department executives to recognize the position of the industrial relations department and to cooperate with it in the closest possible manner. Foremen, superintendents and plant executives are responsible for keeping the industrial relations staff currently and promptly informed of all developments in personnel and labour and for consulting and advising with them before making vital decisions on these matters. Department and top executives are committed to consulting with the department in the formulation of policies and major decisions respecting any matters affecting employees. It should be borne in mind that the authority of line executives and particularly of department managers is final or absolute in matters of personnel and labour policy only within the bounds of general policies which have been laid down by the company, and that the formulation, interpretation and supervision of these policies is a major function of the industrial relations director. In a real sense, therefore, responsibility for the administration of the labour policies of the company is shared between the line organization and the members of the industrial relations department.

### Securing Compliance with Industrial Relations Policy

The major responsibility of the industrial relations director and his staff throughout the organization is to see that the labour policies of the company are adhered to by the operating managements in their handling of personnel and labour matters. In most cases differences of opinion are avoided when executives and operating managers consult in advance with the industrial relations department. However, in case of inability to agree as to the proper course or where the personnel representative thinks that the policy of the company is being disregarded or violated, it is his duty to make his protest first to the foreman, superintendent or plant manager concerned and, failing to secure a correct decision, to take up the matter with the chief executive of the unit affected.

The director, while not in a position to order compliance from subordinate line executives, does have the right of access to the chief executive officers of the company from whom in most cases it is possible to get a decision directing that the proper action be taken by the subordinate executives. As a matter of fairness and co-operation, the industrial relations director, having a problem in any department, will first discuss it with the executive head concerned and then take it to the higher executives.

With the right kind of co-operation from the line organization, the headquarters industrial relations department would be currently informed as to the compliance of field managements with company policies respecting wages, hours and working conditions, either on the initiative of the department managers concerned or through the medium of personnel, hour and wage reports. In actual practice, however, it is found that strong and active employee organizations are of tremendous assistance to both department managements and the employee relations officers in seeing that the day-to-day transactions in the field are in harmony with the wishes of the company as expressed in their written labour policies and departmental working regulations. Likewise, through the medium of periodic conference with the field staff personnel men, the director of industrial relations has an opportunity to keep informed as to the working of the various labour policies in all departments of the organization.

### Industrial Relations in Large and Small Companies

As between large and small companies the plan or organization for industrial relations will differ. The number of persons on the industrial relations staff depends on many factors besides the total number of employees. One business has widely scattered units operating under a variety of conditions, and a considerable field personnel staff may be required. Another operates entirely in one locality. One firm will have an ambitious programme of broad scope while another more cautious and perhaps not so prosperous will have fewer activities. Accordingly, the industrial relations staff may comprise any number of persons—from one man and a stenographer to ten or twelve individuals (director, employment manager, training supervisor, safety engineer, supervisor of benefits, doctor, nurses and a few clerks); and in companies of considerable size and activity in the field there may be as many as sixty staff members, not including the clerical force.

Two considerations are important. First, no company is so small that it can safely disregard industrial relations. The small concern may at least centralize responsibility for these functions on a part-time basis in one executive. Second, the industrial relations staff should exemplify a spirit of fairness and co-operation, of willingness to recognize and promote the employee's legitimate interests, combined with initiative and fearlessness in urging required steps upon the management. This is more important than any particular plan of organization.

### Conclusion

The executive in charge of industrial relations in a company that has just begun organized activity in the field will do well to proceed slowly and to develop his department gradually. He should, however, envisage a complete industrial relations programme for his company and should be quick to take advantage of opportunity to introduce new phases of the programme. He must keep in mind that, with the broadening down of democracy in industry, concessions will be made and that employee good-will is to be expected from the voluntary action of management, not from grudging compliance with compulsory requirements.

It seems quite safe to assure industrial relations executives that a great future lies ahead of them. During the war many firms with a few hundred employees have increased their forces into the thousands. Of necessity they have had greater regard for industrial relations and the consequent demand for qualified industrial relations executives cannot be satisfied. It may be predicted that most of these managements will retain this newly acquired interest in this increasingly important field of company management. They will want the assistance of industrial relations specialists in the vastly different problems of the post-war years. There will be difficulty in finding and developing the men. The greatest need at the moment is more adequate professional training in the field and the provision of some kind of internship for the student. But that is a subject in itself. Surely with governments providing instruction in industrial relations and with a life-long trade unionist like Ernest Bevin proclaiming the importance of this department of business management there can be no doubt of its opportunity for greater service to management, to employees and the nation.

# A SCIENTIFIC APPROACH TO THE PROBLEM OF EMPLOYEE RELATIONS

MORRIS S. VITELES

*Professor of Psychology, University of Pennsylvania, Philadelphia, and Director of Personnel Research and Training, Philadelphia Electric Company, Philadelphia, Pa., U.S.A.*

According to one school of historians, the essentially significant details of an era are to be found not in the records of its great battles and great reforms, or in the approved, formal biographies of its military and political leaders, but in the plays, the essays, the dramas, the novels and in the words-of-mouth stories—yes, even the bawdy ones—told during the period.

While perhaps not agreeing fully with this major emphasis upon literature and conversation as a source of historical material, I am in sympathy with the viewpoint that much concerning the actual role of a person or an event or a movement is to be found in the stories about each which appeal to the man on the street. For this reason, as an industrial psychologist, I find something of interest and significance in the comments on psychology and psychologists appearing in a series of articles, originally published in *Punch*, and later brought together in a book entitled "How to Run a Bassoon Factory," with the subtitle "Business Explained."

### The Business Man Looks at the Psychologist

The author of this book points out that: "A hundred years ago our fathers had to manage without psychologies at all. Even thirty years ago they were the privilege of a very few. But nowadays with our cheap methods of production they are to be found in every home."

Addressing himself specifically to the business man, the author goes on to say: "As a modern business man, it is most important for you to realize that your workers want psychologies of their own and to see that they get really first-class chromium-plated ones, with cavity walls. That was why, somewhat earlier on, I placed a psychologist high on the list of *Experts You Can't Do Without.* It is essential to have a man in the place whose expert knowledge tells him that workers are *Human Beings, Not Machines.* The old chap with whiskers who glues the bits of kid on the bassoon keys—he isn't a machine—really he isn't. So don't let your maintenance engineer oil him, and don't think if he breaks down you can just fit a spare part. He is like the author of *Pagliacci*—'a man with a heart like you'—and he can probably be depended upon to keep himself well-oiled. So just keep him bright and healthy, change his water every day, and have a psychologist deal with his soul."[1]

I recall that my first reaction upon reading the material cited was one of resentment at what appeared to be an attack upon the dignity of psychology and of the professional psychologist. However, I was quick to recognize that, in fact, this bit of satire gives a fairly close approximation of what the ordinary, practical business man frequently thinks of psychology and of the psychologist. Beneath this good-natured jibing lies a keen appreciation of the essential skepticism concerning the use of psychological methods which has seriously hampered the extension of psychological research and practice in industry and business.

### Psychology and Magic

As the years have gone by, I have come more and more to the opinion that such skepticism represents an essentially healthy condition, to the extent that it forces the professional psychologist to work within a sound pattern of real accomplishment in preparing the tools and techniques which he brings to the aid of business. As a matter of fact, such skepticism is to be preferred to the equally common belief that the psychologist has some mysterious power to penetrate the secrets of the individual's occupational abilities through the use of magic formulae which makes it unnecessary to expend time, effort and money in order to get results.

Actually the psychologist has no such mysterious power. He simply applies to the everyday problems of personnel in industry the more or less humdrum principles and practices, which characterize the scientific approach. For example, industry has discovered that it is highly important to select for each job those workers who are particularly qualified to handle it. This is necessary because the production cost per unit may be two or three times as high with the less competent than with the more competent workers. The intimate relationship between vocational adjustment and the mental hygiene of the worker represents a second reason for giving improved selection an important place in the industrial relations programme. Problems arising when management deals with labour furnish a third and equally realistic reason for continued emphasis upon the quality of initial selection. Contracts and also less formal agreements with labour frequently call for the reinstatement on a seniority basis, regardless of performance, of employees laid off for lack of work. Under such conditions, mistakes made in selection are not easily corrected. Experience also shows that among the most troublesome of grievances are those involving the discharge of an employee because of "unfitness." In such cases management ordinarily finds little sympathy on the part of labour for its plea that the worker is incompetent. "That," says labour, "is a matter which should have been settled prior to employment." And whether or not this stand is justified—and I am of the opinion that it frequently is—the issue is one which contributes to misunderstanding and strife.

### The Scientific Approach in Selecting Qualified Workers

It is for such reasons that selection of qualified workers occupies a prominent place in applying science to solving the problems of employee relations. The essential feature of the scientific approach in selecting workers is merely the application to the selection of the testing apparatus of the same rigorous techniques as are applied by the engineer in the selection of equipment required for the industrial plant. In choosing such equipment, the engineer starts by analysing the situation; then writes specifications on the basis of his study; designs the equipment; estimates the cost, and proceeds finally to test the finished equipment under operating conditions before it is finally accepted and approved for use. Similar measures must be taken in the development of scientific techniques for use in picking the right worker for the job. The job must be analysed and specifications written to describe the kind of worker that is needed. Appropriate equipment is then designed to determine whether a man meets the specifications, but this is not finally accepted or approved for use until its effectiveness has been examined under operating conditions and in relation to the cost of replacing and training personnel.

### The Selection of Electric Substation Operations

The methods employed in the development of improved methods for selecting workers, and the results achieved, can

[1] Spade, Mark: *How to Run a Bassoon Factory, or Business Explained.* London, Hamish Hamilton, 1934, pp. 54-57-58.

be illustrated by reference to the experience of the *Philadelphia Electric Company* in the selection of electric substation operators[2]. The management of this system rightly prides itself on the care exercised in the selection of mechanical equipment. In spite of the quality of mechanical equipment there was an average of 36 operating errors per year chargeable to the 140 electric substation operators employed on the system, when, in 1927 the author undertook an investigation of substation personnel*. These errors, it is well to note, were made by operators selected, with more than the usual concern exhibited by electric utilities in the selection of workers, by a well-organized, centralized personnel department which carefully interviewed applicants, reviewed their application blanks, obtained references, and applied other traditional techniques of the employment office in determining fitness for work.

The continued occurrence of operating errors, in spite of the relatively advanced methods of selection, awakened the suspicion that, in part at least, they might be due to the character of the men who had been hired for the job. This suspicion seemed particularly pertinent because, in spite of the similarities of training and experience, certain operators were involved in a number of errors, while others, working under exactly the same conditions, managed to proceed year after year without an operating error. As a matter of fact, an analysis showed that in an experimental group of 84 operators who had been in service for not less than one and not more than ten years, the AVERAGE operators averaged three times as many errors as the BEST; the POOREST operators averaged 7.5 times as many errors as the BEST; the POOREST operators averaged 2.5 times as many errors as the AVERAGE.

The chief purpose of the study was to develop psychological tests for use in measuring the underlying predisposition to error that appeared to be so conspicuously present in the POOREST group and absent in the BEST group of operators. Tests were selected on the basis of a careful analysis of the job to determine the characteristics of the accurate and safe as contrasted with the inaccurate and unsafe operators.

The tests finally chosen for use in measuring the mental abilities and temperamental traits necessary for safe and accurate switching included three series. The test in *Series A* and *B* are used to measure qualities required for accurate switching under normal operating conditions. *Series C* includes one test, known as the Switching Control Test, for measuring adaptability under emergency conditions. It is essentially a fear-reaction test which allows an opportunity for observing and recording changes in accuracy of response under extremely disturbing conditions of electric flashovers, noise, smoke, etc.

As a preliminary to using these tests in the selection of substation operators a study was made of the test scores BEST, AVERAGE, and POOREST operators in the experimental group. The results of this comparison, in so far as Series A and B are concerned, are presented, in part, in *Chart A*. The average score of the POOREST group is shown to be 27.9 points below that of the BEST group and 15.7 points below that of the AVERAGE group. The average score of the latter group is also 12.2 points below that of the BEST.

A further analysis of test scores showed 75.0 to be the CRITICAL SCORE in distinguishing between satisfactory and unsatisfactory operators, and therefore the one to be used as a minimum "passing score." In *Chart B* is presented a comparison of substation operators reaching this score with those who fail to do so. The percentage of BEST operators with the passing score is double that of AVERAGE operators and about ten times that of POOREST operators. It is important to note that only 7.7 per cent of the POOREST operators would have been hired had they been tested prior to employment, whereas 70.6 per cent of the BEST operators would have been employed. This is of particular significance when the difference between the two groups in number of operating errors is recalled. Moreover the average number of errors of operators who made less than the passing score of 75 proved to be over twice that of men who passed.

Such facts show clearly that scores on *Series A* and *B* differentiate substation operators with respect to predis-

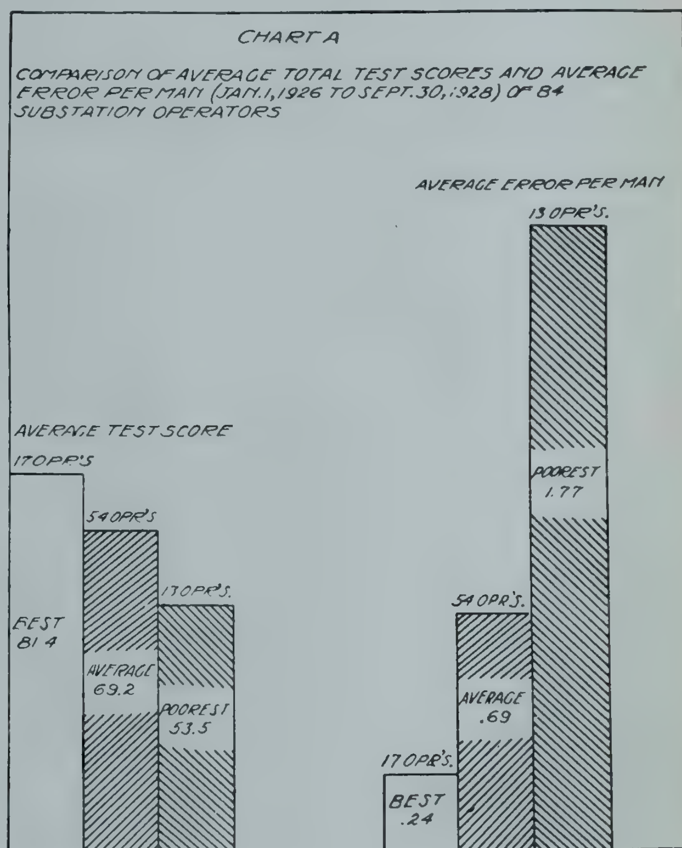



**Chart A**

position to error in switching. These figures, and numerous others of the same kind gathered by checking other groups, including newly hired assistant substation operators, demonstrated the desirability of using the tests in determining fitness for substation operation. The tests were put into operation in the selection of assistant electric substation operators on April 1, 1928. In addition, substation operators who had not been included in the experimental group were examined and the practice established of reassigning operators in service as well as placing new employees on the basis of test scores. So, for example, operators for newer and bigger stations were chosen largely on the basis of test score. On the same basis, operators with low test score and unsatisfactory working records have been reassigned to the smaller stations.

The net result has been the marked decrease in operating errors, shown in *Chart C*, which started immediately after the first changes on the basis of test scores were made, and has continued in spite of increasing load on the system**. It is also interesting to note that operators with low test scores who have been retained in the service have

[2] Viteles, M.S., *The Science of Work,* W. W. Norton, New York, 1934, *Chapter 6.*

* This investigation was formulated with the co-operation of the supervisory staff of the Station Operating Department, in particular through the interest of N. E. Funk, now Vice-President in charge of Engineering, Philadelphia Electric Co., C. C. Baltzly, General Superintendent, Station Operating Division, and of the late E. O. MacFerran, Superintendent of Substations. In general, the development of improved selection procedures described in this paper have involved the active co-operation of operating personnel from the various departments of the Philadelphia Electric Company.

** From a report by R. M. Pennybacker, Superintendent, Substation Section, Station Operating Division.

added errors to their records at a rate above that of operators with higher test scores.

### Other Illustrations of the Use of Psychological Methods in Selecting Workers

Such results have been obtained wherever a conscientious effort has been made to develop improved selection techniques on a sound scientific basis. *The Scovill Manufacturing Company*, for example, reports a marked decrease in the percentage of unsatisfactory apprentices as the result of the use of well-standardized tests in selection. The Scovill Testing Programme was started late in 1923. Following an extended period of research, tests were introduced in 1926 in hiring metal trade apprentices. "The percentage of unsatisfactory apprentices, which had hovered around 40 per cent for the previous five years, dropped to 17 per cent (Table I). In 1930, after a similar study of additional tests, two more were added to the battery, and the percentage

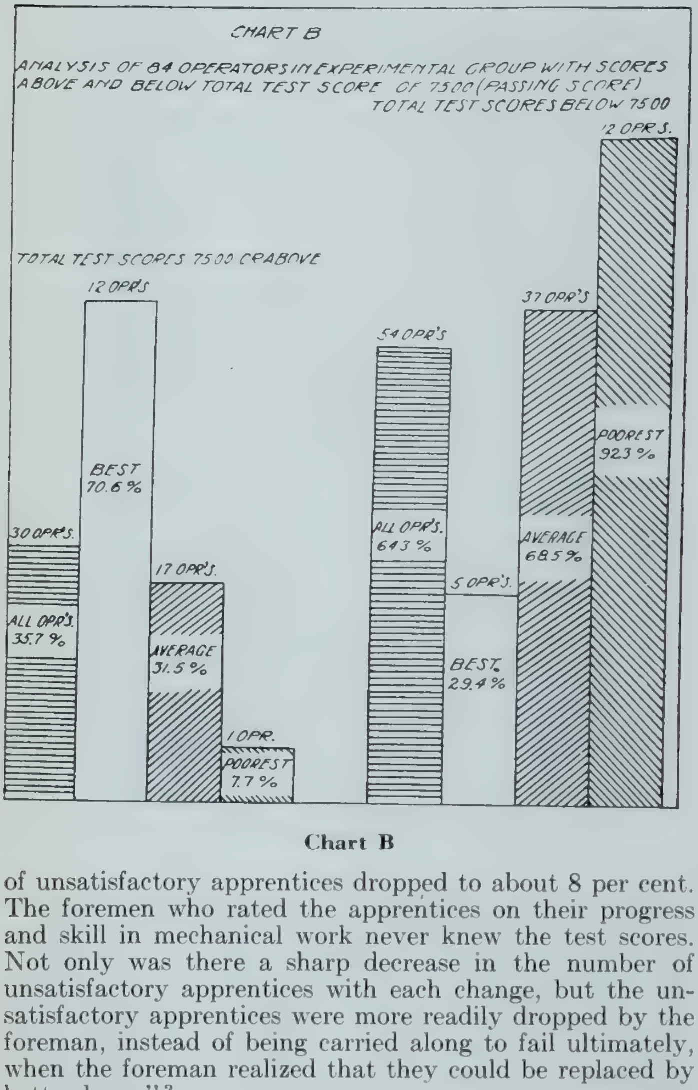



**Chart B**

of unsatisfactory apprentices dropped to about 8 per cent. The foremen who rated the apprentices on their progress and skill in mechanical work never knew the test scores. Not only was there a sharp decrease in the number of unsatisfactory apprentices with each change, but the unsatisfactory apprentices were more readily dropped by the foreman, instead of being carried along to fail ultimately, when the foreman realized that they could be replaced by better boys."[3]

In the ten years subsequent to 1930 new and higher requirements for potential development of trainees beyond the original goals were set, the number of apprentices trained currently increased, etc. Nevertheless, the percentage of failure is still about 8 per cent. This fact is attributed to an enriched interview technique. In other words, in the Scovill works, as in many other plants, experience has brought convincing evidence of the value of psychological methods for employment, and also of the practical advisability of selecting tests and setting the passing marks on the basis of adequate preliminary research.

In adding to its personnel for war the *Westinghouse Electric and Manufacturing Company* is using tests selected on the basis of many years' experience in devising methods of fitting each worker exactly to the task where requirements, talents, and temperament match. Since extremely high standards are set in selection, only 18 per cent of the 10,000 applicants considered since 1937 have passed the tests, but only one per cent of applicants enrolled have failed to make good as skilled workmen.[4]

Similar achievement in improved production, in reduced turnover, in increased sales have been reported both in the United States and abroad. Life insurance firms, for example, have found psychological methods extremely useful in selecting salesmen. It is interesting to note that in this instance tests, as *such*, prove to be of little value. However, a painstaking analysis of biographical data has revealed that it is possible to use specific items of information obtained from an application blank or a general information blank, such as *age, marital status, number of dependents*, etc., in selecting those men who are most qualified for the job of selling.

### The Use of Application Blank Data

The value of this method in selecting life insurance salesmen was demonstrated fifteen years ago in the exeperience of the Phoenix Mutual Life Insurance Company. This company found that the use of a score obtained by weighting 11 biographical items, was followed by a marked increase in sales and in the stability of those employed.[5] In 1919, 56 out of every 100 salesmen employed failed to last out the first year. In 1921-22, when the new plan was fairly operating, only 42 out of every 100 salesmen failed to remain one year. Between 1922 and 1925, this figure had been further reduced to 30 out of every 100. Moreover, whereas in 1912 the *Phoenix Mutual Life Insurance Company* employed 1,700 salesmen to sell insurance to the value of $20,500,000, in 1923, under the new plan, 375 salesmen had sold insurance to the value of $52,000,000. The same company has within the past few years reviewed the experience of all salesmen* who were under contract in regular agencies from 1927 to 1935 and has developed a promising revision of the original scoring methods applying to various age levels.[6]

While the method of using especially selected personal items has found its widest application in the selection of life insurance salesmen, productive results have been obtained in hiring other kinds of salesmen. So, for example, in a study made by the writer in the taxicab industry, it was found that a "good earner" could be differentiated from a "poor earner" prior to employment on the basis of such personal history items.[7] This device is also finding wide application in connection with the war effort, particularly in the selection of aircraft pilots.

In passing, it is interesting to note that there has been a tremendous expansion in the use of psychological tests and allied techniques by the armed forces of the United States and of other countries during the present conflict. It is generally known that such procedures are being used in preliminary screening of all recruits in the American Army and Navy as an aid to assignment for training. More important still, wide use is being made of tests and other psychological techniques in measuring aptitudes necessary for the operation of the highly complex machine which characterizes modern warfare. Engineers working for the military services have discovered, for example, that it is not enough to devise mechanisms designed to bring confusion upon the enemy. Such instruments have no value

[3] Pond, M., "Experience with Tests in the Scovill Mfg. Co.", in *National Industrial Conference Board Report. Studies in Personnel Policy*, No. 32, New York, 1941, p. 45.

[4] Tests, Puzzles, Aid in Selecting War Workers, *Factory Management and Maintenance*, July, 1942, pp. 220-221.

[5] Russell, W. V., & G. V. Cope, A Method of Rating the History and Achievements of Applicants, *Pub. Pers. Studies*, 1925, 3, 202-19.

* With the assistance of the staff of the Life Insurance Sales Research Bureau.

[6] *Selecting, Successful Salesmen,* The Phoenix Life Insurance Company, Hartford, Conn., 1937, 21 pp.

[7] Viteles, M. S., Industrial Phychology, W. W. Norton Co., New York, 1932, pp. 183 ff.

TABLE I
PROGRESSIVE VALUE OF SELECTION

| Dates Hired | Group | Number Hired | Number Satisfactory | Percent Satisfactory | Remarks |
|---|---|---|---|---|---|
| 1-1-20 to 8-31-26 | I | 57 | 36 | 63 | Selected by interview only. |
| | II | 50 | 28 | 56 | |
| | III | 56 | 35 | 63 | |
| | Total | 163 | 99 | 61 | |
| Yearly Groups 9-1-26 to 8-31-30 | IV | 40 | 36 | 90 | Selected by interview and the Scovill Classification Test. |
| | V | 44 | 33 | 75 | |
| | VI | 35 | 32 | 91 | |
| | VII | 36 | 28 | 78 | |
| | Total | 155 | 129 | 83 | |
| Yearly Groups 9-1-30 to 6-1-37 | VIII | 13 | 11 | 85 | Selected by interview, Scovill Classification, MacQuarrie and Wiggly Block Tests. |
| | IX | 1 | 1 | 100 | |
| | X | 3 | 3 | 100 | |
| | XI | 12 | 12 | 100 | |
| | XII | 21 | 19 | 90 | |
| | XIII | 32 | 28 | 83 | |
| | XIV | 65 | 62 | 95 | |
| | Total | 147 | 136 | 93 | |

From: Millicent Pond, "Experience with Tests in The Scovill Manufacturing Company," National Industrial Conference Board Report "Studies in Personnel Policy, No. 32," March 11, 1941, p. 45.

unless they are handled by qualified men, and the selection of such qualified men has been accomplished through the application of the methods referred to in this paper, which have been successfully applied in industry. Unfortunately, it is not possible to speak at this time about the results which have been obtained in the military services.

In considering such results, as well as those reported for industry, it is to be noted again that they are obtained not by guesswork, but through a careful, painstaking, objective check and recheck of the value of the psychological apparatus and methods in relation to men's performance on the job. Only under such conditions can tests of other psychological techniques serve a useful purpose in increasing the probability of obtaining qualified personnel for various industrial, and also military tasks.

### The Concept of "Probability" in Scientific Selection

The term "probability" is used advisedly because the psychologist, as other scientists, deals largely with probabilities and not with certainty. In all scientific fields there are only few generalizations which give the same certainty of prediction as the law of gravity. This limitation applies with special force to psychological generalizations, particularly as they refer to the prediction of individual performance in specific work situations. However, on the basis of adequate statistical treatment it is possible to make accurate predictions as to the characteristics of a group hired through the application of improved psychological methods.

The situation is analogous to that found in the field of vital statistics. The actuarial statistician can predict, for example, the number of deaths, the number of cases of pneumonia and of measles which will occur in a given period among men 30, 40, 50 and 60 years of age, respectively. In the same way, the psychologist can predict how many "good" workers, how many "average" workers and how many "poor" workers there will be among men with scores, let us say, of 60, 70 and 80, respectively, on a well standardized battery of psychological tests.

On the basis of preliminary experimentation a doctor may be able to tell his patient that his chances of surviving an operation are 98 in 100 or he may predict a pneumonia patient's chances of recovery are perhaps 95 out of 100 if sulfanilamide is administered, whereas they would be 75 out of 100 without the drug.[8] In the same way, if the psychological selection method has been suitably standardized it is possible to say that an applicant with a score, let us say, of 60, has a 75 per cent chance of meeting existing production standards, whereas one with a score of 45 has only a 30 per cent chance of meeting the same production standards. In addition, it is possible and necessary, when applying scientific methods in selecting workers, to indicate the extent to which the selectivity of the tests is better both than that of methods already in use or better than a chance method of choosing workers for a specified job.

These may sound like abstract concepts, but just such data are needed and are obtained by the competent psychologist in order to determine whether it is economical to use the test battery; whether the selectivity of the test justifies the cost of administration. There are also procedures for determining objectively how to make best use of the reservoir of available labour. The larger the reservoir, the higher the test score can be set. Conversely, if the reservoir is small, the test score must be lowered. As has been pointed out in a recent analysis by Professor H. M. Johnson*, of Tulane University, this is a practical issue which can be simply met by a series of tables from which can be determined the number of applicants required to obtain 100 employees at various levels of working proficiency.

### In Summary

It is possible that this section of the paper has been extended to the point of boredom, but there seems merit in presenting this material in detail to indicate the scientific character of the psychological approach and to show the advantages which can be achieved through a scientific approach to the selection of workers. In the future, as in the past, the development of scientific techniques for the selection of workers will continue to represent a productive approval in solving the human problems of industry. Because of the wide differences in suitability for varied jobs which characterize members of the human race, the selection of qualified workers represents an important basis for maintaining employee relations while increasing the capacity of industry to meet the economic demands imposed upon it and upon an advancing civilization.[9]

### Strengthening the Will-to-Work

As is apparent from the above discussion, the development and validation of techniques for hiring workers represents one of the major applications of psychology in industry. Considerable progress has also been made in improving the training programme through a scientific approach to the problems of training. However, no matter how well they are selected, or how well they are trained, employees cannot attain maximum efficiency unless they demonstrate the *will-to-work* on the daily job. The development of this will-to-work is one of the major problems in the present employees relations situation. An outstanding practical problem in industry to-day is to find ways of stimulating the inclination to work; and, at the same time, to further the development of job satisfaction and of the loyalties which lead workers to co-operate fully to keep the organization working smoothly.

### The Inadequacy of Financial Incentives

Perhaps one defect in the industrial situation lies in the dependence placed upon wages and wage incentive plans in arousing the will-to-work. There are, of course, very good grounds for the belief that appropriate wage rates and incentive wage payment plans, properly devised and adminis-

[8] Furnas, J. C., Major Miracle, *Ladies Home Journal*, October, 1939. (Quoted from Palmerston, L. R., Psychological Tests in Industry and Education, *Pers. J.*, 1941, 19, 325 ff.

* In a paper to be published in a series of reports prepared for the Civil Aeronautics Administration by the National Research Council Committee on Selection and Training of Aircraft Pilots.

[9] Viteles, M. S., The Role of Industrial Psychology in Defending the Future of America, *Annals of the American Academy of Political and Social Science*, July, 1941, pp. 156-62.

tered, are of great importance in improving performance on the job and in stimulating favourable employee attitudes. The average worker wants a better home, a choicer variety of foods, a bigger and better automobile, a finer radio—more and more of the good things in life which can be procured in increasing amounts as wages increase. Even the Bolsheviks, setting out with the theoretical communistic ideal of sharing everything equally, were quickly forced to come back to wage-incentive plans as a means of stimulating individual workers to reach the maximum levels of productive efficiency. However, the fact which has been overlooked is that pay, and material satisfactions which can be purchased with it, represent but one factor in arousing job satisfaction and in inducing employee co-operation.

At all occupational levels, factors other than wages play an important part in stimulating production, in creating satisfaction, and in building morale among workers. The nature of the evidence leading to such conclusion is illustrated in a study by English investigators of the relative output, in successive weeks, on different work processes, under three systems of wage payment.[10] The order of *worker preference* for the operations, determined through controlled interviews with workers, proved to be: *wrapping*—1; *packing*—2; *weighing and wrapping*—3; *weighing*—4; *unwrapping*—5. The findings of the study clearly show that the effect of each wage incentive plan is most marked in tasks which arouse the more favourable feeling tones, and is completely absent in the least preferred processes. In the most popular operation (wrapping), rate of output was almost trebled by the end of the experiment, while production on the least popular operation (unwrapping), which involved very similar movements, but which appeared to be futile to the workers, showed no improvement.

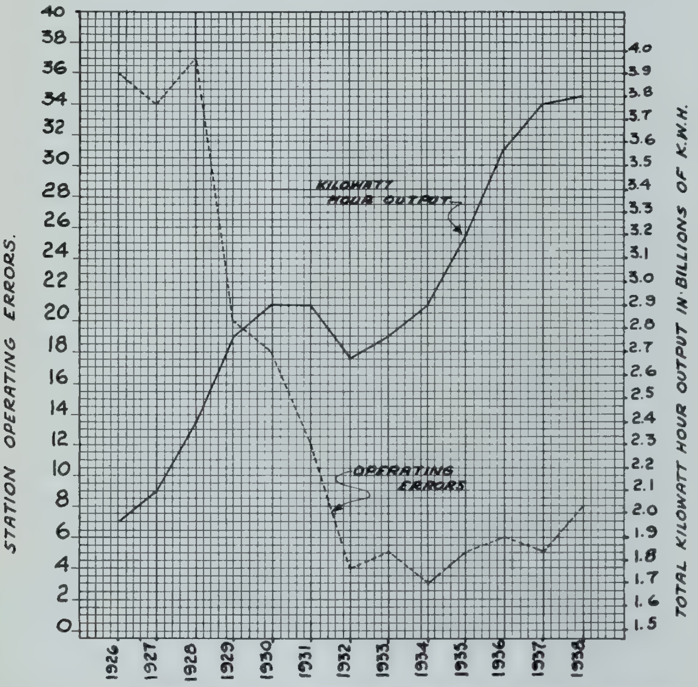



**Chart C—Comparison of substation operating errors and kilowatt-hour output, Philadelphia Electric Company.**

Both experimental studies and everyday observation of the plan brings growing realization that "pay" in itself is but one factor, and frequently a minor one, in arousing satisfaction and in inducing employee co-operation. One investigator in the field of job-satisfaction, for example, tells of an express deliveryman who, when asked to recount the things he *liked most* about his job, replied *first of all,* "I'm satisfied with me boss." Every foreman knows of similar instances. The superintendent of a manufacturing plant declined a position with another company at a higher salary because "That concern was harder to work for than this," and because his employers were "particularly human, sympathetic and interested in people."[11] Almost every supervisor who likes his job will agree with this superintendent's decision.

At all levels factors other than wages play an important part in stimulating production, in creating satisfaction, and in building morale among workers. As the worker proceeds beyond the hunger minimum, the pay check's ability to buy material things is overshadowed by the ability of the worker to obtain an immaterial something of equal importance and of vastly greater intricacy.

Such findings have led many to question the emphasis upon financial incentives by industrial engineers who have been so largely responsible for the development of elaborate systems of wage payment. There is increasing recognition, for example, that demands for increased wages may represent merely a way of expressing fundamental dissatisfaction with the failure of the industrial organization to satisfy the desire for social approval and recognition, for security, for self-expression, and other deep-seated wants.

### What do Workers Want?

Questions that naturally arise out of this discussion include: *What are the chief sources, besides pay, of satisfaction and dissatisfaction at work? What do workers want? What do they expect industry to do for them? What devices can be used most efficiently to stimulate attitude and feelings conducive to efficient production, job satisfaction and to the development of employee morale?*

The tendency in the past has been to guess at the answers to these questions. The present tendency, associated with the development of an adequate programme of employee relations and of industrial psychology, is to seek accurate and honest answers by direct appeal to the workers—through the orderly and objective study of employees' attitudes. If management can find out what workers want; if it can determine the true nature, extent and cause of dissatisfaction with particular incentives, with specified policies, practices or working conditions; constructive changes can be made with the view of effectively stimulating and utilizing employee will-to-work.

The objective study of employee attitude usually takes one of three forms. The first of these involves personal interview with the worker, either on the job or in the home, conducted by trained interviewers. This is the method which has been used in the Hawthorne Plant of the *Western Electric Company.* Another method involves the use of unsigned attitude questionnaires to obtain exact information on employee attitudes. In other cases experimental conditions have been set up within the plant and the observation of the effect of changes in experimental situations upon employees' morale.

### Studies of Employees' Attitudes

Numerous surveys have demonstrated that the employee attitude survey can be a particularly practical and useful tool in finding out what is on the worker's mind and indicating where attention is needed in the field of employee relations. The *Armstrong Cork Company* has gone so far as to place the planning and conduct of the employee attitude survey in the hands of the supervisory force, on the theory that since supervisors are directly responsible for employee relations, they are the logical ones to plan and direct the employee attitude survey.

The types of questions used in the employee attitude survey by means of questionnaires can be illustrated from the *Armstrong Cork Company* study.[12] (Appendix I.) An

[10] Wyatt, S., Frost L., and Stock, F. G. L., *Incentives in Repetitive Work,* Ind. Health Res. Bd. Report—No. 69, London, H. M. Stationery Office, 1934, 65 pp.

[11] Hoppock, R., *Job Satisfaction.* Harper and Bros., New York, 1935, pp. 29-30.

[12] Evans, J. J. Jr., Supervisor Conduct Attitude Survey, *Personnel,* 1940, 17, pp. 142.

example of the questionnaire method of analyzing employee attitudes in the public utility field is found in an experiment conducted during 1940 by the *Florida Power and Light Company.*[13] In this experiment all the employees of the Miami Branch of this utility were asked to fill out a questionnaire containing 32 questions on working conditions in the company having a bearing upon employees' satisfaction. The questionnaires were unsigned and after the employee had filled out the questionnaire, he dropped it into a slot of a large steel box. Each question in the questionnaire was followed by five answers expressing different degrees of satisfaction or dissatisfaction. Each person checked the one answer to each question which expressed his feeling on that question. On the front page the employee printed the name of his department and on the back page printed any additional comments he wished to make having a bearing upon his satisfaction on the job.

A special committee of a dozen employees sorted the questionnaires by departments. The analysis of the questionnaires was made by a disinterested person from outside the company experienced in this type of work and centered particularly upon a study of the comparative "morale" found among employees in various departments of the company as determined from the expressions of employee attitudes towards various policies and practices.

*Chart D,* entitled "1940 Departmental Morale Profile" shows graphically how much the "morale" of this company varied from department to department. Each bar on the chart represents a particular department, the long bar represents a department with high morale, a short bar stands for a department with a relatively low morale. The wide variations among departments are easily noticeable from an examination of the chart.

*Chart E,* entitled "1940 Morale Profile" shows the analysis of the morale situation in one of the departments of this utility. The results show clearly that the "morale" problems of this department were not centered around wages, although, as the investigator points out, many people in the company assumed that "money tells the whole story of employee morale." *Questions 23, 24, and 25* refer to wages. The attitudes of employees in this department towards wages are all "in the black", that is above the corresponding company averages by the amounts of 10.6, 12.6, and 6.5 respectively. The largest deviation in terms of unfavourable attitude is with respect to *Question 18,* "Criticism in Public"; the value in this case is the 18.2 below the company average. This item is purely one of leadership. Evidently the well-known principle of refraining from criticising employees in the presence of others had been violated flagrantly in this department.

*Question 13,* "Consideration and Courtesy Shown to Subordinates", reveals another source of unfavourable attitudes among employees in this department. In other words, the survey revealed that in this department, and, to some extent the company as a whole, the workers wanted more consideration, better treatment by the supervisory force. Such dissatisfaction as existed was not with the wage plan, but with the failure of the department head and his subordinates to recognize the wokers' worth as human beings. The primary source of dissatisfaction was the disregard of the workers' feelings and sentiments—the mainsprings of human conduct.

The chief value of the *employee attitude* survey is to reveal objectively and in numerical terms the specific sources of irritation as a first step in their correction. Another example of how such surveys can be used to find out what employees think about particular employee relations policies and practices, plant condition, and so on is found in a study reported by Bergen.[14] In this, use was made of a questionnaire in measuring the over-all "morale" and reactions to particular policies of 1,000 employees from selected office and factory departments of a manufacturing company.

Among the outcomes of this study are the findings that approximately one-half of the factory workers were dissatisfied with the wage incentive plan; 70 per cent of the hourly workers felt that there should be work sharing before layoff; there was considerable dissatisfaction among the salaried group with respect to promotion policies and practices; 28 per cent of the factory employees were convinced that the company employed labour spies, although this was not the case; 29 per cent of factory employees were of the opinion that management was unfair to organized labour.

### What Workers Think of Labour Unions

In addition to the studies in individual plants and industries to determine workers' attitudes towards management and working conditions, the survey technique has been used in numerous studies to determine workers' attitudes toward unionism.

Management frequently has ready-made answers to these questions, such as "Workers don't really want to join unions, but they are being forced into them by racketeering labour agitators supported by self-seeking politicians." Labour leaders invariably speak of unionism as a spontaneous expression of solidarity on the part of a universally exploited, dissatisfied class of the population. And as Chamberlin points out, the opinions of labour leaders, particularly those engaged in the administrative work of labour unions, have apparently been accepted by political leaders as representative of the views of at least a majority of the workers themselves.[15]

[13] Smith, McGregor, Mending Our Weakest Links, *Advanced Management.*

[14] Bergen, H. B., Finding Out What Employees Are Thinking, *Industrial Conference Board Management Record, April,* 1939, pp. 1-6.

[15] Chamberlin, E. M., What Labor is Thinking, *Pers. J.* 14 (1935), pp. 118, ff.

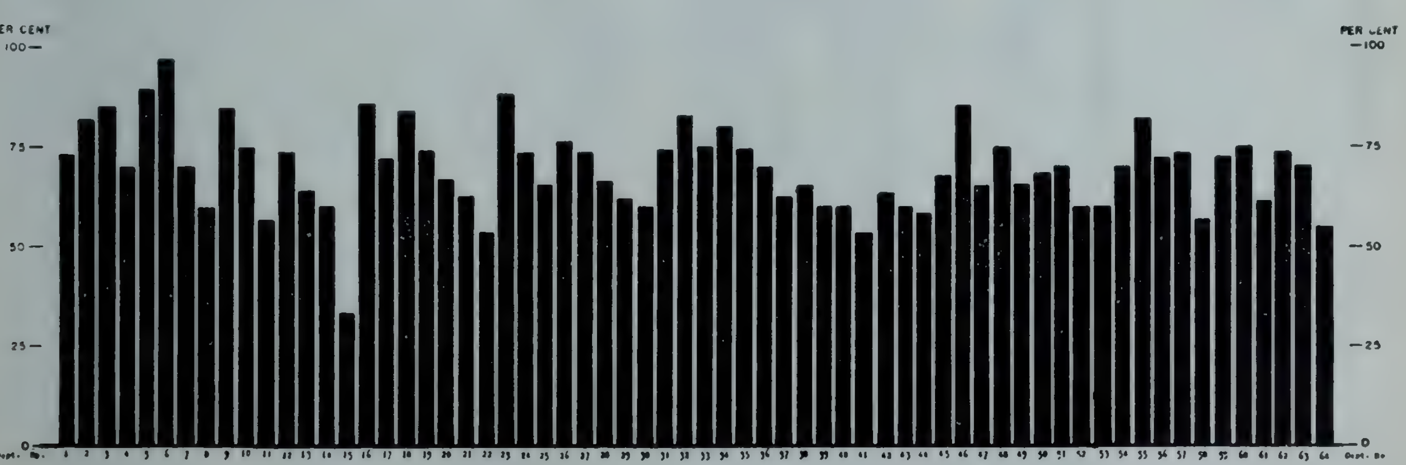



**Chart D—1940 departmental morale profile in the Florida Power and Light Company.**

In contrast to the vociferousness with which such opinion is expressed, there are studies, such as one reported by Chamberlin, which undertake to answer factually even on a small scale some of the questions of this type. In his investigation Chamberlin interviewed 200 men employed in textile mills in Massachusetts—100 union members and 100 non-union members. Their answers to his queries indicated that 90 per cent of union members and only 38 per cent of non-union members believed that the unions get results.

To a request for reasons for which they would join the union, non-union men gave the following in the order noted: (1) because fellow workers had joined; (2) because they desired a feeling of greater security; (3) because a union is the only way that the working man can get results; (4) because of a liking for such organizations.

The principal objection of non-union men to unions was the failure to get results (45 per cent) with the type of leader running a close second (41 per cent).

Both union members and non-union members showed a remarkable emphatic agreement that the strike is not the only way workers can get results, 87 per cent of union members and 100 per cent of non-union members answering "no" to the question on this item. However, there was close agreement between union members and non-union members that bankers and inventions are the causes of depression. Moreover, 88 per cent of union members and 65 per cent of non-union members agreed that mill owners do not treat the working man like a human being.

Summing up his results, Chamberlin points out that "The typical male textile worker in Massachusetts, who is about 33 years old, thinks that the textile unions are effective in obtaining results, but is unwilling to entrust to his union leaders the management of all of his labour problems, in spite of the fact that he has an adequate knowledge of the mental capacities of these leaders. On the other hand, our typical (textile) worker has no knowledge of what goes on behind the scenes at labour-management conferences.

"If a member of a union, he joined because he felt that it was the only way that the working man could get results, although he is not of the opinion that the only way workers can get results is to strike, and he considers it unfair to be called out on a 'sympathetic' strike. Contrary to the statements of union leaders, our typical (textile) worker is entirely satisfied with the number of hours in the work week, and his chief dissatisfaction is with wages, working conditions and management. As far as unions are concerned, he prefers a national to a company union. He is convinced that he can use his spare time effectively."

## In Conclusion

Such are examples of the scientific approach in the study of employee attitudes which underlie the will-to-work and play a predominant role in the development of conflict situations in our modern industrial civilization. Probably the most immediate and most pressing need, to further the harmonious relations so necessary to the war effort, is for a more complete understanding of the nature, the origin, and the operation of such attitudes. To arrive at such an understanding, with the aim of promoting a more effective and more satisfying application of human energy in occupational life—now and in the better years to come—is the major objective in the scientific approach to the problems of employee relations.

## APPENDIX I

### Typical Items from Questionnaire Used in Employee Attitude Survey Armstrong Cork Co.

*Hours of Work and Pay*

5. On the whole, are you given an equal number of hours of work in comparison with other employees in your department?

   1. Always More ( ); 2. Almost Always More ( ); 3. Given the Same ( ); 4. Most Always Less ( ); 5. Always Less ( ).

   I say so because. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

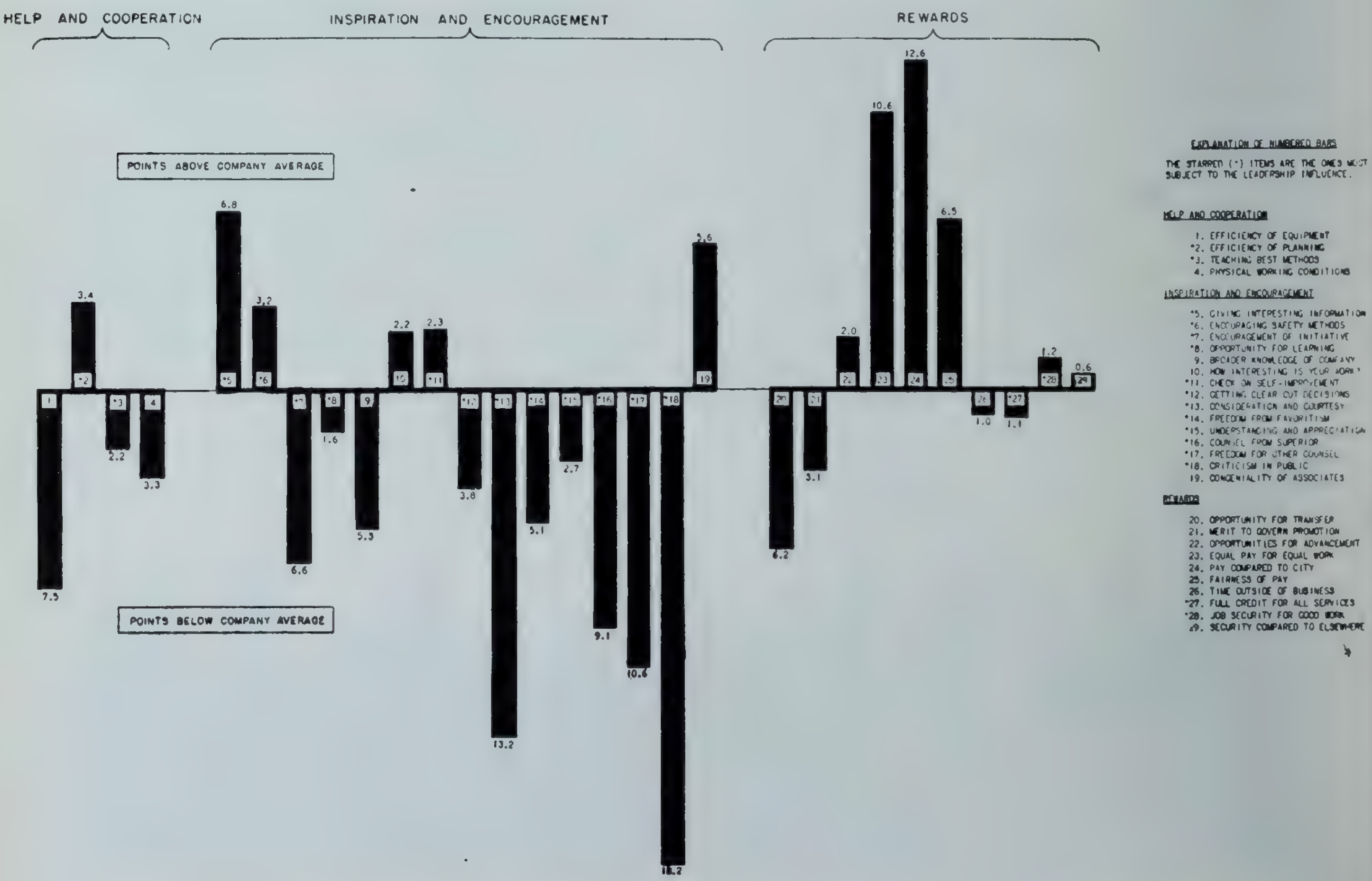



**Chart E—1940 morale profile of a single department in the Florida Power and Light Company.**

6. Do you understand how your pay is figured?
   1. Yes ( ); 2. No ( ).
   I suggest..............................................

12. All in all, does your superior give you fair treatment?
   1. Always ( ); 2. Almost Always ( ); 3. Sometimes ( ); 4. Seldom ( ); 5. Never ( ).
   I say so because..............................................
   I suggest..............................................

13. If you thought you were qualified for a better job that might open up, do you feel that you would be given fair consideration?
   1. Yes ( ); 2. Probably ( ); 3. Doubtful ( ); 4. Would Get None ( ).
   I say so because..............................................
   I suggest..............................................

17. Taking all things in all, I think the Armstrong Cork Company is
   1. The Best Place to Work I Know ( ); 2. A Poor Place to Work ( ); 3. As Good as Most Places I've Heard of ( ).

From J. J. Evans, Jr., "Supervisors Conduct Attitude Survey," *Personnel*, 1940, 17, p. 142, ff.

# DISCUSSION

**(The Committee earnestly invites further discussion on the subject of industrial relations. Several members of the Institute in their daily task have to deal with this important phase of our social organization. It is requested that they share with their fellow-members the benefit of their experience. Contributions from non-members will be welcomed as well and should be forwarded to Headquarters of the Institute, 2050 Mansfield Street, Montreal, Que.)**

Captain J. A. Kitchen[1]

The Director of Personnel Selection for the Canadian Army was instructed about a year and a half ago to carry out duties in the army similar to those performed by personnel or industrial relations men in industry.

In the army we have men of every type, some of whom are exceptionally brilliant; it is of primary importance that that ability should not be wasted. Now, when these men come into the army we know nothing about them. They may be of any grade of intelligence or capacity. Therefore, they are given a preliminary test, commonly known as the "M Test," which gives some idea as to their ability in various subjects. This includes a very practical short interview, which is not on any particular line, but is a general and friendly conversation. All results are recorded, and as each man goes from his recruiting centre to his place of basic training that information is available to the personnel men at those points. In that way we are able to follow any peculiarity or exceptional ability that a man may have.

For example, officer material is looked for, so that if a man comes up and reaches the necessary standard as he goes through his courses he will be given an opportunity for an officers' training course.

During his training after his basic training, which everyone must take, he is selected for a particular arm—artillery, engineers, ordnance, armoured corps—according to his aptitude and special requirements.

He may be chosen for technical training. For example, in the army, we need highly technical men in connection with devices used by the artillery. We have specific requirements and tests for those men; there are also other highly specialized technicians, in whose case requirements are based on the lines mentioned earlier this afternoon, and shown by the graphs and the charts that were exhibited.

Morale is an important point in dealing with selection. Morale means much in industry, for if you get a man working for you whole-heartedly, putting everything he has into his job, he will do far more than by any driving method. This has been proved by the experience of the last war. Thus it is part of our job as personnel people in the army to encourage men who go behind in their training, or who become despondent.

Frequently men find it difficult to have conversations with their own officers, due to the regimentation that must exist in any army, but any man is always at liberty to contact a personnel officer, and as a result such officers are able to do much to promote morale.

Dr. K. S. Bernhardt[2]

After listening to Dr. Viteles' paper any psychologist like myself would be proud that our science is making such an admirable contribution to personnel work.

If we were to ask the so-called "man in the street" for his comments about the world in which he lives to-day, he would probably remark that he is amazed at the enormous strides we have made, technologically, and at what the engineers have been able to do with material, but that he is horrified, to put it mildly, at the messes that we quite frequently get into in terms of social relationships.

Perhaps the most valuable feature in this afternoon's session has been the demonstration that scientific methods and technique can be amplified to problems of human relationships in much the same way that they can be applied to physical materials. We still have a lot to learn and the real demonstration of scientific technique in action in dealing with human material is something that we need more and more of.

There is a feeling on the part of a good many people, especially in industry, that there may be something in these tests that the psychologists talk about. In fact, some industrialists have gone so far as to apply such tests and have been partly disappointed that they did not work, as anticipated, and partly glad, because they did not think the procedure was any good anyway. But the attempt to use such scientific methods without the kind of steps that Dr. Viteles has outlined so well is, of course, doomed to failure.

In Dr. Bryce Stewart's address, one thing that he said near the end should be underlined. After we had followed him through the intricacies of the machinery of industrial relations programmes, we came to the core of the whole problem, namely, as Dr. Stewart suggests, that the spirit of the thing is much more important than the machinery. That means the full recognition of the human factor in the situation.

A. U. Sanderson, m.e.i.c.[3]

I would like to ask Dr. Stewart if, generally speaking, he has found that the average working man in Canada is more interested in security for his old age, and if he is married, for his wife, than he is in obtaining the last few cents in wages. I have found that, generally speaking, the labouring man is more concerned about his security for the future than he is about a higher wage.

Dr. Bryce M. Stewart

In the devising and installation of pension plans it has been found almost always that interest in pensions rises with age. There is also a sex factor. In an organization which is composed largely of young employees, and many of those are women, their interest in pensions is quite low.

But you will find in the few that are up around 40 and over, a great interest. So I just put it that way. Men are all like when they are young. They are mainly out for a good time and it is pretty hard then to sell life insurance, as you know. But once they make the turn of the middle thirties and often shortly after they are married, the interest in pensions mounts very rapidly and from that period they are much more concerned in seeing the pension than seeing another dollar or two in the pay envelope.

V. S. Foster, m.e.i.c.[4]

Regarding the block tests which Dr. Viteles has mentioned I noticed that if you look at the blocks long enough you see a different number of blocks. I am wondering which answer you base your results upon?

[1]Army Examiner, District Depot No. 2, Military District No. 2, and President of the Trades Testing Board, Toronto, Ont.
[2]Department of Psychology, University of Toronto.
[3]Chief Engineer, Water Supply Section, Department of Works, City of Toronto.
[4]Induction Motor Engineer, Canadian General Electric Co., Peterborough.

Professor M. S. Viteles

That is an interesting question; but the change in number occurs only with prolonged exposure of the blocks. That test is taken in three minutes by those to whom it is given and there is not time for the change in point of orientation that you experienced.

That is a very interesting thing. I must have shown these pictures on the screen some fifty times, and you are the first man who has ever noticed that. The first answer is right. That is the one that comes with the short exposure.

Professor E. A. Allcut, m.e.i.c.[5]

Remarked that he did not have the opportunity of seeing the test results and the diagrams of which Dr. Viteles had spoken but he had prepared the following contribution to the discussion.

Professor Viteles draws a parallel between the specification and supply of materials, and the specification of jobs and the supply of suitable workers to do them. If this procedure could be carried out accurately and surely, the process would indeed be scientific, but the field of industrial relations is so full of imponderables and unknown factors, that personnel management appears to be more of an *art* than a *science*. The smaller the knowledge of the inside of a material, the larger is the "factor of safety," or "factor of ignorance," that must be applied to its use. If this be so with materials which can be weighed, measured, analysed and tested, that stay where they are put and can be transported or manipulated at will, still more must it be the case with people, whose reactions are frequently dictated rather by prejudice than by reason, whose ideas and ideals change and who are sometimes mere pawns moved by able and unscrupulous hands. The problems of the psychologist are, therefore, complicated and, while some of us feel that progress is being made toward their solution, we also feel that, in many instances, the consistency and significance of the test results are over-estimated. Too much emphasis is placed on averages and the fact is frequently ignored that there are more exceptions to some of the "laws" than there are examples of them. In the long run, it is the individual who has to be dealt with if misfits, excessive labour turnover and other personnel troubles are to be avoided.

The paramount importance of the personality of the supervisor has been rightly stressed. The forceful, tyrannical type is only a little less obnoxious than the mean, nagging busybody—both are foci of discontent and, on the whole, probably cause more trouble than do questions of wages. Also, in the writer's experience, the form of the wage formula is less important than is the method of *applying* it. Question 6 (Appendix I) has a distinct bearing on this matter, as workers are usually suspicious of what they do not understand and it is important, therefore, that wage incentive systems should be simple and should give prompt returns. Mutual confidence is imperative if satisfactory personnel relationships are to be obtained and maintained.

Another significant remark is that "there was close agreement between union members and non-union members that bankers and inventions are the causes of depression." The writer knows nothing about banking, but the old bogey that research and invention produce unemployment takes a lot of laying. Eighteen new industries introduced within the last fifty years or so are responsible for one fourth of all employment in the U.S.A., and most of the products of the electrical and chemical industries were unknown twenty years ago. If statistics prove anything, they do show that invention has produced far more employment than it has displaced.

Dr. J. B. Challies, m.e.i.c.[6]

I remember a very eminent, greatly beloved Anglican Minister in Montreal. People said that all through his life he comforted the afflicted and afflicted the comfortable.

Dr. Stewart and Dr. Viteles have afflicted the comfortable in this case, because the company that I have the honour to be associated with, a utility organization in the province of Quebec, has always been proud of the personnel relations of the four or five thousand people on the staff. It now appears that we have been babes in arms; we have learned to-day from these gentlemen something which will enable us to attempt, with the advice of such experts, to do something far better than has been done so far.

I feel that this year under President Young has been one of the most constructively successful in the history of the Institute, and one of the most satisfactory accomplishments has been the setting up of this Committee on Industrial Relations under the able chairmanship of Mr. Maclachlan.

A. U. Sanderson, m.e.i.c.

While I appreciate that Dr. Viteles in adopting the test for employment of personnel was trying to choose the best men for a certain type of labour, what would happen to the under-average man if all employers used this scientific method of choosing personnel?

Professor M. S. Viteles

The answer to that is very simple. The under-average man gets the job in which he ought to be, instead of getting the job he can't handle, and there is a place for the under-average man. The difficulty is that usually he is not recognized as under-average. The problem is one of application and distribution of labour, making the best use of what you have.

What can happen, not only with the under-average man, but also the very-much above-average, is perhaps illustrated in a study made for a department store some years ago. The store was selecting wrapper girls, who spend all day wrapping packages to be handed out to customers. We used a test and discovered that girls who made scores of below thirty on the test did not meet the wrapping standards on that job. On the other hand, girls who made sixty-five on the test did not stay long enough on the job for the company to be repaid for the time and money that was used in training them as wrappers. Evidently for that particular job it was just as undesirable to have a really superior person, as to have an under-average person. What was needed was an average person.

The problem is to take jobs in the plant, classify, pick the under-average man for the under-average job and the above-average man for the above-average job. And it must be remembered that the under-average man for one job may still be bright, he may be intelligent, but he may have poor mechanical dexterity. The fact that he is above average in intelligence, in mental ability, should not be a reason for placing him on any job where a high degree of skill is required. The problem is one of picking the man for the job in terms of exact specifications.

With reference to Professor Allcut's remarks, I should like to recall a statement made by a vice-president in charge of engineering of the Philadelphia Electric Company. He was telling about the installation of lightning protectors on their high tension lines, running a distance of ninety miles into Philadelphia. The question was: Should $300,000 be spent in putting in lightning arrestors on these lines?

When they started on the problem they found they did not know, to begin with, just how much voltage was generated in a particular stroke of lightning. They found they knew too little about the resistance of certain of the insulators, because they did not feel free to expose the insulators to sufficiently high voltage to test them as they should be tested and as he said there were other variables of which they were ignorant. Notwithstanding all this, they

[5]Professor of Mechanical Engineering, University of Toronto, Toronto, Ont.

[6]Vice-President and Executive Engineer, The Shawinigan Water & Power Company, Montreal.

spent the $300,000 for the lightning protectors, because it seemed like a good bet.

Now if the engineer is willing to do that, with all his fine technique, and when there are so few difficulties in the handling of material goods, as compared with those involved in the handling of human variables, the phychologist can perhaps be excused if he occasionally makes some guesses about the human element. Actually, the good psychologist does not guess as frequently as is supposed. If the test is adequately developed, the psychologist knows what the standards are, or has estimates for the accuracy of each score, and he can tell you when a man makes a score of 70, it really means that this score lies somewhere between 65 and 75. It is not a score of 70, because there is a standard error of estimate of five points on that score, and for that reason, he knows that the probability of that man making good cannot be expressed as a hundred per cent or as eighty per cent. We would say that the chances are between 70 and 90 per cent that that man will make good.

Here is another man with a score of 35. His score lies somewhere between 30 and 40, but the chances in his case for making good are somewhere between 20 and 30 per cent.

Now, those figures are available in standardized tests. This was not put in the paper but the concept of possibility to which I refer takes care of all the comments which Professor Allcut made. The situation remains one of dealing with probabilities. Actually we are interested in groups, say of a hundred people, available for a job.

We need twenty welders. Picking by chance, we will get ten above-average welders and ten below-average welders. Picking by means of scientific tests we will get 15 men or 17 men who are good or above-average. Let us get the 17, and not worry about the other three until we get the war done with.

Gordon McL. Pitts, m.e.i.c[7]

This scientific selection of personnel is very instructive. But how does organized labour respond to the acceptance of this principle, and how far do you think that the wages should be affected by the result of these tests?

Professor M. S. Viteles

Labour, I think, still remains suspicious of tests, just as labour was suspicious of medical examination when it was first introduced. That suspiciousness has largely disappeared, but not completely.

Well, there is the same attitude of suspicion towards psychological tests. I think that suspicion is unwarranted. I think labour will come to recognize, as some unions have already done, that the one way to settle the issue on selection with management is for labour to participate in the creation of the tests and to help set the standards. That would support some of their actions with respect to keeping certain men out of the union, whom they now keep out on a cash basis of fees—it would help to decide which men were most acceptable to the union and would strengthen the union because there would be less strife between management and labour with respect to the retention of certain men.

Such a movement had developed in Germany before the war, where labour unions participated in tests. In Russia, the labour unions were presumably running the tests. Practically all the Institutes where tests developed were supported by the labour unions, although the tests were by the government. In that country it is very difficult to find the dividing line between the labour union and the government. I hope a progressive movement will bring labour into the fold to the advantage of all parties.

With respect to wages, so far as improved production is concerned, I believe that part of that return should go back to the worker. I think that is the attitude of progressive management. It is a matter of education. Labour needs education just as well as management.

Chairman Maclachlan

In the matter of the medical examination, many of us have been emphatic in connection with colour blindness, where there is choosing of colours and distinguishing between a red and a green light, and so on. Yet we were told in this room yesterday that the R.A.F. was using colour blind people to see through camouflage.

In England I personally observed during the last war the use of blind people in winding transformer coils and winding machine coils. They made fewer mistakes than people with sight. Yet many would reject the blind. If you find a place for these various people then you gain the advantage.

By these tests for placement, for selection and use in certain specific things you will get an advantage to management and to the man.

Professor J. A. Long[8]

As a psychologist in a gathering mainly of engineers, I would like to put in a brief word for the psychologist.

I have the honour to be a member of the Faculty of the University of Toronto and we have a School of Engineering there, where certain examinations are conducted every year, presumably with the desire of selecting people who will become good engineers, and flunking those who will not. I think they are not a hundred per cent successful, because some who fail, if allowed to continue, would have made acceptable engineers, and some of those who pass do not turn out according to expectations.

I believe that what can be done in two or three hours, by a set-up such as Dr. Viteles describes is almost as successful in picking out, in separating the sheep from the goats, as what the Engineering Faculty does in testing over three or four years.

W. C. Smith, m.e.i.c[9]

I find myself rather confused in regard to personnel selection because first, I was raised in a trade union mechanic's home, graduated into engineering and then became involved as an employer.

This transition has given me an appreciation for both sides.

In the lifetime of men who are working there are three distinct periods—the younger period of working, the middle period and the older period, when they are settled.

In my opinion, a great mistake is made in plants where they do not permit the employing of men over 42 years of age. That unsettles men from the age of 38 to 42 to an unbelievable degree. If they are laid off they lose their seniority, they were out on their neck and nobody will hire them. That is one thing that should be corrected from the standpoint of the employers.

Under the selection system, a man on entry is allocated to a certain branch in the plant. If the foreman and the sub-foremen are not conversant with the selective method, then there is not the progress there should be. The selection system should continue so that the man is not stuck in a groove, but allowed to advance in accordance with his merits.

As regards trade unions—they are undoubtedly against scientific selection in a general way. Education will not correct this, in so far as the men are concerned, because their education comes through delegates, to use a polite term—or agitators, to speak less delicately—and there are both classes in labour.

Most men realize their limitations in any operation. Most men are honest in the back of their minds. If they are getting a fair deal they are satisfied and if personnel management, through their foreman and sub-foremen in the large shops are interested in seeing that they get a fair deal, and demonstrate that interest by their improvement from time to time, happier relationships will exist in our plants. But we cannot expect full happiness in our plants until the unions are so organized that they represent the interests of the men and not the interests of the delegates.

[7]Member of the firm Maxwell & Pitts, Architects, Montreal.

[8]Professor of Educational Research, University of Toronto.

[9]Manager of Engineering Division, Cooksville Company Limited, Toronto, Ont.

# THE FIFTY-SEVENTH ANNUAL GENERAL MEETING

**Convened at Headquarters, Montreal, on January 15th, 1943, and adjourned to the Royal York Hotel, Toronto, on February 11th, 1943**

The Fifty-Seventh Annual General Meeting of the Engineering Institute of Canada was convened at Headquarters on Friday, January fifteenth, nineteen hundred and forty-three, at eight o'clock p.m., with President C. R. Young in the chair.

The general secretary having read the notice convening the meeting, the minutes of the Fifty-Sixth Annual General Meeting were submittted, and, on the motion of deGaspé Beaubien, seconded by John G. Hall, were taken as read and confirmed.

### Appointment of Scrutineers

On the motion of George H. Midgley, seconded by H. R. Little, Messrs. G. D. Hulme, H. Massue, and A. G. Moore, were appointed scrutineers to canvass the officers' ballot and report the result.

There being no other formal business, it was resolved, on the motion of J. R. Auld, seconded by P. E. Poitras, that the meeting do adjourn to reconvene at the Royal York Hotel, Toronto, at nine-thirty a.m. on the eleventh day of February, nineteen hundred and forty-three.

### Adjourned General Meeting at the Royal York Hotel, Toronto, Ont.

The adjourned meeting convened at ten o'clock a.m. on Thursday, February 11th, 1943, with President C. R. Young in the chair.

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1943 as follows:

Nominating Committee—1943

*Chairman:* G. A. Vandervoort

| *Branch* | *Representative* |
|---|---|
| Border Cities | C. G. R. Armstrong |
| Calgary | F. K. Beach |
| Cape Breton | J. R. Morrison |
| Edmonton | J. Garrett |
| Halifax | I. P. Macnab |
| Hamilton | A. Love |
| Kingston | H. W. Harkness |
| Lakehead | E. L. Goodall |
| Lethbridge | N. H. Bradley |
| London | F. T. Julian |
| Moncton | H. W. McKiel |
| Montreal | E. R. Smallhorn |
| Niagara Peninsula | A. L. McPhail |
| Ottawa | W. H. Munro |
| Peterborough | W. T. Fanjoy |
| Quebec | A. O. Dufresne |
| Saguenay | S. J. Fisher |
| Saint John | V. S. Chesnut |
| Saskatchewan | H. R. MacKenzie |
| Sault Ste. Marie | L. R. Brown |
| St. Maurice Valley | M. Eaton |
| Toronto | Wm. Storrie |
| Vancouver | W. O. Scott |
| Victoria | S. H. Frame |
| Winnipeg | H. L. Briggs |

### Awards of Medals and Prizes

The General Secretary announced the awards of the various medals and prizes of the Institute as follows, stating that the formal presentation of these distinctions would be made at the annual dinner of the Institute that evening:

*Gzowski Medal*—To Dr. S. D. Lash, M.E.I.C., Kingston, for his paper "Analysis and Design of Rectangular Reinforced Concrete Slabs supported on Four Sides."

*Duggan Medal and Prize*—To J. H. Maude, M.E.I.C., Montreal, for his paper "The New Oil-Hydraulic Press in Munitions Manufacture."

*Plummer Medal*—To Professor E. A. Allcut, M.E.I.C., for his paper "Producer Gas for Motor Transport."

*Leonard Medal*—To Paul Billingsley, Burton, Washington, and C. B. Hume, Hedley, B.C., for their joint paper "Ore Deposits of Nickel Plate Mountain."

*Julian C. Smith Medals*—"For Achievement in the Development of Canada"—To Henry Girdlestone Acres, M.E.I.C., Niagara Falls, and Robert Melville Smith, M.E.I.C., Toronto.

### Students' and Juniors' Prizes

*John Galbraith Prize*—(Province of Ontario)—To Robert J. G. Schofield, Jr.E.I.C., Hamilton, Ont., for his paper "Cotton Yarn Dyeing."

*Phelps Johnson Prize*—(Province of Quebec)—(English)—To Paul O. Freeman, S.E.I.C., Montreal, for his paper "Cold Rivetting—Its Principles, Procedure and Advantages."

*Ernest Marceau Prize*—(Province of Quebec)—(French)—To René Dansereau, S.E.I.C., Montreal, for his paper "Etude comparative de la construction par rivure et par soudure d'un pont route en acier."

### Report of Council

On the motion of B. G. Ballard, seconded by R. E. Heartz, it was resolved that the report of Council for the year 1942, as published in the February *Journal*, be accepted and approved.

### Report of Finance Committee, Financial Statement and the Treasurer's Report

On the motion of J. E. Armstrong, seconded by G. G. Murdoch, it was resolved that the report of the Finance Committee, the financial statement and the Treasurer's report, as published in the February *Journal*, be accepted and approved.

### Reports of Committees

On the motion of R. B. Chandler, seconded by G. M. Brown, it was resolved that the reports of the following committees be taken as read and accepted: Board of Examiners and Education, Post-War Problems, Western Water Problems, Civil Defence, Membership, Professional Interests, Industrial Relations, Legislation, The Young Engineer, Library and House, International Relations, Deterioration of Concrete Structures, Publication, Papers, and Employment Service.

### Branch Reports

On the motion of J. W. Falkner, seconded by R. C. McMordie, it was resolved that the reports of the various branches be taken as read and approved.

### Aid to Engineers' Families

Having regard to By-law 32 which states "The Council shall not incur any expenditure for extraordinary purposes unless previously authorized to do so at an annual general meeting," and to the fact that because of the war there are in Canada to-day several members of families of engineers ordinarily resident in the British Isles, and that in the future additional persons may come to this country under similar circumstances, on the motion of H. E. Brandon, seconded by J. M. Gibson, it was unanimously resolved that

Council be authorized at this annual general meeting to incur such expenditures as Council may consider to be appropriate to aid in the support of these families, providing such persons are referred to the Institute by sister societies in the British Isles.

### Recognition of Twenty-five Years Service

In appreciation of twenty-five years of loyal and intelligent service to the Institute, the president called Miss Ellen L. Boyden, the Institute accountant, to the platform, and on behalf of himself and Council and all the members, thanked her for all she had done. He then called on Secretary-Emeritus R. J. Durley, and Mr. Durley, speaking on behalf of the three general secretaries with whom Miss Boyden had worked, expressed his pleasure at participating in this ceremony of recognition. On behalf of the Institute he presented her with a bouquet of flowers.

### Election of Officers

The general secretary read the report of the scrutineers appointed to canvass the officers' ballot for the year 1943 as follows:

| | |
|---|---|
| *President* | K. M. Cameron, Ottawa |
| *Vice-President:* | |
| Zone A (Western Provinces) | W. P. Brereton, Winnipeg |
| Zone B (Province of Ontario) | L. F. Grant, Kingston |
| Zone C (Province of Quebec) | C. K. McLeod, Montreal |
| *Councillors:* | |
| Vancouver Branch | C. E. Webb |
| Edmonton Branch | E. Nelson |
| Saskatchewan Branch | A. M. Macgillivray |
| Lakehead Branch | H. G. O'Leary |
| Border Cities Branch | G. E. Medlar |
| London Branch | J. A. Vance |
| Toronto Branch | H. E. Brandon |
| Kingston Branch | A. Jackson |
| Ottawa Branch | N. B. MacRostie |
| Montreal Branch | E. V. Gage |
| | J. A. Lalonde |
| Saint Maurice Valley Br. | H. J. Ward |
| Saguenay Branch | J. W. Ward |
| Saint John Branch | J. P. Mooney |
| Halifax Branch | C. Scrymgeour |

On the motion of E. D. Gray-Donald, seconded by Viggo Jepsen, it was resolved that the report of the scrutineers be adopted, that a vote of thanks be tendered to them for their services in preparing the report, and that the ballot papers be destroyed.

It was announced that the newly elected officers would be inducted at the annual dinner of the Institute that evening.

Before delivering his retiring address President Young expressed his feeling of indebtedness to his friends in the Institute for selecting him as president for the year 1942. It had been a source of great pleasure and satisfaction to him to serve in this position, following, as he had, many men of great eminence in the profession of engineering in this country. His address, "The Days Ahead," will be found on page 115 of this issue of the *Journal.*

On the motion of E. P. Muntz, seconded by A. MacQuarrie, it was unanimously resolved that a hearty vote of thanks be extended to the Toronto Branch for their hospitality and activity in connection with the Fifty-Seventh Annual General Meeting.

On the motion of G. E. Booker, seconded by Huet Massue, it was unanimously resolved that a hearty vote of thanks be accorded to the retiring president and members of Council in appreciation of the work they have done for the Institute during the past year.

There being no further business, the meeting adjourned at ten-forty-five a.m.

## THE GENERAL PROFESSIONAL MEETING OF 1943

When planning began for the Annual Meeting of 1943, it was a question whether its activities should be limited to the transaction of such business as is necessary for the proper management of Institute affairs, or whether, under war conditions, it would be proper to hold professional sessions, together with a modest programme of social events. After receiving the approval of the Ottawa authorities, the latter course was adopted; this decision was amply justified by the success of the meeting which has just concluded. Not only were the papers and addresses helpful as contributions to the war effort, but the many members who attended from all over the Dominion had opportunities of meeting informally and exchanging ideas on their wartime activities in a way which would otherwise have been impossible. Further, each technical session was devoted to the discussion of some topic of special importance at this stage of the war.

The Toronto Branch deserved and received the thanks of the Institute for the very effective way in which this policy was carried out. Its committees, besides undertaking the detail organization of the meeting, had much to do with the smooth functioning of the professional sessions. As already mentioned, these were all of a somewhat unusual type. They were extremely well attended by members and visitors, who appreciated the effective way in which the subjects were presented and the value of the preparatory work which resulted in such instructive discussions.

A striking feature of the meeting was an exhibition of war material and photographs in the foyer of the Convention Floor of the hotel. This was made possible by the kind cooperation of several of the Canadian companies engaged in the production of basic war equipment, and had the approval both of the Department of Munitions and Supply, and the Wartime Information Board. Among the interesting exhibits may be mentioned components and assemblies of the latest patterns of such weapons as the Browning machine gun, the Bren gun, the Sten carbine and the Lee-Enfield rifle. The products of the newly established Canadian optical glass industry were well displayed, together with the range finders, gun-directors, binoculars and other instruments in which they are being used so successfully. These exhibits, with many others, served well to indicate the diversity of Canadian wartime arms manufacture.

Facilities were also given for visiting the remarkable exhibition of machine parts, components, castings, forgings and so on, organized at 51 Bathurst Street by the Department of Munitions and Supply, to show what has already been accomplished in saving critical materials by changes in design or technique which made possible the use of substitutes for materials previously employed.

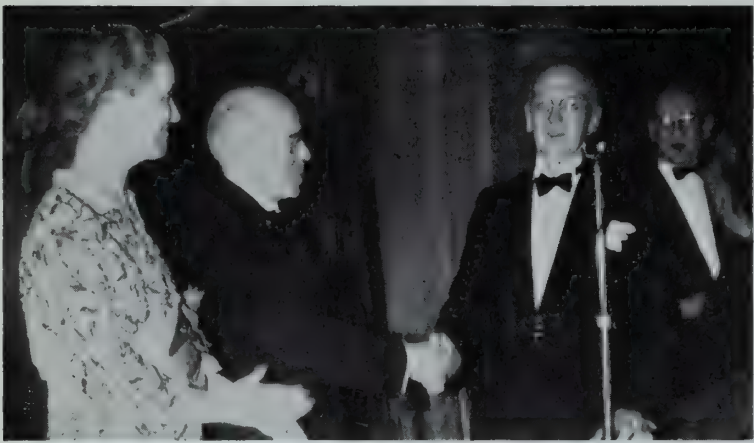
In order to avoid any interference with war production, no plant visits were arranged for this annual meeting—a departure from the usual practice which met with general approval.

The first professional session on the morning of Thursday, after the general business meeting, was necessarily a short one. The topic was "The Engineering Features of Civil Defence". Interest in this matter has been stimulated by the lectures delivered last year by Professor Webster and by the activities of an Institute committee which includes members from practically every branch of the Institute, who take part in the work of its various local sub-committees.

The committee's chairman, John E. Armstrong, presided and gave a general statement, after which the chairmen of sub-committees, Messrs. H. F. Bennett, R. F. Legget, I. P. MacNab, and G. McL. Pitts spoke briefly on their respective divisions of the subject which are Structural Defence Against Bombing, Organization for Repair of Damage, Specifications for Air-Raid Shelters, and Protection of Buildings. Although the time available was limited there was a lively discussion and all present agreed that real progress was being made. The material presented will be published in *The Engineering Journal* as space permits.

(*Continued on page 140*)

# CLOSE-UPS OF THE BANQUET PROCEEDINGS



*Above:* **K. M. Cameron takes over from C. R. Young.**

*Above:* **Dr. Edward C. Elliott, president of Purdue University, the guest speaker.**

*Right:* **H. G. Acres receives from his class-mate, the Julian C. Smith Medal.**

**President Young introduces Ezra B. Whitman, president of the A.S.C.E.**

*Below:* **H. V. Coes, president of the A.S.M.E., greets the Institute.**

**Prof. E. A. Allcut receives the Plummer Medal.**

**The president presents the Gzowski Medal to Dr. S. D. Lash.**

*Right:* **J. L. Bennett, president of the American Institute of Chemical Engineers, presents greetings from his society.**

*Below:* **Past Vice-President E. P. Muntz.**

# SPEAKERS AT MEETINGS

Brig.-Gen. C. L. Sturdevant speaks on The Alaska Highway at the Thursday luncheon.

Vice-President Lieut.-Col. L. F. Grant introduces the speaker, Desmond A. Clarke, on his right. On his left, K. M. Cameron and R. A. Elliott, president, Association of Professional Engineers of Ontario.

Retiring president's dinner. *Left to right:* Past-Presidents T. H. Hogg and C. J. Mackenzie, Brig.-Gen. C. L. Sturdevant, President C. R. Young, Past-Presidents J. M. R. Fairbairn and O. O. Lefebvre.

Prof. M. S. Viteles of Philadelphia speaks on "A Scientific Approach to the Problems of Employee Relations."

Colonel A. L. Bishop thanks Desmond A. Clarke.

Dr. Bryce M. Stewart contributes to Industrial Relations, his paper on "The Role of the Industrial Relations Executive in Company Management."

***Above, from left to right:*** **President K. M. Cameron, H. W. Lea, Nicol MacNicol, Col. W. S. Wilson, Mrs. Wilson, Lieut.-Col. L. F. Grant and J. J. Spence.**

***Above, left to right:*** **J. P. McRae, J. G. Hall and J. T. Farmer.**

**Lee-Enfield rifle parts are examined by W. E. Bonn, E. G. Hewson, T. S. Glover and J. R. Dunbar.**

**Optical glass under the scrutiny of,** ***from left to right:*** **A. R. Hannaford, E. G. Ratz, L. B. Chubbuck and W. B. Buchanan.**

**A Department of Public Works group.** ***Left to right:*** **O. S. Cox, H. F. Bennett and F. G. Goodspeed.**

## THE GENERAL PROFESSIONAL MEETING OF 1943

(*Continued from page 137*)

After luncheon, at which Brigadier-General C. L. Sturdevant, U.S. Corps of Engineers, gave an illustrated address on the work of that Corps in constructing the Alaska Highway, the professional meeting took up problems of Industrial Relations. Two papers were presented and discussed, under the chairmanship of Wills Maclachlan, as follows: "A Scientific Approach to the Problems of Employee Relations" by Professor M. S. Viteles of the University of Pennsylvania, and "The Role of the Industrial Relations Executive in Company Management" by Dr. Bryce M. Stewart of the Industrial Relations Counselors, Inc., of New York. Professor Viteles is Director of Personnel Research and Training for the Philadelphia Electric Co., while Dr. Stewart has, for the past two years, been Deputy Minister of Labour for Canada. The subjects were thus treated authoritatively by persons of wide experience, and the papers were followed by considerable discussion. They appear in this issue of the *Journal.*

On the morning of Friday, an interested audience gathered to hear about two technical problems of war production —"The Statistical Control of Quality in Production" and "The Conservation of Critical Materials". The chairman at this session was Professor E. A. Allcut, who pointed out that these very broad topics, together with others dealt with at the professional sessions, had been selected for discussion in consultation with officers of the Department of Munitions and Supply.

The development of statistical control in recent years has been rapid, but many of its features are still in the debatable stage. Two papers were recently reprinted in

*The Engineering Journal**, as an introduction to this subject. The first speaker at the meeting was H. H. Vroom, of the Northern Electric Company, who is well qualified to discuss it, in view of the wide application of statistical control in the manufacture of telephone equipment. Following Mr. Vroom, H. H. Fairfield, Metallurgist, Department of Mines and Resources, Ottawa, spoke on the rational interpretation of test data in ordnance work.

The question of conservation of critical materials was considered by C. B. Stenning, Department of Munitions and Supply, who illustrated his remarks by reference to the Bathurst St. exhibition of components and machine parts, already mentioned, showing how substituted materials can be made to give satisfactory and, in some cases, even improved service.

These addresses and the resulting discussions will be duly recorded in the *Journal.*

At the luncheon on Friday, at which Lieut.-Col. L. F. Grant took the chair, the achievements of Canadian shipyards—and some of the difficulties they have overcome—were ably described by Mr. Desmond A. Clarke, the Director General of Shipbuilding, Department of Munitions and Supply. His address was appreciated by an attentive audience of 511 persons.

The closing professional session on Friday afternoon dealt entirely with various aspects of Post-War Planning and Reconstruction. Warren C. Miller, who presided, is chairman of the Institute Committee on that subject and was supported by members of his committee.

The discussion was opened by Hugh G. Cochrane who presented a paper entitled "Post-War Pattern". He was followed by J. C. W. Irwin, speaking on "Forestry Problems in Reconstruction" and Professor A. F. Coventry of the University of Toronto, who treated of "Soil and Water Conservation". There was a general discussion, after which, by special arrangement with and by the kind permission of Dr. H. H. Bennett, Chief of the Soil Conservation Service of the U.S. Department of Agriculture, a new documentary film was shown, entitled "A Heritage We Guard".

The chief non-technical event of the meeting was of course the Annual Banquet of the Institute on Thursday evening at which the induction of President K. M. Cameron took place and Dean Young relinquished the presidential office which he has filled so ably during the past twelve months. The Prizes and Medals of the Institute were presented. The speaker of the evening was Dr. Edward C. Elliott, President of Purdue University and Chief of the Professional and Technical Employment and Training Division, U.S. War Manpower Commission at Washington. His subject was "The Search for Might." In his address, after commenting on the narrow specialization which has now developed in the engineering profession, he observed that in the world to-day hope has largely been replaced by hate. As a result we are searching for might to destroy those who would destroy us. Our combat lines are held by machines. To produce, control and operate these we are searching for man-power, and must depend on statesmanship, leadership and disciplined strength of our people for a successful outcome. We are finding that the resources of nature and of man are limited. The answer is the broad and effective application of selective service.

The flashes of humour which Dr. Elliott emitted at brief intervals were in contrast with the serious nature of the message he delivered. Incidentally he referred in complimentary terms to the assistance given by the Institute's general secretary—while stationed in Ottawa—to the U.S. officials who are working on man-power problems in that country and have been in consultation with officers of the Canadian Government. The attendance at the dinner was close to 500.

After the dinner, the retiring president and Mrs. Young, the incoming president and Mrs. Cameron, together with the chairman of the Toronto Branch and Mrs. Wilson, held a reception previous to the dance which closed the evening's proceedings.

Other social events included parties on Friday afternoon and evening for the ladies, and a smoker with a variety show, to which members of the Association of Professional Engineers of Ontario were specially invited.

The Annual Meeting of that body was held on Saturday the 13th, and was preceded by a joint luncheon to which all members of The Engineering Institute were invited. This courtesy was greatly appreciated and is a welcome evidence of the spirit of co-operation between engineering societies which is so necessary for the progress of the profession.

The vote of thanks of the Institute to the Toronto Branch which was passed unanimously at the general meeting of the Institute was a sincere recognition of the effective manner in which the officers and members of that Branch had carried out the arrangements for a most successful gathering. Much credit for this result, achieved in spite of difficulties arising from war conditions, goes to the branch chairman, Lieut.-Col. W. S. Wilson, the committee's secretary, J. J. Spence, and to the twenty (or more) members who constituted the nine sub-committees which undertook the supervision of finance, paper and meetings, entertainments, hotel arrangements, registration, the reception and smoker, the exhibition, publicity and, last but not least, the welcome to the ladies. Particular credit belongs to Professor R. F. Legget for the systematic manner in which he attended to the work of the Papers Committee. The attendance throughout the meeting was far larger than had been anticipated, a fact which speaks well for the interest and loyalty of our Institute members. R.J.D

**The Engineering Journal*, January 1943, pp. 11-17.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## CANADA'S INDUSTRIAL PROGRAMME

From *Trade and Engineering* (London), December, 1942

The "all-out" programme of the Dominion authorities to complete the organization of Canadian industry and commerce for the most effective war service has been outlined in unambiguous terms, but many details still have to be formulated and put into operation, Mr. Donald Gordon, the Chairman of the Wartime Prices and Trade Board, told the recent convention of the Canadian Chamber of Commerce that each industry would be expected to submit its own proposals after the board had determined the required extent of curtailment of its civilian production.

One reason for the application of this planned direction to the newsprint industry has been the need to provide additional electric power for the manufacture of aluminium, pending completion of certain large projects now in course of construction. The very large requirements of timber for uses related directly to the war may necessitate diversion of loggers from the cutting of pulp wood and thus curtail the supply of raw material for the paper mills and cause a further reduction of the output of newsprint.

### IMPORTANCE OF SMALL ECONOMIES

An illustration of the importance of relatively small economies in civilian consumption is afforded by the statement by one of the Canadian Administrators that the saving in raw material effected by the regulations restricting the manufacture of hairpins and "bobby pins" was sufficient to produce 55,000,000 "of a certain-sized vital airplane bolt."

Successful substitution of Canadian wood pulps for cotton linters as the source of cellulose for use in the manufacture of nitrocellulose explosives is saving several million dollars annually. Experiments were undertaken during 1914-1918, but they were unsuccessful because no means was found to nitrate the wood pulp cellulose evenly. This difficulty has since been overcome, however, and one war-time explosives plant has been operating on wood pulp for more than a year, and two others have been utilizing it exclusively as a source of cellulose for some months.

In order to meet the needs of nickel-mining the Government called on the gold-mining companies in the Porcupine and Kirkland Lake areas in Ontario to provide 700 miners initially, and the Minister of Labour has stated that "upwards of 10,000" gold miners will be transferred to base metal mines and other war industries, in a "planned gradual movement" designed to dovetail with the decision of the United States War Production Board to halt all gold-mining in the United States. Several of the principal base-metal mining companies have decided to employ women on surface work, wherever feasible. It is expected that the curtailment of gold production will release certain equipment and facilitate the more thorough mechanization of the base-metal producers.

Investigation of chrome discoveries in the Bird River area in the Province of Manitoba has proved that the deposits are extensive and seems to justify hopes that they will provide the basis for a large chrome products industry in the Dominion. After a visit to the field by a member of its staff, the *Northern Miner* stated in a leading article that surface sampling and diamond drilling had indicated enough ore on the two main groups of claims to support plants each at least 1,000 tons capacity daily. The chromite occurs in strong bands of great length and good widths, with the chromite oxide content indicated as averaging at least 22 per cent. Utilization of the ore will entail a complex metallurgical problem, because of the high iron-to-chrome ratio, but Canadian research scientists are making an effort to devise a satisfactory solution.

### MORE PIGS AND SHEEP

The 10 per cent advance in hog prices resulting from the new agreement between the United Kingdom and Canada will benefit nearly all Dominion farmers. The expansion of hog production to supply war-time needs has been remarkable, and further impressive gains may be expected, aided by the abundance of feed grain in the prairie provinces. In spite of greatly increased marketings the hog population of the Dominion at well over 7,000,000 is about 1,000,000 greater than a year ago and more than double the number on Canadian farms in 1938. Enlargement of sheep-raising has paralleled closely that of hog production. Canada's sheep population has increased from a little more than 2,800,000 on December 1, 1941, to approximately 4,000,000, which will be available for shearing next year, and it is expected that the total will reach 5,500,000 in 1944. As a result of this expansion the Dominion's 1943 wool production is estimated at 28,000,000 lb., against between 19,000,000 lb. and 20,000,000 lb. this year. Canada's wool consumption amounts to about 150,000,000 lb. annually, but such total includes a large amount of fine wools of types not produced in this country.

Although the adoption of a general system of price ceilings in the United States should help to support the Canadian system, the situation here is still difficult, and there seems to be a need for even closer co-operation of the United States, the United Kingdom, and Canada, not only as regards allotment of supplies, but in respect also of the prices at which commodities are supplied. Prices of woollen fabrics of United Kingdom manufacture provide a case in point. While manufactured woollens sold in Canada are subject to the Canadian price ceilings, British prices on woollen cloths as established by the British Board of Trade were increased recently by 20 per cent with the result that Canadian agents of the British manufacturers were unable to accept orders. Such difficulties undoubtedly will be adjusted, but they could be avoided or at least eased by continuous consultation and close co-operation of the control organizations in the three countries. Canada's Price Stabilization Corporation is continuing its efforts to restrict and curtail cost-adjustment subsidies in respect of both imported supplies and goods of Canadian manufacture, but such subsidies, which represent a part of the cost of the price-ceilings policy, have mounted to an impressive total.

Progress has been made in developing, in Canada, drug ingredients which formerly were imported from Europe or other sources no longer available because of the war. A Toronto pharmaceutical house obtained belladona seed from botanical departments at Guelph, Ottawa, and Washington, and with the co-operation of a florist has grown sufficient belladona to provide a valuable reserve stock, replacing supplies which came principally from Bulgaria. The same firm has grown hyoscyamous, a drug used as a sedative, and last year it produced digitalis, but the roots were winter-killed. Peppermint leaves, from which menthol is extracted, are being cultivated from seed at several places in Ontario, and juniper berries also are being grown on a small scale. The experience and discoveries of the National Research Council of Canada in working with the Navy, some years ago, in testing milkweed floss have led to the adoption of this product as a substitute for kapok in life-preservers. United States scientists and industrialists have co-operated and a factory in Northern Michigan recently began commercial production of the milkweed floss.

### 6,000 MILES ACROSS AFRICA

From *Trade and Engineering* (London), December, 1942

Details were disclosed recently of an air route from West Africa to Egypt, over 6,000 miles of equatorial jungle bush, and desert, along which, during the past two years, thousands of British and American aircraft have been delivered to the Middle East Command. It arose out of the difficulties created when France fell, cutting off the normal supply route to the Middle East and creating the necessity for setting up a new one without delay. It was therefore decided to assemble the aircraft on the west coast and fly them across the vast continent of Africa to Egypt.

A small town was chosen originally as the most suitable starting point because of its harbour. There was an aerodrome already in existence but with extremely limited facilities. To-day that aerodrome is one of the biggest and best equipped in Africa, and there are others. The best and quickest route to Egypt from West Africa was found, and thousands of natives cleared big spaces in the jungle and bush to make emergency landing grounds for aircraft *en route*. Very soon everything was ready for the first convoy of aircraft to be flown to the Middle East. Nobody was quite sure how it would work. The difficulties were enormous —they still are, in spite of greatly improved facilities. But from the word go the venture was a success, and it was evident that there was the answer to Britain's supply route problem so far as aircraft were concerned.

POLISH PILOTS

As more aircraft were shipped from Britain and America for assembly and delivery so more pilots were required, and nearly 100 of the most experienced Polish pilots in Britain were sent out to become part of an organization which was rapidly developing. Although practically all fell victims to malaria on arrival, the Poles quickly took their places in the scheme of things and even managed to find time to attend daily classes in English.

At the start it was mostly Hurricanes and Blenheims that arrived at the assembly point, but very soon the first of American Marylands and Tomahawks came along. The machines arrived by ship in crates and had to be assembled in the local workshops, which were expanding daily. At first only two or three convoys of aircraft made the trip each week, but latterly such convoys have been a daily occurrence. Each journey takes over 24 flying hours, excluding putting down at the various landing-grounds *en route*, where aircraft are refuelled and the engines inspected. The fighters carry additional petrol tanks, as otherwise they could not make the long "hops" between the landing-grounds. Naturally enough the daily hazards which accompany this cross-continent ferry service have produced stories of individual exploits and endurance. For the most part, however, the convoys get through without incident. Established along the route now is a chain of aerodromes, each with its R.A.F. ground staff, and with a fresh supply of fuel, spare parts and a workshop.

### SHIPS RESISTANCE

From *Trade and Engineering* (London), December, 1942

EFFECTS OF FOULING

With the growth of knowledge of naval architecture the power required for propelling a ship in fine weather under ideal conditions has been reduced, but the benefits of this are diminished by the serious loss constantly incurred in service through the fouling of the hull if the intervals between dry-docking and painting are unduly prolonged. This deterioration of the underwater surface results, generally, from the adhesion of seaweed and shell, and the extent to which it occurs depends largely upon the proportion of a ship's time spent in harbour, where, it is thought, the fouling organisms attach themselves. Thereafter the growth increases in direct relation to the length of time between dry-dockings.

LOSS OF SPEED

As a general rule the skin friction of a ship increases at a rate of about ¼ per cent a day out of dock in temperate waters and about ½ per cent in tropical waters. On this basis the speed of a freighter may be reduced by about one knot after 100 days out of dock, and actual trials have shown the speed of relatively fast ships to be reduced by four knots after 120 days' service in tropical waters. A further factor in the problem is that increased resistance of the hull form acts as a drag upon the propeller, so that the machinery is incapable of developing its full output. In considering the matter statistically it must be borne in mind that marine growth is particularly sensitive to the conditions of service, and if the fouled ship enters a fresh-water port the fouling organisms are speedily killed and their growth stopped, although they may adhere to the surface. For this reason there is little fouling with ships on the North-Atlantic trade plying between fresh-water ports on the Clyde and St. Lawrence

Most anti-fouling compositions incorporate ingredients that will have a toxic effect on the attaching organisms. The efficacy of poisons in ship paint, however, is now being questioned on account of the difficulty of maintaining a sufficient concentration to have the desired lethal effect, and investigations of the effects of light and colour on fouling have been proceeding for some time in America. The tests have shown that the marine larvae responsible for fouling tend to attach themselves in the shaded areas, while the algae responsible for weed growth react positively to light. This confirms the general experience that weeds form thickly over an area four to five feet below the water line and that the worst fouling from shell growth is concentrated on the flat bottom and behind the bilge keels. Tests on panels of various colours have shown that the density of fouling is much less on those of lighter colour, increasing progressively from white, buff, green and red to black. Later experiments carried out in Germany have confirmed these conclusions, showing the extent of fouling on plates of red and green colouring to be in the ratio of six to one. These experiments are particularly suggestive as red is the colour most commonly used in anti-fouling paints.

### THE NEW BATTLESHIPS H.M.S. "ANSON" AND H.M.S. "HOWE"

From *The Engineer* (London), October 23, 1942

On Wednesday, October 21st, it was officially announced by the Admiralty that two further battleships of the "King George V" class—H.M.S. "Anson" and H.M.S. "Howe"— are now at sea with the Fleet. The "Anson" was laid down in July, 1937, and was built and engined on the Tyne, her hull being entrusted to Swan, Hunter and Wigham Richardson, Limited, and her machinery to the Wallsend Slipway and Engineering Company, Limited. H.M.S. "Howe" was laid down at the Govan yard of the Fairfield Shipbuilding and Engineering Company, Limited, on the Clyde, where she was built and engined. Each ship has the following principal particulars:—Displacement, 35,000 tons; length, 739 ft. 8 in.; beam, 103 ft.; and mean draught, 27 ft. 8 in. The armament includes ten 14 in. guns, sixteen 5.25 in. guns, and four multiple pompoms, besides several smaller guns. The 14 in. guns, it is stated, are of a new model, which has an effective range greater than that of the 15 in. guns which were mounted in earlier ships. The design includes enhanced defence against air attack. Provision is made for the carrying of four aircraft on each ship. The propelling machinery comprises a quadruple-shaft arrangement of Parsons geared turbines, taking steam from Admiralty type three-drum oil-fired boilers. The total shaft horsepower for each ship is about 152,000, corresponding to a speed of something over 30 knots. The complement of officers and crew is 1,500. H.M.S. "Howe" is commanded by Captain C. H. L. Woodhouse, R.N., who commanded the cruiser "Ajax" at the battle of the River Plate, and the "Anson" by Captain H.R.G. Kinahan, R.N. The "Howe" has been adopted by the City of Edinburgh and the "Anson" by the City of London.

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

### CONFUSION IN COLLEGE

Students of engineering in Canadian universities are more fortunate than their neighbours to the south. In Canada, at least the student knows the relationship between his responsibilities to the active services and his educational course. He knows he will be deferred sufficiently from the call-up to allow him to finish his course, providing he meets certain simple but clear conditions, and he knows too that after graduation he will be placed where his technical qualifications can be used to advantage.

In the United States there has been some indecision, many changes, and certain lack of co-operation between the services, with the result that the students seem confused and discouraged, the faculties baffled and bewildered. Even yet it is difficult to discern any final plan for general acceptance. An outsider cannot find the line of reason along which the authorities are working. Conversations with deans, professors and students indicate many differences of opinion.

Apparently, at the present time, every male student upon reaching the age of 18 is inducted into the army. If he has completed one full year of college before reaching this birthday, he is likely to be given a deferment sufficient to let him finish his course, but not otherwise. Consequently there is little use of a prospective student entering university unless he is under 17. This would seem to put an end to most enrolments in the regular way.

In the month of February the writer saw in one university over sixty engineering students lined up at the office counter to receive a refund of their fees. They had been called out and had to report without any regard to the courses they had partially completed. Conversation with one student revealed that in the ordinary way he would have been graduated this spring. Other students were in the third and second years.

Many engineering colleges are receiving drafts of men from the army or navy for special short courses which may run from three to ten months. In most cases, these new entrants have not the usual academic requirements for entrance to university. Looking on this as an outsider, one wonders why qualified students with courses partly completed are taken out of college, and others with little or no preparation are put in. To the uninformed, it looks like a great shuffling of thousands of people, only to reduce the number of engineers available for industry and the services, and to increase the number of partially trained mechanics for the army and navy.

Arrangements are being discussed, whereby students with university entrance qualifications will be put into uniform and sent to the universities for special courses. These would not be the usual engineering courses, although they will have in them some of these elements. It is expected that the courses will include lectures on geography and history. Such students will receive the regular army pay of $50.00 a month and their keep. There has been some indefiniteness about the curricula, and the suggestions made by the navy differ substantially from those made by the army, both as to content of the courses and as to the period of time involved.

Apparently these arrangements are still in the discussion stage, but it appears likely that definite announcements will be made shortly whereby such procedures will be established

Doubtless to those who plan these policies, a definite and justifiable objective is clear, but to persons in Canada who have a knowledge of the Canadian situation, the American developments seem confused and confusing. Certain it is that the Canadian policy more nearly meets Canadian needs than would the American plans. Naturally it would be the sincere desire of every Canadian that the American policy should be equally effective for American conditions.

### NEW ACTIVITIES—NEW COMMITTEES

It is a natural development that in times of national activity an institution should find its programme enlarged. Some time ago, The Engineering Institute established three committees to work on activities which are related to the war and to the engineer. These have been announced previously and in the months since that time have completed their organizations and broken much ground. They are—the Committee on the Engineering Features of Civil Defence, the Committee on Industrial Relations, and the Committee on Post-War Problems.

At the annual meeting of Council held in Toronto in February, two new committees were authorized. The work of these committees is (a) to approach the proper federal authorities on behalf of the engineers in the Civil Service, and (b) to make similar representation on behalf of the engineers in the active services.

Both these fields present great opportunities for improvement. In the case of the Civil Service the principal complaint is that the regular scale of salaries is so far below those available in private enterprise that competent engineers are not being attracted to the service. Government business is just as important as private business and should be permitted to pay salaries that will enable it to compete in this professional field for services that are steadily becoming more and more important.

The situation in the active services is more complicated and more urgent. Ever since the beginning of the war the Institute has been pursuing this interest. Up to now its efforts have produced nothing but negative replies. The new committee is examining the whole case again—this time with new evidence, new tactics and new determination. Once the committee has proven to itself the justness of the case—which should not be difficult—it will make representations to the proper authorities.

From all branches of the services where engineers are used, complaints have come, which refer not only to rank and remuneration, but also to the use of non-technically trained and inexperienced persons in technical appointments. There are frequent comparisons between the treatment accorded engineers and that given medical doctors.

A wide survey of the situation should produce some useful and interesting information upon which to base conclusions and recommendations.

Professor D. S. Ellis, of Kingston, is chairman of the committee.

### THE ENGINEER IN THE CIVIL SERVICE

The committee appointed by Council in February to make representations on behalf of the engineers in the Federal Civil Service appeared on March 5th before the special committee appointed recently to advise the Treasury Board on such matters. The Institute committee reports that it was well received, and is hopeful that some substantial relief may be recommended in the report of the Advisory Committee.

The brief presented by the Institute is reproduced herewith (p. 145), along with the diagram that tells the story. To establish and maintain government services that will compare, in efficiency and economy, with private enterprise, would seem to require a substantial improvement in the amount of remuneration.

The Institute is indebted to a small group of employers who hastily made available their salary scale for engineers. In order to establish an illustration that would meet all possible arguments, wage scales were gathered from three

*(Continued on page 146)*

# REMUNERATION OF ENGINEERS IN GOVERNMENT SERVICE

**Brief presented by The Engineering Institute of Canada to the Committee Advising the Federal Treasury Board on Administration of Personnel**

Ottawa, March 5, 1943.

The Chairman and Members of the
Advisory Committee to the Treasury Board,
Ottawa, Ont.

Gentlemen,—

1. The Council of the Engineering Institute of Canada has learned, with gratification, that a committee, under the chairmanship of H. J. Coon, Esquire, has been established to advise the Treasury Board with reference to the administration of the personnel of the public service of Canada during the war.

2. The Engineering Institute is the largest professional body in Canada and is interested in all matters of national importance. The economic and efficient conduct of the business of Government is certainly of national importance and, therefore, of interest to the Institute. Accordingly Council has appointed a committee under the chairmanship of N. B. MacRostie, to approach the Advisory Committee in the hope of presenting information which may be useful in these deliberations.

3. This is not the first time that The Engineering Institute has been privileged to make representations on behalf of the members of the engineering profession in the Civil Service. In 1930 a brief was presented to the Royal Commission on Technical and Professional Services under the chairmanship of E. W. Beatty, and the recommendations of the Institute had a definite bearing on the findings of the Commission. The Institute Committee now before you suggests that the findings of the Royal Commission of 1930 are at least equally true to-day, and with the general increase in wages since that time, the conditions described in the report are even more acute now.

4. It is with much satisfaction that the Institute's committee presents herewith certain details of the employment of engineers in other spheres of activity in the expectation that comparison of conditions will indicate conclusively the wisdom of rewarding government engineers on a basis commensurate with the value of their services and with scales offered by other employers. The figures and statements contained herein are not hypothetical. Through the officers and members of the Institute, who are thoroughly experienced in these matters, it is possible to obtain accurate information on working conditions, as well as the results of adequate and inadequate remuneration.

The Institute's primary interest in this investigation is that it realizes the business of Government is the nation's greatest business and believes that such responsibilities cannot be met satisfactorily under existing conditions. Most employers of engineers have recognized certain fundamental principles, but the Federal Government, through the Civil Service, has established rates of remuneration, which ignore these accepted principles, and which, in the opinion of the Institute, place the Government under harmful and unnecessary handicaps.

5. The results of an inadequate wage scale may be tabulated as follows:

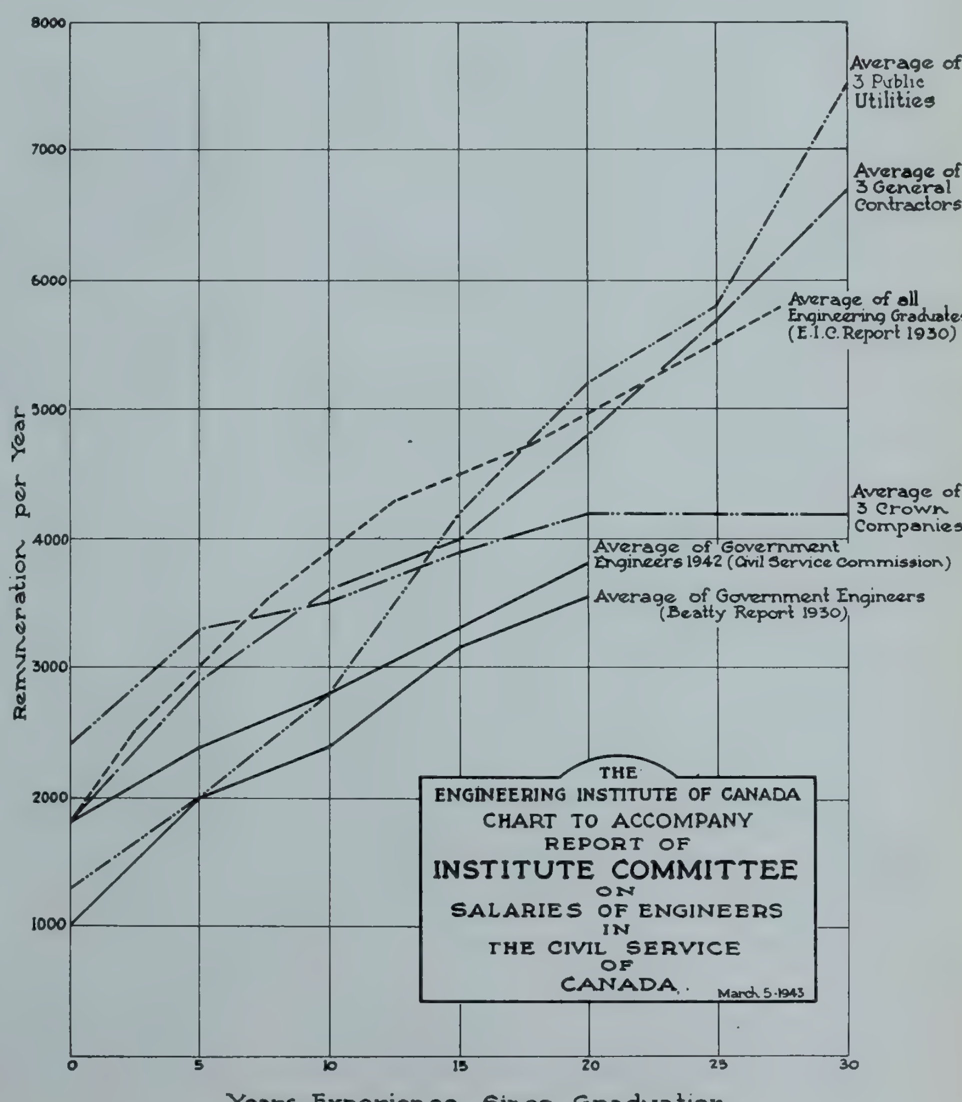
a) The better grades of Engineers, both Junior and Senior, are not now attracted to the Service.

(b) Men who can be recruited in times of depression leave for other work at more attractive wages when times improve, after the Government has spent time and money training them.

(c) Experienced engineers leaving the service cannot be replaced in prosperous times, although the need of engineering assistance is greatly increased in these circumstances.

(d) In the absence of good candidates, persons of inadequate experience have had to be taken into the service. This results in wasted time and increased costs, frequently of great magnitude.

(e) Failure to obtain qualified candidates results in overworking the present employees. There are many cases where these conditions exist to-day, much to the detriment of the work itself and to the financial disadvantage of the country.



(f) Failure to obtain a sufficient number of engineers of ability and experience, frequently results in the contractor doing the engineering work for the Government, with his own staff. In this way, the Government actually pays rates much higher than those authorized by Civil Service classifications. This puts the Government in a ridiculous position, but under present conditions there seems to be no alternative if the work is to be expeditiously and economically carried out.

(g) There are many examples in the civilian branches of the three active services, of wages well beyond the Civil Service rates. These services found that competent persons could not be employed at the usual low rates, and, in one way or another, they obtained concessions whereby they could carry out the work assigned to them. In these scattered cases the Government has admitted the inadequacy of its wage scale, but, apparently, no attempt has been made to make these increases applicable generally.

6. All the above conditions are based on what might be called normal conditions. Under conditions of war emergency, everything is magnified many times. Therefore, what in times of peace might be called unfortunate circumstances, become matters of tragic importance in times of international strife.

7. The Advisory Committee must recognize certain fundamental facts and conditions:

(a) Competent engineers cannot be obtained at present salaries.

(b) Persons employed for war work do not participate in pensions nor can they look forward to any degree of permanence of employment. They work many hours of overtime with no financial compensation.

(c) Commercial firms are steadily drawing from the ranks of the Civil Service and such losses cannot be replaced.

(d) War conditions have raised wages. Therefore, the Civil Service scale is more than ever out of line. Developments in the last three years have opened new opportunities for engineers. Therefore, the demand is and will be greater than ever before both in Government circles and in industry. How can the business of Government meet these new demands with scales of wages that have been inadequate for at least a generation?

(e) After the war, greater burdens will fall on Government departments. Now is the time to prepare for these inevitable conditions. Organizations cannot be built over night nor can they be built at all unless the wage incentive is sufficient to meet conditions established by employers outside the service.

(f) Crown companies pay salaries far in excess of Civil Service classifications, because competent persons could not be obtained at the regular rates. In such cases the Government has recognized the inadequacy of its own wage scales. If these scales are not sufficient for the Crown in war plants, they are not sufficient for the Crown in its other engineering activities.

8. The standing of the engineer in Government employment is not only high but exhibits a degree of unselfish service beyond that found in many other sections of the profession. This is evidenced by the fact that they serve faithfully under conditions of remuneration far below those commonly in force outside the service. It is not fair to use this sense of loyalty and devotion to the disadvantage of the individual.

9. In conclusion this Committee has endeavoured to prove the following points:

(a) There can be no argument as to the inadequacy of the present scale of wages.

(b) There can be no argument as to the advisability of employing competent engineering services in the interests of economy and efficiency.

(c) There can be no argument but that such persons cannot be obtained or retained under existing scales of wages.

(d) There can be no argument but that Government business is as important as private business.

Therefore, it is apparent that adjustments should be made if Government business is to be carried on as efficiently and economically as private business. Through this Committee, the Institute urges that these cold facts be faced fairly and squarely and that steps be taken now to correct unfair and uneconomic conditions which, unfortunately, have existed for so long.

10. In brief, all that is requested is that the Treasury Board permit such adjustments in the classifications as will be fair and equitable and will meet the scales of remuneration found to be necessary and fair by other employers. It is a fact that industry cannot afford to operate at a loss and, therefore, scales of remuneration have been developed that will permit the employment of competent engineers. In other words, industry cannot afford low wages and of necessity has had to adopt adequate scales of salary. If industry has found by experience that these wages are necessary, it is evident that similar wages are necessary and economical for Government service.

11. The Institute's Committee has not attempted to propose specific wage scales but, if subsequently, the Advisory Committee, or any other body decides to examine such fields, The Engineering Institute will be very pleased to co-operate in any way in establishing new schedules, and to make available information which is already in its possession.

Yours sincerely,

N. B. MacRostie, m.e.i.c.

Chairman of the Institute Committee.

MEMBERS OF THE COMMITTEE

N. B. MacRostie, m.e.i.c., r.p.e.o., Consulting Engineer, Ottawa, Ont., Chairman of Institute's Committee.

deGaspé Beaubien, m.e.i.c., r.p.e.q., Consulting Engineer, Montreal, P.Q.

L. Austin Wright, m.e.i.c., r.p.e.q., General Secretary, The Engineering Institute of Canada, Montreal, P.Q.

*Representing the Dominion Council of Professional Engineers*

L. E. Westman, m.e.i.c., r.p.e.o., Consulting Chemical Engineer, Ottawa, Ont.

## THE ENGINEER IN THE CIVIL SERVICE

(*Continued from page 144*)

employers in each of the following groups: public utilities, general contractors, and crown companies. The graph shows three lines representing the average for each group compared to the scale of the Civil Service.

The crown companies' average shows that the government is already paying wages much higher than the Civil Service scale. The same can be said for the general contractors, as they are engaged principally on government work. The utilities' average shows salaries paid in private enterprises that offer permanent employment and pensions similar to the government. Taken all together this graph seems to provide interesting evidence as to the difficulties under which the government services are trying to operate. It is hoped that the present investigation of Civil Service conditions of employment will result in adjustments that will eliminate unfairness, and at the same time permit a strong and effective organization to be established for post war activities.

The Institute committee consists of Chairman N. B. MacRostie, Ottawa; de Gaspé Beaubien, Montreal, and the general secretary. President Cameron invited W. P. Dobson, president of the Dominion Council to attend with the committee, but at the last moment Mr. Dobson was unable to be present and named L. E. Westman, assistant director of National Selective Service to represent him.

## R.E.M.E.

### (Royal Electrical and Mechanical Engineers)

From time to time fragments of information have come to Headquarters with reference to a new corps of engineers, adopted by the Imperial Army. At last a fairly comprehensive account of the organization of the Corps has come to hand. It is reproduced herewith.

The Institute is in possession of additional details, including schedules of pay and allowances for officers and men, stories of actual experiences in the North African campaign and statements of advantages as compared to similar work formerly carried out by the Ordnance Corps. Subsequent numbers of the *Journal* will carry more news of this relatively new development, which seems to have altered all former practices and to have produced excellent results in meeting conditions of modern warfare.

The following information is reproduced from the Journal of the Institution of Mechanical Engineers, London.

"It is hardly necessary to emphasize to engineers the great and growing importance of the role played by the engineering maintenance services in the Army. Machine war on an ever-increasing scale requires an enormous engineering organization to keep the vehicles, weapons, and instruments in a state of maximum efficiency. Until recently these functions were carried out mainly by the engineering staff of the Royal Army Ordnance Corps, which Corps is also responsible for the supply of all warlike stores, vehicles, and clothing. Certain mechanical and electrical engineering maintenance and provision duties are also carried out by the Royal Engineers and the Royal Army Service Corps. It was therefore deemed desirable to reorganize and coordinate some of these mechanical and electrical engineering personnel into a single Corps and thereby give more efficient service to the Army and also effect a saving in technical man-power.

On 22nd May, 1942, the formation of the new Corps with the title "The Royal Electrical and Mechanical Engineers" was authorized by Royal Warrant and it is expected that this Corps will come into full operation as a separate entity about 1st September.

The function of the Corps is, briefly:—

- (i) Inspection and maintenance of tanks, wheeled vehicles, all artillery (including field, anti-aircraft, and coast defence), small arms and machine guns, radiolocation, fire control, and all other instruments, tunnelling equipment, pumping sets, and the installation of coast artillery machinery.
- (ii) Repair of all the above equipments consequent upon ordinary wear and tear, or battle casualties.
- (iii) Investigation into defects of design and recommendations for improvements.
- (iv) Advice on prototype design from a maintenance angle.

There is a complete chain for the direction and coordination of the technical activities of the R.E.M.E., starting with the Director of Mechanical Engineering in the War Office, Major-General E. B. Rowcroft, C.B.E., M.I. MECH.E. (*Member of Council*) and passing down through Deputy Directors to the Electrical and Mechanical Engineer, or E.M.E. as he is called, who acts as technical adviser to a Brigade Commander. Each formation—Army, Corps, Division—and certain individual units have their own mobile workshops and engineering staff. Backing these are the great static base workshops in this country and in all theatres of war, where any type of repair to any equipment can be effected and where, if necessary, manufacture of parts on a limited quantity basis can be undertaken.

Experience of the past three years has shown that engineers, especially those attached to units individually or in a Light Aid Detachment ("L.A.D."), must always be fighting soldiers and much doughty work has been done by workshop units in France, the Middle East, and elsewhere. Light Aid Detachments frequently have to do repair work on tanks, vehicles, guns, and other equipment under fire, and the recovery and evacuation of badly damaged tanks and other equipment, which is an R.E.M.E. responsibility, can be quite an exciting affair when the gauntlet of the enemy's guns has to be run. The new Corps is therefore combatant. Selected officers are sent to the Staff College.

It is intended that the officer personnel of the Corps shall consist of qualified Mechanical and Electrical Engineers who will be graded as E.M.E.'s 1st, 2nd, 3rd, or 4th class. In war time, in order to obtain the required number of officers it has been necessary to introduce an ungraded section of officers not so highly technically or practically qualified, but every effort is made to maintain the highest possible standard. Other ranks will consist of tradesmen such as armament artificers, armourers, fitters, etc., covering nearly sixty different engineering trades, together with such non-tradesmen as are required for regimental and administrative duties.

The Institutions of Mechanical and Electrical Engineers are both keenly interested in the new Corps and have been in consultation with the Adjutant-General to the Forces, General Sir Ronald F. Adam, Bt., K.C.B., D.S.O., O.B.E., who is responsible for its formation and launching and who welcomes the interest and help the Institutions are giving and will be able to give in the future. Many of the members of the Corps are, of course, also members of one or both of the Institutions and it is hoped that friendly and intimate cooperation will be maintained between the Institutions and the Corps.

Modern war is simply an expression of the industrial age in which we live and therefore is largely a contest between engineers. The linkage between user and producer—the engineer in the field and the engineer in charge of manufacturing and design—must be strong and complete. The formation of this Corps should help, in some measure, to bring this about and we wish it all success and honour. Its performance will be watched with the closest interest by all members of the Institution.

### Organization and Functions of R.E.M.E.

So much interest has been aroused by the publication, in the September Journal, of an account of the organization and functions of the new Corps of Royal Electrical and Mechanical Engineers, that it has been considered desirable to publish a further note setting out the qualifications required for, and conditions of service of, officers in the Corps. This information, which follows below, has been provided by the War Office.

The function of the new Corps, the formation of which was announced in the Foreword of the Journal for September, is briefly:—

- (i) Inspection and maintenance of tanks, wheeled vehicles, all artillery (including field, anti-aircraft, and coast defence), small arms and machine guns, radiolocation, fire control, and all other instruments, tunnelling equipment, pumping sets, and the installation of coast artillery machinery.
- (ii) Repair of all the above equipment consequent upon ordinary wear and tear, or battle casualties.
- (iii) Investigation into defects of design and recommendations for improvements.
- (iv) Advice on prototype design from a maintenance angle.

The qualifications required for commissions in the new Corps are as follows:—

*Graded Officers* (*E.M.E.*). Candidates must have undergone an apprenticeship of at least three years' duration and, in addition, must

- (*a*) Possess a degree in engineering of any recognized university; *or*
- (*b*) Be a Graduate member of the Institution of Mechanical Engineers; or of the Institution of Electrical Engineers; or have qualifications exempting from the examinations of these Institutions.

The upper age limit is forty years of age.

The emoluments are 16*s.* 4*d.* per diem, plus allowances, the latter being tax-free.

The rank is that of Lieut., E.M.E.

*Ungraded Officers.* Candidates who have the necessary practical experience, but are not in possession of the academic qualifications mentioned in (*a*) or (*b*) above may be considered for appointment to the Mechanical Engineering Branch of the R.E.M.E. as 2nd Lieutenant (ungraded), R.E.M.E.

The upper age limit is forty years of age.

The emoluments are 12*s.* 2*d.* per diem, plus allowances, the latter being tax-free.

*Telecommunication Branch (Wireless and Radio), Royal Electrical and Mechanical Engineers.* Upon the training, experience, and technical qualifications of a candidate for employment with the Telecommunications Branch of the R.E.M.E. will depend whether he is considered suitable for service as a commissioned officer, either as Electrical Mechanical Engineer (Wireless) or ungraded officer.

(*1*) *Graded Officers* (*Telecommunications*). Candidates must have two years' experience in the radio or telecommunication industry and, in addition, must

(*a*) Possess a degree in engineering, physics, or mathematics of any recognized university; *or*

(*b*) Be a Graduate member of the Institution of Electrical Engineers, or have qualifications exempting from the examinations of that Institution.

The upper age limit is forty years of age.

The emoluments are 16*s.* 4*d.* per diem, plus allowances, the latter being tax-free.

The rank is that of Lieut., E.M.E.

(*2*) *Ungraded Officers* (*Telecommunications*). A candidate who has the necessary practical experience but is not in possession of the academic qualifications mentioned in (*1*) (*a*) or (*1*) (*b*) may be considered for appointments to the Mechanical Engineering (W) or (R) Branch of the R.E.M.E. as 2nd Lieutenant (ungraded) R.E.M.E., Radio Maintenance Officer, or Wireless Maintenance Officer.

The upper age limit is forty years of age.

The emoluments are 12*s.* 2*d.* per diem, plus allowances, the latter being tax-free.

*Equivalent Civilian Emoluments.* An ungraded 2nd Lieutenant, for example, receives total annual emoluments calculated to be, if single, £368, equivalent to £470 in civilian employment; if married, the total is £433, equivalent to £584 per annum in civilian employment."

**The General Secretary of the Institute visited Purdue University at Lafayette, Indiana, last month, on his return from Terre-Haute, where he delivered the commencement address at Rose Polytechnic Institute. Mr. Wright is shown here inspecting one of the electrical laboratories at Purdue in company of, left to right, Dean A. A. Potter of Purdue Schools of Engineering and D. D. Ewing, professor of electrical engineering.**

# THE ENGINEERS' CONTRIBUTION TO THE WAR EFFORT IN THE U.S.A.

HAROLD V. COES

*President, The American Society of Mechanical Engineers*

**From an address delivered at the Annual Banquet of The Engineering Institute of Canada at Toronto, Ont., on February 11th, 1943**

To a very considerable extent this is an engineers' and scientists' war. A few paranoics have plunged us into it, but it is due in large measure to the number of, training, experience and skill of the engineers in your country, in mine and in those of our Allies, that we have been able to meet the challenge with augmented peacetime facilities.

This has been accomplished largely through skill in design; in specification preparation; in selection and layout of productive equipment; in tooling, in jigs and fixtures; also in adopting semi or in-line production methods to the products for fighting the war, whether for small fire control or aviation instruments, or huge tanks and bombers.

I remember talking with a gentleman in the club car of a train just after the President had stated he wanted 60,000 planes of all kinds in 1942. This man said, "That is fantastic, ridiculous and impossible." I replied, "Not fantastic if he tells us what he wants, gives the right of way to the machine tools and materials, partially freezes the designs and bars labour agitation and strikes; he will then get his planes." As a matter of fact we produced 49,000 planes in 1942, many of them of considerably larger size than was contemplated in the original schedule, so in all probability, allowing for this, the President received very nearly the equivalent of the 60,000 planes called for.

To request that 60,000 planes be produced in a year does not produce them, as we know; that is just a requisition for production. These demands set in motion, however, such gigantic engineering projects, for example, as multiplying our aluminum and magnesium production facilities, plane engines, instruments, plane parts and plane assembly facilities. You can readily appreciate the mass of engineering calculations, sketches, drawings and specifications that were required before these facilities could be constructed.

Think of the improvisations that were made to save critical materials, to replace unavailable productive facilities and to overcome unforeseen contingencies, such as developing single purpose engine drilling machines from portable bench drills, changing structural designs from steel to reinforced concrete or timber, relocation of buildings on the site and the like. This affords some comprehension at least of the enormity of the problems that confronted the engineers aside from the stupendous volume of details that had to be meticulously fitted together.

To bring the picture into closer focus let us consider for a moment what this plane production which the engineers have provided for means. At the end of 1943 the total horse power of the engines required for the planes to be produced in the United States will be about 350,000,000 hp. That is like an astronomer's unit of measurement, the light year. Unless it is related to something one can compare it with, the mind does not take it in. This 350,000,000 plane engine hp. is probably from one and a half to two times the installed central station capacity of the world and perhaps six or seven times the combined hp. of the British and the United States Navies.

At Chicago the Chrysler Corporation will soon have the world's largest factory in operation producing plane engines, an engineering feat which in many respects surpasses our Boulder Dam hydro-electric project.

This is what engineering has enabled management to do to support, in an incredibly short time, the armed forces of the United Nations. Truly a marvelous performance on the part of the engineers.

# KENNETH MACKENZIE CAMERON

**PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA, 1943**

The newly installed president of the Institute is one of the many distinguished engineers in the government service who have held that office. The names of Past-Presidents Marceau, St-Laurent, Camsell and Desbarats come to mind in this connection. Although engineers in the civil service have been responsible for the effective and economical expenditure of large sums of public money, their names are not associated in the taxpayer's mind with any particular outstanding engineering achievements. Thus they do not become known to the public so well as do their brethren who are in private practice or in the employ of prominent industrial or engineering organizations. In fact, the importance of the part which engineers in the civil service have taken in the development of Canada is not so generally recognized as it should be. It is therefore most fitting that The Engineering Institute should now confer the honour of its presidency on one who is at the head of the engineering branch of the Department of Public Works.

The work of the engineering branch covers a wide field as regards design, construction and maintenance. It deals with wharves, piers, breakwaters, and drydocks; dredging and beach protection; hydrographic and topographical surveys for harbour and river work; interprovincial bridges; ferries and the control of works over navigable rivers. Under normal conditions, all this involves an annual expenditure of from five to ten million dollars not including the cost of special major items like drydocks which are of infrequent occurrence. As in the case of other government departments operating under war conditions, its regular activities have been greatly curtailed since 1940, but many of the duties performed by the branch have a direct bearing on war work and must therefore be maintained.

K. M. Cameron, M.Sc., M.E.I.C.

President Cameron was born at Strathroy, Ontario, and received his early education at the Collegiate Institutes at Strathroy and London. In 1901 he graduated with honours at the Royal Military College, Kingston, then proceeding to McGill University where he received the degree of B.Sc. in civil engineering in the following year. After a period of post-graduate work in hydraulics, he was granted the degree of Master of Science, and served as demonstrator in hydraulics and in testing of materials at McGill University. He is the second graduate of the Royal Military College to become president of the Institute—the first was Lieut.-Col. R. W. Leonard.

After some months in the office of the chief engineer of the Canadian Pacific Railway, Mr. Cameron worked for two years as office and inspecting engineer of the Canadian Niagara Power Company at Niagara Falls, Ontario. He was lecturer on surveying and geodesy at McGill University during the 1905-1906 session, and then went to the United States, where he obtained valuable experience in such positions as transitman at New York on the Pennsylvania main line tunnels under the Hudson; as inspecting engineer on a power station at Ellsworth, Maine; and as resident engineer for the Ambursen Construction Company on hydro-power and irrigation dams in Wyoming. On returning to Canada, in 1908, he did work for Smith, Kerry and Chace, consulting engineers, Toronto, and then joined the Department of Public Works of Canada, serving first in the offices at London, Ontario, and later as district engineer at Sherbrooke, Que. He came to Ottawa in 1912 as senior assistant in the dredging branch of the Department. In September, 1918, he became assistant chief engineer and on April 1st, 1923, he succeeded the late Arthur St-Laurent as chief engineer of the Department, the appointment which he now holds.

Works of major interest completed while Mr. Cameron has been chief engineer include three large drydocks, namely, the Saint John Drydock at Saint John, N.B., the Champlain Drydock, Quebec Harbour, and the Esquimalt Drydock at Esquimalt, B.C.

Long identified with the Institute which he joined as a Student in 1901, Mr. Cameron was chairman of the Ottawa Branch for 1922, and represented that Branch as councillor in 1924-25. In 1941 and 1942 he was a vice-president of the Institute for the province of Ontario.

It is interesting to recall that in 1902 Mr. Cameron was the recipient of one of the four inaugural awards of Student prizes established by Council at that time. In some extent this may explain his continued interest in Student prizes. His subject was "The Practical Use of Extensometers."

He has served as president of the Professional Institute of the Civil Service of Canada, and represented the engineers of the Civil Service when civil service matters were being considered by the Beatty Commission in 1930. He is a member of the Lake of the Woods Control Board.

Greatly interested in post-war reconstruction problems, he is now chairman of an important sub-committee of the committee appointed by the Dominion Government under the chairmanship of Dr. James to report on reconstruction matters. Mr. Cameron's sub-committee is actively engaged in classifying and preparing the necessary data for construction projects which can be put in hand without delay as soon as the war ends.

He has contributed several papers to the Proceedings and prepared for the semi-centennial number of *The Engineering Journal* the informative article on "Fifty Years of Public Works in Canada", which is one of its principal features.

An engineer of wide professional experience, versed in administration affairs and well known from coast to coast, our new president enters upon his year of office with the best wishes of all members of the Institute.

## HONOURS FOR INSTITUTE MEMBERS

It is a pleasant duty to record, from time to time, the various honours and distinctions received by members of the Institute. In the February number of the *Journal* reference was made to those members who were honoured in the new year's honours list. Additional events of this kind have been announced recently, and it is a pleasure to record the awards of honorary doctorates to a past-president, a past member of council and the general secretary of the Institute.

In January, at the annual dinner of the Graduates Society of the Ecole Polytechnique, the degree of Doctor of Applied Science *honoris causa* was conferred by the University of Montreal upon Past-President Georges-Joseph Desbarats, C.M.G., M.E.I.C., and Colonel Arthur-Edouard Dubuc, D.S.O., M.E.I.C., both of whom have distinguished themselves in the public service. At the ceremony, they were presented for their degrees by Dr. Augustin Frigon, M.E.I.C., with the following citations:—

MONSIEUR GEORGES-J. DESBARATS:

Né à Québec, diplômé de la 3e promotion de l'Ecole Polytechnique, membre de l'Association des Anciens de l'Ecole depuis ses débuts, M. Georges Desbarats est, non seulement notre aîné à tous, mais aussi l'un de ceux qui ont fait le plus d'honneur à la profession d'ingénieur, au pays et à l'étranger. Sa compétence et ses talents se sont égalés à toutes les situations de premier plan qu'il a occupées au cours de sa carrière de cinquante-cinq années.

Membre du personnel au Ministère des Chemins de fer et Canaux, il collabore à la construction des canaux du Long-Sault à Carillon et de Sainte-Anne-de-Bellevue; en sa qualité d'assistant de l'ingénieur en chef, il dirige les travaux des canaux de Welland, du Sault Sainte-Marie et de Cornwall. Il construira en outre les ponts du canal de Lachine, et, enfin, collaborera à l'aménagement du canal des Galops. Entre temps, on lui aura confié l'inspection des chemins de fer de la Colombie britannique.

Au début de ce siècle, il fait un relevé hydrographique du fleuve Saint-Laurent, de Kingston à Québec. Puis il dirige les chantiers maritimes de Sorel. En 1908, Ottawa se l'attache et fait de lui, d'abord un sous-ministre de la Marine et des Pêcheries, puis du Service Naval, ensuite en 1922, un sous-ministre de la Défense Nationale, poste qu'il occupe jusqu'à sa retraite, en 1932.

Sa haute situation le désigna tout naturellement au Gouvernement, pour remplir certaines missions techniques, à l'étranger. A Londres, en 1913, il agit comme délégué plénipotentiaire du Canada à la Conférence Radiotélégraphique Internationale; à Gênes, en 1922, il représente le Canada à la Conférence Internationale Maritime de la Ligue des Nations; à Washington, en 1928, il est le chef de la délégation canadienne à la Conférence Internationale de l'Aviation Civile; à Anvers, en 1930, il représente encore notre pays à la Conférence Internationale de Navigation Aérienne. Rien d'étonnant si un tel voyageur est maintenant président de la Canadian Geographical Society . . .

Mais il est membre aussi de bien d'autres sociétés, notamment de l'Engineering Institute of Canada, dont il fut président; membre fondateur et membre d'honneur de l'Association des Diplômés de Polytechnique. Rappelons, pour finir, que Sa Majesté le Roi Georges V lui conférait, en 1915, les insignes de l'Ordre de Saint-Michel et de Saint-Georges.

Depuis cette date, M. Desbarats, on l'a vu, est loin d'avoir démérité. L'Ecole Polytechnique a voulu lui manifester sa respectueuse admiration. A sa demande, l'Université de Montréal est heureuse et fière de le proclamer aujourd'hui docteur ès-sciences appliquées "ad honorem."

LE COLONEL DUBUC:

Arthur-Edouard Dubuc est un Montréalais par sa naissance, par son éducation, reçue au Mont-Saint-Louis et à l'Ecole Polytechnique, et par les vingt-trois premières années de sa pratique d'ingénieur. Dès 1901, il entre au Ministère fédéral des Travaux publics en qualité d'ingénieur assistant et devient bientôt ingénieur de district; en 1924, il passe au Ministère des Chemins de fer et Canaux, d'abord comme surintendant, puis comme ingénieur en chef. Le pays tout entier lui est redevable de nombreux travaux de génie.

Sa haute compétence lui mérite, en 1936 la vice-présidence, puis le poste d'ingénieur en chef au Conseil des Ports nationaux, qui régit, comme on le sait, les ports de Halifax, de Saint-Jean, de Québec, de Montréal et de Vancouver.

Ingénieur distingué, M. Dubuc est encore un militaire d'égale valeur. Il a servi, au cours de la première Grand Guerre en qualité de capitaine, de major, de lieutenant-colonel et de commandant du glorieux 22e bataillon. Il était à Ypres et à Courcelette, à Vimy, à Amiens, à Arras pour ne signaler que quelques étapes de sa haute bravoure. Blessé trois fois sur le champ de bataille, nommé deux fois dans les dépêches, il fut décoré du Distinguished Service Order et de la Croix de la Légion d'honneur. Démobilisé, il sert encore au pays à la tête de la 11e brigade d'infanterie et s'occupe des Pensions et du Rétablissement des Soldats. Depuis 1935, il est aide-de-camp honoraire du Gouverneur général.

On pense bien qu'il fait partie des Associations professionnelles d'ingénieurs du Québec et de l'Ontario et que, dès 1914, il s'est inscrit à l'Association des Diplômés de Polytechnique, dont il a été, à son heure, vice-président et président.

Tant de mérites, civils et militaires, ont rejailli sur l'Alma Mater. Aussi, l'Université, qui veut aujourd'hui lui en exprimer sa gratitude, se rend-elle avec un vif plaisir à la requête de l'Ecole Polytechnique, en proclamant Arthur-Edouard Dubuc, docteur ès-sciences appliquées "ad honorem."

A translation follows:—

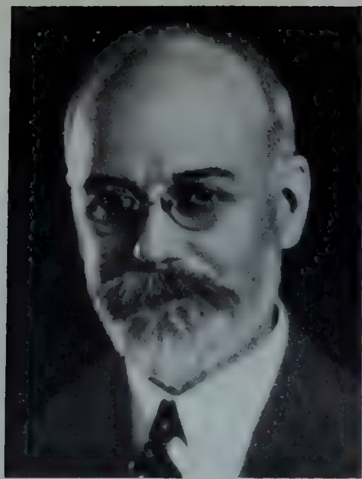
GEORGES-J. DESBARATS

Mr. Desbarats was born at Quebec. He is a member of the third graduating class of the Ecole Polytechnique (1879) and a member of the Alumni Association of the Ecole which he joined upon its foundation. Mr. Desbarats is not only our senior in years but also one of the most distinguished engineers, both in Canada and in foreign countries. His competency and his talents have been equal to all situations in the important positions he has occupied during his brilliant fifty-five year engineering career.

On the staff of the Federal Department of Railways and Canals, he worked on the construction of the Carillon Canal and the locks at Ste-Anne-de-Bellevue; as assistant to the chief engineer, he supervised the construction of the Welland, Sault Ste-Marie and Cornwall Canals. He also worked on the erection of the bridges over the Lachine Canal and on the construction of the Galops Rapids Canal. At one time he was inspector of railways for the Federal Government in British Columbia.

Early in the present century, he was engaged in hydrographic surveys on the St. Lawrence River, from Kingston to Quebec. Later he was in charge of the Government shipyard at Sorel. In 1908 he was called to Ottawa as Deputy Minister of the Department of Marine and Fisheries, later occupying the same position with the Department of Naval Service. In 1922, he became Deputy Minister of National Defence, a position which he occupied until he retired in 1932.

His high office designated him naturally as a member of technical missions outside of Canada. In London,



Dr. Georges J. Desbarats, M.E.I.C.

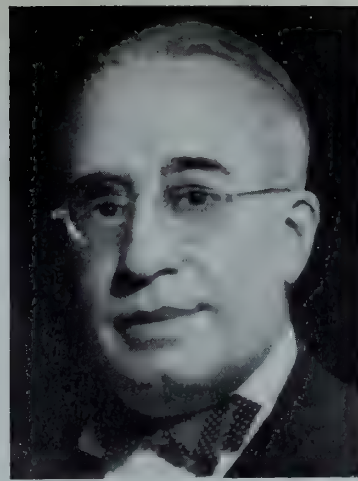


*Photo: Art. Roy, C.N.S.*
Dr. A. E. Dubuc, M.E.I.C.

Dr. L. Austin Wright, M.E.I.C.

in 1913, he was Canadian plenipotentiary at the International Wireless Conference. At Genoa, Italy, in 1922, he represented Canada at the Seamen's Conference of the League of Nations; in 1928, he was chief of the Canadian delegation to the International Conference on Civil Aviation, at Washington; at Antwerp, Belgium, in 1930, he represented his country at the International Conference on Aerial Navigation. No wonder that such a voyageur should now be president of the Canadian Geographical Society. He is also a member of several other societies, particularly of The Engineering Institute of Canada, of which he was president; he is a charter and honorary member of the Alumni Association of Polytechnique.

Finally, it should be recalled that His Majesty King George V conferred upon him, in 1915, the decoration of the Order of St. Michael and St. George. Since then, as has been shown, Mr. Desbarats has lived up to this honour.

The Ecole Polytechnique wishes to show him its admiration, and at its request the University of Montreal is happy and proud to proclaim him, to-day, Doctor of Applied Science "ad honorem."

COLONEL DUBUC

Arthur-Edouard Dubuc is a Montrealer by birth, by education and by engineering experience during the first twenty-three years of his professional career. He received his education at Mont Saint-Louis College and at the Ecole Polytechnique. In 1901, he entered the Dominicn Department of Public Works as assistant engineer, soon becoming district engineer; in 1924, he transferred to the Department of Railways and Canals, first as superintendent, and later as chief engineer. To him belongs credit for many outstanding engineering works in Canada.

His competency was recognized, in 1936, when he was appointed vice-president and chief engineer of the National Harbours Board, which administers the harbours of Halifax, Saint John, Quebec, Montreal and Vancouver.

A distinguished engineer, Colonel Dubuc is also a gallant soldier. He served during the First Great War as captain, major, lieutenant-colonel and officer commanding the glorious 22nd Battalion. He was at Ypres, Courcelette, Vimy, Amiens and Arras, to mention only a few of the engagements. He was wounded three times, and twice mentioned in despatches. He received the decoration of the Distinguished Service Order and La Croix de la Légion d'Honneur. Although he is now demobilized, he continues to serve his country as officer in command of the 11th Infantry Brigade (R.A.), and continues his interest in pensions for, and re-establishment of, soldiers. Since 1935, he has been Honorary Aide-de-Camp to the Governor-General.

Colonel Dubuc is a member of the Associations of professional engineers of Quebec and Ontario, and since 1914 has been a member of the Alumni Association of Polytechnique of which he was at one time vice-president and later president. (He has also been a member of The Engineering Institute of Canada since 1899.)

Such achievements in life, both civil and military, have reflected much credit upon his Alma Mater. The University of Montreal, desirous of expressing its gratitude, is particularly pleased to comply with the request from the Ecole Polytechnique in proclaiming Arthur-Edouard Dubuc, Doctor of Applied Science "ad honorem."

Those present at the last annual banquet of the Institute noted with pleasure the complimentary terms in which Dr. Elliott, president of Purdue University, referred to the value of the aid and information which United States officials had received from our general secretary, in his capacity as assistant director of National Selective Service in Ottawa. This co-operation, together with Mr. Wright's many contacts with sister societies in the United States on behalf of the Institute, no doubt led to the recognition of his achievements by one of the leading engineering schools in the United States, the Rose Polytechnic Institute, Terre-Haute, Indiana. He was not only invited to deliver the commencement address there on February 13th, but was also honoured with a degree of Doctor of Engineering. The subject he chose for his address was "Vocation or Profession?"

In presenting Mr. Wright for his degree, the Chairman of the Board of Management read the following citation:

LESLIE AUSTIN WRIGHT, MECHANICAL ENGINEER

You graduated from the University of Toronto and practiced your profession with signal success with municipalities, public services and private corporations.

By reason of your attainments and your successes in your profession, you were chosen for the high positions you now hold as General Secretary of The Engineering Institute of Canada and as Editor of *The Engineering Journal.*

Because of your accomplishments in these fields and your wide acquaintance and friendships with the engineering fraternity, you were chosen to organize the Wartime Bureau of Technical Personnel at Ottawa under the auspices of the Department of Labour.

You held the honourable and difficult post of Assistant Director of National Selective Service of the Dominion of Canada, discharging its duties with honour to yourself and with devotion to your country.

You have many devoted friends among engineers in this country, and Rose Polytechnic Institute is honoured in giving to you and in your acceptance from her, of an honorary degree.

I am happy to present you, the honoured son of our beloved sister nation on this continent, for the honorary degree of Doctor of Engineering.

To our three most recent doctors, our members will accord their hearty congratulations. R. J. D.

# NEWLY ELECTED OFFICERS OF THE INSTITUTE

**Wilfred Proctor Brereton,** M.E.I.C., is the new vice-president of the Institute for the Western provinces. Born at Bethany, Ont., he received his primary education at the public and high schools of Port Hope, Ont., and studied engineering at the University of Toronto, where he graduated as a B.A.Sc. in 1903. Upon graduation he joined the engineering staff of Heyl & Patterson, Pittsburgh, Pa., where he worked until 1904. From 1906 to 1912 he was employed with Smith, Kerry and Chace, consulting engineers, Toronto, as assistant engineer on the construction of the hydro-electric plant for the city of Winnipeg and later as resident manager at Portland, Ore., on the construction of a hydro-electric power plant for the Mount Hood Railway and Power Company. Later he became Commissioner for the Winnipeg and St. Boniface Harbour Board.

In 1917 he was appointed city engineer at Winnipeg, Man., and has occupied that position ever since. Mr. Brereton was chairman of the Winnipeg Branch of the Institute in 1918 and 1919 and he was a councillor of the Institute in 1919, 1920 and 1921.

**Lieut.-Colonel Le Roy Fraser Grant,** M.E.I.C., was elected a vice-president of the Institute representing the province of Ontario at the annual meeting last month. Colonel Grant is General Staff Officer at Military District No. 3 Headquarters, Kingston.

Born at Toronto, he attended the Royal Military College and Queen's University, Kingston, obtaining a diploma with honours from the former in 1905 and the degree of B.Sc. from the latter in 1925. In 1910 he became registered as a British Columbia Land Surveyor. From 1905 until 1909 he was engaged on railway work as draughtsman, levelman and resident engineer successively on the Grand Trunk Pacific Railway in British Columbia. He then became associated with the firm of F. S. Clements and later with that of Dutcher Maxwell and Company in Vancouver, B.C.

During four years he was with the Canadian Overseas Railway Construction Corps as captain for two years and later received the promotion to major, second in command of the 5th Battalion, Canadian Railway Troops. On his return to Canada he was engaged in surveying for three years and he was made instructor in engineering at the Royal Military College, in 1922, becoming associate professor the following year. In 1940 he was appointed to his present position.

In 1936-37 Colonel Grant was secretary-treasurer of the Kingston Branch and in 1938, 1939 and 1940, he was a councillor of the Institute.

W. P. Brereton, M.E.I.C.

Lt.-Col. L. F. Grant, M.E.I.C.

C. K. McLeod, M.E.I.C.

**Clement Kirkland McLeod,** M.E.I.C., is the newly elected vice-president of the Institute for the province of Quebec. Mr. McLeod is managing director and chief engineer of Walter Kidde & Company of Canada Limited, Montreal, as well as engineering representative of the Permutit Company of Canada Limited for the provinces of Ontario, Quebec and the Maritimes.

Born in Montreal, he graduated from McGill University with the degree of B.Sc. in chemical engineering in 1913, and upon graduation became plant chemist with the Canada Cement Company for the next three years. From 1916 to 1919 he was engaged on the inspection of explosives with the Imperial Ministry of Munitions. In May, 1919, he was appointed chief chemist for the Dominion Glass Company and a year later became superintendent with Consumers Glass Company. In May, 1921, Mr. McLeod was with the Phoenix Bridge and Iron Works on design and sales of structural steel work. When this firm was taken over in October, 1923, by Canadian Vickers Limited, he occupied a similar position with the new organization. Since 1925, Mr. McLeod has represented the Permutit Company, Walter Kidde and Company and the American Hard Rubber Company in eastern Canada, first as manager of the Chemical Engineering Equipment Company, then as a principal of Busfield McLeod Limited and in 1934 he entered into business under his own name representing the same interests. He is an alderman for the City of Westmount.

Mr. McLeod is very well known to the membership of the Institute as a past secretary-treasurer of the Montreal Branch, which office he held for ten years. He was chairman of the Montreal Branch in 1939 and councillor of the Institute in 1940, 1941 and 1942. He is a son of the late Professor C. H. McLeod, who for twenty-five years was general secretary of the Institute.

**Clarence Victor Christie,** M.E.I.C., head of the department of electrical engineering at McGill University, Montreal, is the newly elected treasurer of the Institute. Born at Couva, Trinidad, B.W.I., he was educated at Dalhousie University, Halifax, where he received the degree of B.A. in 1902, and the following year was awarded the M.A. degree. In 1906 he graduated from McGill University with the degree of B.Sc.

Following graduation, he was appointed lecturer at McGill and in 1908 became assistant professor. In 1913 he was appointed associate professor of electrical engineering and in 1926 he succeeded the late Dr. L. A. Herdt, M.E.I.C.,

C. V. Christie, M.E.I.C.

C. E. Webb, M.E.I.C.

as Macdonald professor of electrical engineering and head of the department.

On many occasions, Professor Christie has acted as consulting engineer for Shawinigan Water & Power Company Limited and other firms and is recognized as an authority in his field. His text-book on electrical engineering has been widely used by students in universities both in Canada and the United States.

He has always taken an active interest in the work of engineering societies and in 1927 he was chairman of the Montreal Branch of the Institute. He was a councillor of the Institute in 1931, 1932 and 1933. Professor Christie was vice-president of the American Institute of Electrical Engineers in 1935-36.

**Christopher Everest Webb,** M.E.I.C., is the newly elected councillor of the Institute representing the Vancouver Branch. Mr. Webb is the district chief engineer for British Columbia of the Dominion Water and Power Bureau of the Department of Mines and Resources. He graduated from the University of Toronto in 1910 with the degree of B.A.Sc. and since 1913 he has been in the service of the Department. From 1913 to 1918 he was assistant to the assistant chief engineer and from 1918-25 he occupied the position of assistant chief engineer. In 1925 he was appointed to his present position.

In 1934 Mr. Webb received the degree of civil engineer from the University of Toronto He was a member of the Council of Association of Professional Engineers of the Province of British Columbia in 1936 and in 1939 was elected president of the Association. In 1940 he was appointed a member of the board of arbitration established by the International Joint Commission to enquire into damages suffered because of the diversion of Goat River, B.C., which formerly emptied into Kootenay Lake and now empties into Kootenay River above the lake. He is at present a member of the International Kootenay Lake Board of Control.

Mr. Webb was chairman of the Vancouver Branch of the Institute in 1940.

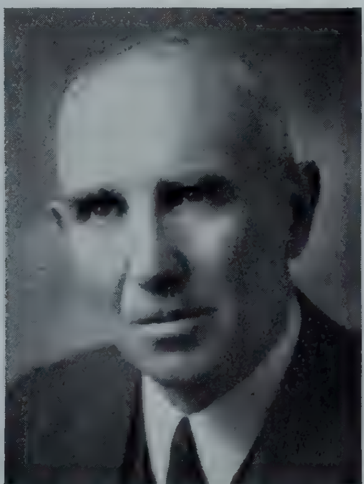
**Edward Nelson,** M.E.I.C., has been elected councillor of the Institute representing the Edmonton Branch. Born at Teddington, Middlesex, England, he was educated at Bristol, England, and came to Canada as a youngster. He later studied in Edmonton under Professor Muir Edwards of the University of Alberta, and, from 1913 to 1920, he was engaged in surveying work in the West. He joined the Department of the Interior of the Dominion in 1920 and did surveying work until 1924 when he entered the employ of Northwestern Utilities Limited at Edmonton, the company of which he is now chief engineer.

He was chairman of the Edmonton Branch of the Institute in 1940.

**Alexander McIntosh Macgillivray,** M.E.I.C., has been elected councillor of the Institute representing the Saskatchewan Branch. Born at Antigonish, N.S., he received his engineering education at St. Francis Xavier College, Antigonish. He joined the Canadian Northern Railway in 1900 and during several years was engaged on construction work in the maritime provinces.

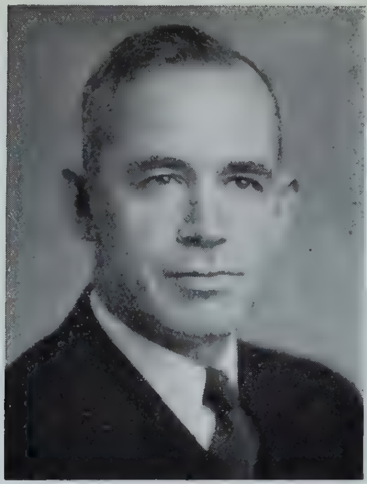
He went to Manitoba in 1914, and in 1918 became division engineer for the Canadian Government Railway at Port

E. Nelson, M.E.I.C.



A. M. Macgillivray, M.E.I.C.

H. G. O'Leary, M.E.I.C.



Geo. E. Medlar, M.E.I.C.

J. A. Vance, M.E.I.C.

Arthur, Ont. In 1919 he became district engineer with Canadian National Railways, at Saskatoon, Sask., a position which he still holds.

Mr. Macgillivray was active on the executive of the Saskatchewan Branch for several years.

**Hugh Gordon O'Leary,** M.E.I.C., was elected councillor of the Institute representing the Lakehead Branch at the annual meeting last month. Born at Lindsay, Ont., he studied engineering at the University of Toronto where he graduated with honours in 1904. Upon graduation he joined the Transcontinental Railway and he was engaged in surveying work until 1906 when he went with the Grand Trunk Pacific Railway Company where he held the position of resident engineer of the Lake Superior Branch from 1907 to 1909. In 1909, he returned to the Transcontinental Railway as division engineer. In 1927 he became superintendent with the Canadian National Railways at Fort William, Ont., a position which he still holds.

Mr. O'Leary was chairman of the Lakehead Branch of the Institute in 1940.

**George Elmer Medlar,** M.E.I.C., is the newly elected councillor of the Institute representing the Border Cities Branch. Born in Wentworth County, Ont., he was educated at the Hamilton public and high schools, later taking a correspondence course in engineering and surveying. In 1908 to 1918 he was engaged in surveying work in Saskatchewan and Alberta. In the early part of 1919 he was with the Hamilton Harbour Commission as assistant on surveys and reports and later became assistant on sewers, waterworks and power dam development surveys at Timmins, Ont. From 1920 to 1938 he was engineer in charge of field and office work with the Essex Border Utilities Commission at Windsor, Ont., and in 1938 he became office engineer with the Windsor Utilities Commission at Windsor, Ont., a position which he still holds.

Mr. Medlar acted as secretary-treasurer of the Border Cities Branch and he was chairman in 1941.

**James Alfred Vance,** M.E.I.C., engineer and contractor of Woodstock, Ont., was re-elected councillor of the Institute representing the London Branch at the annual meeting last month. He has been a councillor representing his Branch since 1933.

Born in the County of Oxford, Ont., he was educated at the University of Toronto. On the death of his father in 1914 he took over the contracting business and became responsible for the administration, engineering and construction of steel and concrete highway bridges. From 1919 the business grew to include the design and construction of factory buildings, sewers, dams and various concrete and steel structures. Mr. Vance is at present the proprietor and engineer of the firm of J. A. Vance, contractor, at Woodstock.

Mr. Vance has been active in Institute affairs for a great many years. Lately he has represented the Institute on the Engineers' Council for Professional Development Committee on Professional Recognition.

**Harry Elmer Brandon,** M.E.I.C., structural and mechanical engineer with the Hydro-Electric Power Commission of Ontario, has been elected councillor of the Institute representing the Toronto Branch. He was born at Can-

H. E. Brandon, M.E.I.C.

N. B. MacRostie, M.E.I.C.

A. Jackson, M.E.I.C.

E. V. Gage, M.E.I.C.

nington, Ont., and was educated at the University of Toronto where he was graduated in 1907. Upon graduation he went with the Manitoba Bridge and Iron Works at Winnipeg, and in 1910 joined the Vulcan Iron Works of Winnipeg. From 1911 to 1915 he was chief engineer with this firm, and from 1915 to 1919 he was overseas in active service. In 1919 he joined the Hydro-Electric Power Commission of Ontario as a structural and mechanical engineer and is still with the Commission.

Mr. Brandon was chairman of the Toronto Branch of the Institute in 1941.

**Norman Barry MacRostie,** M.E.I.C., has been elected a councillor of the Institute representing the Ottawa Branch. Born at Metcalfe, Ont., he was educated at Queen's University where he graduated in 1911. In 1912 he was in charge of field work as assistant to the inspector of surveys in Manitoba and Saskatchewan and in 1913 he was employed with J. B. McRae, consulting engineer, Ottawa, as inspector on construction of a dam at High Falls, Que. In 1913 he joined the engineering department of the City of Ottawa, first as assistant roadway engineer and later he became in charge of sidewalks as well as city surveyor. From 1916 to 1918 he was gauge examiner with the Imperial Munitions Board.

In the spring of 1918 he joined the Royal Canadian Engineers and went overseas. Upon his return to Canada in 1919 he became a member of the firm of Lewis and MacRostie, civil engineers and surveyors, Ottawa. Later he was associated with the firm of MacRostie and White. At present he is in practice on his own account.

Mr. MacRostie was chairman of the Ottawa Branch of the Institute in 1942.

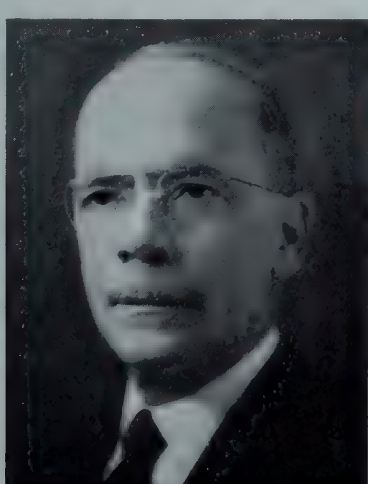
**Arthur Jackson,** M.E.I.C., professor of engineering drawing at Queen's University, is the newly elected councillor of the Institute representing the Kingston Branch. Born at Hamilton, Ont., he received his primary education in the local schools and from 1908 to 1912 he served an apprenticeship with Hamilton Bridge Works Company at Hamilton, then went to Queen's University where he graduated in 1916 as a Bachelor of Science. He went overseas in the summer of 1916 and served with the Royal Canadian Engineers in France and Belgium until 1919. He joined the staff of Manitoba Bridge and Iron Works at Winnipeg upon his return to Canada in the summer of 1919. The following year, he joined the staff of Queen's University as an associate professor in engineering drawing, later becoming professor, a position which he still holds.

Professor Jackson has been active on the executive of the Kingston Branch for a great many years.

**Edward Victor Gage,** M.E.I.C., president of A. F. Byers Construction Company, Montreal, has been elected a councillor of the Institute representing the Montreal Branch. Born at Pearceton, Que., he received his engineering education at McGill University and graduated in civil engineering with the degree of B.Sc. in the class of 1915.

Upon graduation he joined the firm of the late A. F. Byers, M.E.I.C., engineer and contractor, and has been with the company ever since. Upon the death of Mr. Byers last year, Mr. Gage became president of A. F. Byers Construction Company, Limited.

He has been active in the Montreal Branch of the Institute for a great many years.



J. A. Lalonde, M.E.I.C.

H. J. Ward, M.E.I.C.

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

John P. Mooney, M.E.I.C.

Chas. Scrymgeour, M.E.I.C.

**Joseph Antonio Lalonde,** M.E.I.C., was elected councillor of the Institute representing the Montreal Branch at the annual meeting last month. Born at Au Sable, Michigan, he was educated at the Ecole Polytechnique, Montreal, where he graduated in 1912. Upon graduation he spent a few months on railway work with the North Railway Company at Hudson Bay. In 1913 he joined the staff of the City of Outremont as assistant engineer. In 1920 he went with the City of Montreal as assistant superintendent of streets, a position which he left in 1924 to join the staff of Quinlan, Robertson and Janin, Montreal, as manager of the paving department. In addition to these duties he was chief engineer of A. Janin and Company from 1930 to 1939. At that time he became manager and chief engineer of the Quebec Paving Company, Montreal, and associated companies. Last year he accepted a position as production manager with Marine Industries Limited at Sorel, Que. He has been professor in municipal engineering at Ecole Polytechnique since 1926.

Mr. Lalonde was chairman of the Montreal Branch of the Institute in 1942.

**Herbert James Ward,** M.E.I.C., is the newly elected councillor of the Institute representing the St. Maurice Valley Branch. Born and educated in England, Mr. Ward joined the Shawinigan Water & Power Company Limited at Shawinigan Falls, Que., in 1911, and has been employed with the firm ever since. From 1915 he was assistant city engineer of Shawinigan Falls. Mr. Ward has been connected with the hydro-electric development in the Valley since the earliest days and he now holds the position of superintendent of property of the company at Shawinigan Falls.

Mr. Ward was chairman of the St. Maurice Valley Branch of the Institute in 1938.

**John Wilmot Ward,** M.E.I.C., has been elected councillor of the Institute representing the Saguenay Branch. Born at Hagersville, Ont., he was educated at the University of Toronto where he graduated in 1921. From 1921 to 1923 he was service manager for Wagner Electric Corporation at Toronto, Ont. In 1923 he joined the staff of the Aluminum Company of Canada Limited at Toronto as assistant engineer. In 1926 he was transferred to Arvida, Que., as assistant engineer in the electrical department.

Mr. Ward was chairman of the Saguenay Branch of the Institute in 1940-41.

**John Patrick Mooney,** M.E.I.C., is the newly elected councillor of the Institute representing the Saint John Branch. Born at Saint John, N.B., he was educated at the University of New Brunswick where he received the degree of B.Sc. in 1916. Upon graduation he entered the employ of B. Mooney and Sons, general contractors at Saint John. In 1919 he became manager of the company still retaining this position when the firm name was later changed to Mooney Construction Company.

Mr. Mooney was chairman of the Saint John Branch of the Institute in 1940.

**Charles Scrymgeour,** M.E.I.C., refinery engineer with Imperial Oil Limited at Dartmouth, N.S., is the newly elected councillor of the Halifax Branch of the Institute. Born and educated at Liverpool, England, he served his apprenticeship with Jas. Buchanan & Sons, Ltd., engineers at Liverpool. During the last war he was employed in the manufacture of munitions for the same firm and later for the Austin Motor Company at Birmingham. He came to Canada in 1919 and joined the Acadia Sugar Refining Co. Ltd., at Woodside, N.S., as a draughtsman. In 1921 he went with Imperial Oil Refineries Limited at Dartmouth, N.S., becoming assistant refinery engineer in 1926. In 1929 he was appointed refinery engineer a position which he still holds.

Mr. Scrymgeour was chairman of the Halifax Branch of the Institute in 1940.

## JANUARY JOURNALS REQUIRED

**There has been an unusual demand for extra copies of the January, 1943, issue of *The Engineering Journal* and it would be appreciated if members who do not retain their copies would return them to Headquarters, at 2050 Mansfield Street, Montreal, Que.**

# INSTITUTE PRIZE WINNERS

**Henry Girdlestone Acres,** M.E.I.C., consulting engineer, H. G. Acres and Company, Niagara Falls, Ont., is one of the recipients for 1942 of the Julian C. Smith Medal awarded by the Institute "for achievement in the development of Canada."

The citation, read upon presentation of the medal to Dr. Acres at the annual banquet is as follows:

"A distinguished graduate of the University of Toronto where he was awarded a doctor's degree in 1924, Henry Girdlestone Acres began his association with power development with Canadian Niagara Power Company in 1903. In 1911 he became the chief hydraulic engineer. During the next twelve years he dealt with installations having a total capacity of over a million horsepower. In 1924 he began his consulting practice. His sphere of activity has included work in Quebec, New Brunswick, Alberta, Saskatchewan, Newfoundland, India and South America.

Dr. Acres has taken such a leading part in the development of our power resources that it would seem especially fitting for The Engineering Institute of Canada to recognize his achievements and professional eminence."

**Robert Melville Smith,** M.E.I.C., deputy minister of the Department of Highways for the province of Ontario, is one of the recipients for 1942 of the Julian C. Smith Medal awarded by the Institute "for achievement in the development of Canada." Mr. Smith could not be present at the annual banquet to receive his medal. The citation which accompanies the award reads as follows:

"The successful development of the admirable highway system of Ontario during the past twenty years has been in no small measure due to the supervisory work of Robert Melville Smith, first as chief engineer and then deputy minister of highways, and since 1935 as deputy minister of the combined Departments of Highways and Northern Development. In these capacities his administration has been far-sighted and economical. He has been called in as consultant on many important projects, among which may be mentioned the extensive programme of the Grand River Conservation Commission and the Alaska Highway.

Mr. Smith is a distinguished alumnus of Queen's University where he graduated in 1914. Since then his time has been devoted to the public service, in which he has gained a well-earned reputation as one of the leading Canadian authorities on highway problems. He has indeed 'rendered outstanding service in furthering the development of Canada'."

**Dr. Stanley Dale Lash,** M.E.I.C., has been awarded the Gzowski Medal of the Institute for 1942, for his paper, "The Analysis and Design of Rectangular Reinforced Concrete Slabs Supported on Four Sides," published in the September 1941 issue of *The Engineering Journal.* Born at Sheffield, England, Dr. Lash is an honour graduate of the City and Guilds Engineering College, London, England, and a Ph.D. of the University of Birmingham. He came to Canada in 1929 as draughtsman with the Northern Electric Company of Montreal, and later was employed with the Dominion Reinforcing Steel Company, Limited, Montreal. In 1930, he went to Vancouver as a structural detailer with the British Columbia Electric Railway Company, Limited. From 1931 to 1933 he did post-graduate work at the University of Birmingham, and from 1933 to 1935 he worked as a research assistant with the Steel Structures Research Committee in England.

Returning to Canada in 1935, he was instructor in civil engineering at the University of British Columbia until 1938, when he joined the National Research Council at Ottawa as a junior engineer. Later Dr. Lash was acting secretary of the National Building Code project with the National Research Council. In 1941 he joined the teaching staff at Queen's University as a lecturer in civil engineering and last year he became assistant professor of civil engineering. Dr. Lash is a frequent contributor to *The Engineering Journal.*

**John Henry Maude,** M.E.I.C., chief designer of the Mining, Metals and Plastics Machinery Department of the Dominion Engineering Company, Montreal, is the recipient of the Duggan Medal and Prize of the Institute for 1942, for his paper on "The New Oil-Hydraulic Press in Munitions Manufacture" presented at the annual meeting of the Institute in 1942 and published in the February, 1942 issue of *The Engineering Journal.*

Born at Manchester, England, he was educated at the Manchester College of Technology, and served an apprenticeship with Sir W. G. Armstrong Whitworth at Manchester. From 1917 to 1924 he was employed as a draughtsman and designer for the general engineering department of Sir W. G. Armstrong Whitworth, and from 1924 to 1929 he was leading designer with Messrs. Vickers Armstrong, Manchester.

Mr. Maude came to Canada in 1929 as a mechanical engineer with Dominion Bridge Company Limited at Lachine, Que., later transferring to the Dominion Engineering Company Limited. He is the patentee and co-patentee of the numerous devices used on the presses manufactured by his company. Since the outbreak of war he has been particularly responsible for the design and development of the modern hydraulic presses used in the manufacture of shell cases.

H. G. Acres, M.E.I.C.

R. M. SMITH, M.E.I.C.

S. D. Lash, M.E.I.C.

J. H. Maude, M.E.I.C.

E. A. Allcut, M.E.I.C.

Paul Billingsley, M.C.I.M.M.

**Edgar Alfred Allcut,** M.E.I.C., professor of mechanical engineering at the University of Toronto, is the recipient of the Plummer Medal of the Institute for 1942, for his paper, "Producer Gas for Motor Transport" published in the April, 1942 issue of *The Engineering Journal.* Born at Birmingham, England, he was educated at the University of Birmingham where he received the degree of B.Sc. in engineering with honours in 1908 and the degree of M.Sc. in engineering in 1909. From 1908 to 1910 he was research scholar at the University of Birmingham. From 1910 to 1913 he was assistant engineer with the Humphrey Pump Company at Westminster, England, and in 1913 he became manager in the engineering and testing machine department of W. & T. Avery Limited, Birmingham. From 1917 to 1921 he was chief inspector of materials with the Austin Motor Company at Birmingham. Professor Allcut came to Canada in 1921 as associate professor of mechanical engineering at the University of Toronto, and in 1931 he became professor of mechanical engineering. In 1930 Professor Allcut was awarded the Herbert Akroyd Stuart prize of the Institution of Mechanical Engineers, London, England, for the best paper published in their Proceedings during the years 1927-28 and 1929, on the general subject of the origin and development of heavy oil engines. This was the first time that one of the Herbert Akroyd Stuart prizes had been awarded outside of Great Britain.

Professor Allcut is technical advisory editor of *Manufacturing and Industrial Engineering* a monthly publication from Toronto, and chairman of the sub-committee on Producer Gas of the National Research Council. He is also a member of the Institute's committees on Industrial Relations and International Relations.

**Paul Billingsley,** M.C.I.M.M., is the joint winner of the Leonard Medal of the Institute for 1942 for his paper written in co-operation with Mr. C. B. Hume on "Ore Deposits of Nickel Plate Mountain," published in the May 1941 issue of *The Canadian Mining and Metallurgical Bulletin.* Mr. Billingsley is a consulting geologist of Burton, Wash.

**Chamberlain Bruce Hume,** M.C.I.M.M., joint winner of the Leonard Medal of the Institute for 1942, was born at Revelstoke, B.C. He was educated at Mount Allison University, Sackville, N.B., and Nova Scotia Technical College, Halifax, where he received the degree of B.Sc. in mining engineering in 1930. From 1930 to 1932 he was engaged in highway construction work in British Columbia and he did prospecting work in the Caribou district, B.C. Since 1934 he has been with the Kelowna Exploration Company at Hedley, B.C., and is now chief engineer and resident geologist in charge of operations at the Nickel Plate mine.

**Robert John Graham Schofield,** Jr.E.I.C., has been awarded the John Galbraith Prize of the Institute for 1942. He received his early education in Winnipeg, Toronto and Montreal West. He entered McGill University in 1929 and graduated in 1935 with the degree of Bachelor of Engineering in chemical engineering. Upon graduation he went with Brunner Mond (Canada) Ltd., at Amherstburg, Ont. In 1936 he joined Canadian Cottons Limited, and spent two years in their Milltown, N.B. branch and was then transferred to their mill in Hamilton, Ont., where he is at present located.

C. B. Hume, M.C.I.M.M.

R. J. G. Schofield, Jr.E.I.C.

René Dansereau, S.E.I.C.

**Paul O. Freeman, S.E.I.C.**

**René Dansereau,** S.E.I.C., has been awarded the Ernest Marceau Prize of the Institute for 1942 for his paper on "Etude comparative de la construction par rivure et par soudure d'un pont-route en acier." Mr. Dansereau received his early education at Mont Saint-Louis College, Montreal and is a graduate of Ecole Polytechnique in the class of 1942. During vacations he worked for several firms of contractors as inspector and draughtsman and was with the Dominion Bridge Company, Limited, for a time.

Mr. Dansereau is now a Pilot Officer in the R.C.A.F. in training at Rivers, Man.

**Paul O. Freeman,** S.E.I.C., was awarded the Phelps Johnson Prize of the Institute for 1942 for his paper on "Cold Rivetting—Its Principles, Procedure and Advantages." He received his primary education at the Montreal West High School and is at present in his final year of civil engineering at McGill University. During college vacations he has been employed at the Angus Shops of the Canadian Pacific Railway Company, and with the Dominion Bridge Company.

## MEETINGS OF COUNCIL

The Annual Meeting of the Council of the Institute was held at the Royal York Hotel, Toronto, on Wednesday, February 10th, 1943, convening at ten o'clock a.m.

*Present:* President C. R. Young (Toronto) in the chair; Past-Presidents T. H. Hogg (Toronto) and C. J. Mackenzie (Ottawa); Vice-Presidents deGaspé Beaubien (Montreal), K. M. Cameron (Ottawa), Hector Cimon (Quebec), J. L. Lang (Sault Ste. Marie), and G. G. Murdoch (Saint John); Councillors J. E. Armstrong (Montreal); J. M. Fleming (Port Arthur), E. D. Gray-Donald (Quebec), J. G. Hall (Montreal), R. E. Heartz (Montreal), W. G. Hunt (Montreal), E. M. Krebser (Walkerville), N. MacNicol (Toronto), C. K. McLeod (Montreal), A. W. F. McQueen (Niagara Falls), A. E. Pickering (Sault Ste. Marie), G. M. Pitts (Montreal), H. R. Sills (Peterborough), J. A. Vance (London), and A. O. Wolff (Saint John); Vice-President Elect L. F. Grant (Kingston); Councillors-Elect H. E. Brandon (Toronto), E. V. Gage (Montreal), A. Jackson (Kingston), N. B. MacRostie (Ottawa), and H. J. Ward (St. Maurice Valley). Treasurer E. G. M. Cape (Montreal), Secretary-Emeritus R. J. Durley, General Secretary L. Austin Wright, and Assistant General Secretary Louis Trudel.

There were also present by invitation—Past-Presidents J. B. Challies (Montreal), J. M. R. Fairbairn (Peterborough), and O. O. Lefebvre (Montreal); Past-Vice-President H. E. T. Haultain (Toronto); Past-Councillor Huet Massue (Montreal); T. S. Glover, chairman, Hamilton Branch; R. S. Eadie, chairman, Montreal Branch; René Dupuis, chairman, and Paul Vincent, secretary, Quebec Branch; J. T. Farmer (Montreal), chairman, Duggan Medal and Prize Committee; G. A. Gaherty (Montreal), chairman, Committee on Western Water Problems; S. R. Frost, member of Membership Committee; W. S. Wilson, chairman of the Toronto Branch and chairman of the Annual Meeting Committee.

After extending a cordial welcome to all councillors and guests, President Young asked each person to rise and introduce himself to the meeting.

President Young explained that this proposed "Canons of Ethics" had been prepared by a special committee of the Engineers' Council for Professional Development (E.C.P.D.), under the chairmanship of Dr. Dugald Jackson. The committee had realized that undoubtedly there would be some criticism regarding the length of the document, but it had felt that it would be very useful to young engineers if these principles of ethics were set forth in a little more detail than in the ordinary short codes. The committee was co-operating with the E.C.P.D. committee on Professional Training which is particularly concerned with the progress of young engineers in the post-graduate years. It was felt that such a document would serve a very useful purpose in pointing out to young engineers certain pitfalls which might not be revealed in a shorter code. If any organization wished to have a shorter code, an abstract could be prepared.

The proposed "Canons of Ethics" had been sent out to all members of Council with a request for comments, and the general secretary reported that replies had been received from seven members. These replies varied somewhat—some expressed approval, others made some comment, and one or two had made constructive suggestions. The general opinion appeared to be that the document was too long, although it was admitted that it might be necessary to include all the items in order to accomplish the desired result.

At the president's request, the general secretary gave a summary of the replies received and after some discussion, on the motion of Mr. Pitts, seconded by Mr. Gray-Donald, it was unanimously resolved that the president appoint a small committee to study the proposed "Canons of Ethics" and the replies received from councillors, and prepare a report for submission to Council.

Dr. Challies, chairman, of the Institute's Committee on Professional Interests, reported that in Manitoba the Council of the Association of Professional Engineers and the executive of the Winnipeg Branch of the Institute had approved a form of co-operative agreement, which was acceptable to the Committee on Professional Interests.

This was noted with satisfaction, and the hope was expressed that the agreement would be consummated at an early date. It was explained that at the moment the Council of the Association feels that as many of its members are overseas, a ballot to obtain approval of the agreement from the membership should not be taken until after the war. Following some discussion, on the motion of Mr. Vance, seconded by Mr. Wolff, it was unanimously resolved that Council should express to the Association its appreciation of the progress which has been made, and inform them that Council is prepared to send out the Institute ballot to members in Manitoba concurrently with a similar action by the Association, at any time acceptable to the Association and the Winnipeg branch.

President Young introduced the topic of affiliation with sister societies by explaining the sequence of events prior to the recent authorization by the Board of Direction of the American Institute of Electrical Engineers (A.I.E.E.) of a new section in the city of Montreal. He informed Council that he had gone to New York to discuss this matter with Mr. Osborne, the president of the A.I.E.E., with whom the situation was reviewed thoroughly and the Institute's policy and aspirations were explained in detail. In President Young's opinion, additional sections of American societies in Canada would be unfortunate inasmuch as they would confuse and retard the efforts of the Institute to simplify and coordinate organized engineering in Canada. The president emphasized to Mr. Osborne the seriousness of this development, not only from the point of view of the Institute, but the whole profession, and suggested to him that the A.I.E.E. take no action with regard to the application for the section until the two societies had had an opportunity to survey the situation to see if some other amicable and equally advantageous arrangement might be evolved.

While at that time Mr. Osborne agreed that some co-operative basis of operation might be evolved which would work out to the mutual advantage of both organizations, President Young had received, a few days previous to this Council meeting, a letter from Mr. Osborne stating that the A.I.E.E. Board had unanimously decided to grant section status to the Montreal members. The latter from President Osborne and the brief acknowledgment of President Young were read to the meeting.

At the request of the president, Past-President J. B. Challies summarized recent developments referring to the viewpoint of several senior Montreal members of the A.I.E.E. who had approached him in the matter and expressed strong disapproval of the proposed section. He pointed out the difficulties which would face organized engineering in Canada if all the American societies decided to operate sections in various parts of Canada, particularly if these societies attempted to enter the Canadian universities and organize student chapters.

Mr. Challies stated that the recent action of the Board of the A.I.E.E. posed a problem for the E.I.C. which must be considered dispassionately from a long-term viewpoint, and in its broadest aspect. He thought the time had come when the Institute should consider the advisability of obtaining authority by an appropriate new by-law, similar to the by-law authorizing co-operative agreements with the provincial professional associations that would permit the Council to enter into co-operative agreements with British, American or Canadian professional engineering bodies, covering joint meetings; reciprocal membership privileges; availability at reduced cost of society publications, etc., etc., all for the purpose of promoting the best interests of the engineering profession in Canada.

Past-President Dean Mackenzie stated that he thought there was a great danger in the movement which had been started, particularly if it gets into the universities. He expressed the view that there was a definite value in membership in the American societies, but these values were principally in the publications. He agreed with Mr. Challies that the situation should be canvassed with dignity and consideration in order to find a satisfactory solution. Past-Presidents Fairbairn and Lefebvre were also of the opinion that the profession would suffer in a development of segregation and that everything should be done to avoid it. Past-President Lefebvre pointed out that the engineers are the only profession that allowed themselves to be divided in their societies.

It was the unanimous opinion of the members present at the meeting that an immediate survey be made of the Institute's relations with other engineering societies and that at the same time a study be made as to the best way for improving these relations in the future and possibly of codifying them through co-operative agreements similar in general setup to those that have been entered into between the Institute and the provincial professional associations.

A motion made by Vice-President Beaubien and seconded by Councillor Armstrong was unanimously agreed to—that the incoming president select a committee to advise Council as to what action would be appropriate under the circumstances and to do so with the least practicable delay.

Mr. Hall reviewed the work of the Membership Committee during the past year and commented briefly on the various items which had received consideration by the committee, including branch affiliates, Institute affiliates, membership in provincial professional associations, branch recommendations with particular reference to the waiving of examinations, and the whole question of the method of dealing with applications. His committee had reported on the various items, and there was now before Council a report which included a proposed "Memorandum to branch executives—re qualifications for membership," together with a suggested form for the use of branch membership or executive committees in summarizing all available information regarding an applicant. A copy of this memorandum had been sent to all members of Council and councillors-elect with a request for comments.

Mr. Hall's committee would like to see this form used by the branch committees, and would also like to see some central committee appointed to study applications before they are presented to Council.

Colonel Cape expressed his appreciation of this very comprehensive report. In his opinion more information should be available to members of Council, including details of the examinations which have to be passed, and a list of the schools which are recognized by Council.

Mr. Gray-Donald pointed out that the requirements for the various classes of membership as described in the by-laws, were the minimum requirements in each case. He felt that Council was perhaps too lenient in admitting to corporate membership applicants who only just fulfil the requirements. Membership in the Institute was not "permission to practise," but such membership gave a definite standing in the profession which took a certain length of time to acquire.

Following some further discussion, on the motion of Mr. Hall, seconded by Mr. Armstrong, it was unanimously resolved that the report of the Membership Committee be approved, and that the proposed memorandum be sent out to all branch executives with a request that they operate under it for one year as a trial.

A letter was presented from the Toronto Branch advising that that branch had given consideration to the use on the Institute letterhead of the words "Incorporated 1887 as The Canadian Society of Civil Engineers." There appeared to be a feeling among certain engineers that the Institute is being operated mainly by and for the benefit of civil engineers rather than for the whole engineering profession. To counteract this, the Toronto Branch feels that unless there is some special reason for retaining those words on the letterhead, it would be desirable to omit them.

The general secretary reported that on receipt of this letter, he had consulted the Institute's counsel who had advised that it would be in order for the Institute to retain on its letterhead and other documents the words "Incorporated 1887" and, at the same time, eliminate the words "as The Canadian Society of Civil Engineers". The fact that the Canadian Society of Civil Engineers had changed its name to the Engineering Institute of Canada, did not in any way affect the date of its incorporation.

On the motion of Mr. MacRostie, seconded by Mr. Heartz, it was unanimously resolved that the words "as The Canadian Society of Civil Engineers" be deleted from the Institute letterhead and other documents.

The general secretary read the following letter which had just been received from the Assistant Dean and Secretary of the Faculty of Applied Science and Engineering at the University of Toronto:

"The report of the Committee on Industrial Relations of the Engineering Institute of Canada has been considered and studied for some time by the Committee on Policy of the Council of the Faculty of Applied Science and Engineering.

"The Council at its meeting of February 1, 1943, recorded in its minutes its sympathetic approval of the attention being devoted to Industrial Relations by the Engineering Institute of Canada, and directed that the Institute be advised of the importance with which the Council views the work presently conducted in the Faculty in this field. The Council has appointed a comittee to investigate the desirability and possibility of extending this work, and of initiating instruction in the general field of Industrial (or Administrative) Engineering."

Dr. Challies commented on the appointment of Robert E. Laidlaw, K.C., as judge on the Appellate Division of the Supreme Court of Ontario. He pointed out that Mr. Laidlaw had been graduated as a civil engineer from the University of Toronto in 1915. He had entered Osgoode Hall the following year, and was called to the bar of Ontario in 1919. He has had a distinguished career, and in association with Dean C. R. Young was co-author of the only text book in Canada on Engineering Law. Dr. Challies suggested that a letter from the president to his associate, congratulating him on his appointment, would be most appropriate. President Young was quite sure that Mr. Justice Laidlaw would be delighted to receive such an appreciation from the Council of the Institute. Although he had not practised engineering for a number of years, he was still keenly interested in engineers and engineering. He is a man of extraordinary capacity and one of the leading lawyers of the province. Accordingly, on the motion of Mr. Vance, a class-mate of Mr. Laidlaw, seconded by Mr. Hall, it was unanimously resolved that a letter congratulating him on his recent appointment, and expressing the good wishes of Council, be sent to Mr. Justice Laidlaw.

A number of applications were considered, and the following elections and transfers were effected:

| Admissions | |
|---|---|
| Members | 11 |
| Junior | 1 |
| Students | 32 |
| Affiliates | 6 |

| Transfers | |
|---|---|
| Junior to Member | 6 |
| Student to Member | 6 |
| Student to Junior | 13 |

The president announced that a meeting of the new Council, to which all retiring councillors are invited, would be held on Thursday, February 11th, at four o'clock p.m.

The Council rose at one fifteen p.m.

A meeting of the Council of the Institute was held at the Royal York Hotel, Toronto, on Thursday, February 11th, 1943, at four o'clock p.m.

*Present:* President K. M. Cameron in the chair; Past-President C. R. Young; Vice-Presidents Hector Cimon, L. F. Grant, J. L. Lang and G. G. Murdoch; Councillors J. E. Armstrong, H. E. Brandon, E. V. Gage, E. D. Gray-Donald, R. E. Heartz, W. G. Hunt, A. Jackson, N. B. MacRostie, A. E. Pickering, G. M. Pitts, H. R. Sills, J. A. Vance and H. J. Ward; Past-Councillor A. O. Wolff; Colonel E. G. M. Cape; H. F. Bennett, chairman of the Committee on the Young Engineer; R. S. Eadie, chairman of the Montreal Branch; Colonel George Beecroft, Military Advisor to the Wartime Bureau of Technical Personnel; Secretary-Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

In opening the meeting Mr. Cameron thanked the councillors for attending, and expressed the hope that the Council would have a very profitable and constructive year.

On the motion of Mr. Vance, seconded by Mr. Cimon, it was unanimously resolved that L. Austin Wright be reappointed general secretary of the Institute.

On the motion of Mr. Gray-Donald, seconded by Colonel Grant, it was unanimously resolved that Professor C. V. Christie be appointed treasurer of the Institute.

Before reporting on the work of his committee on the Training and Welfare of the Young Engineer, Mr. Bennett, as a member of Mr. Cameron's staff for many years, extended, on behalf of the staff of the Department of Public Works of Canada, congratulations to Mr. Cameron on his election to the presidency of The Engineering Institute of Canada. He expressed the hope that his efforts would be crowned with the same success that the Institute has had in recent years.

Although he had nothing of special importance to report regarding the work of this committee, Mr. Bennett stated that he was definitely pleased with the activities of the branches in the matter of student guidance. Student guidance committees had been appointed by all of the branches except three, namely, the Cape Breton Branch which was being looked after in that regard by the Committee of the Halifax Branch; the Moncton Branch which is represented on the main committee by Dean McKiel, and the Lethbridge Branch which is really the only branch not represented. Three active members from the Quebec Branch were in attendance at this annual general meeting. Through the courtesy of the Shawinigan Water and Power Company, the committee had been provided with a French translation of the booklet, "The Profession of Engineering in Canada." These have been distributed to French schools and the reaction has been very favourable—equally or more so than in the English schools. During the past year the committee has had many enquiries from individual students asking for additional information—a very definite evidence that the money and effort expended has been effective. In Mr. Bennett's opinion, it will continue to be so as the work of the student guidance committees is really just getting under way.

Regarding the matter of government aid to university students which had been brought up at the Council meeting in Niagara Falls in October, Mr. Bennett had discussed this with interested parties and there seemed to be no reason why engineering education should not be included in such an arrangement after the war. As the Wartime Bureau of Technical Personnel might be dissolved after the war, it was felt that the matter should be followed up by The Engineering Institute of Canada. Accordingly, his committee will keep in touch with any movement along this line and will have something to present to the government in the future.

Mr. Bennett then touched briefly on the committee's work among the junior engineers. A junior section had recently been formed in the Toronto Branch, and he has agreed to address the group in March or April. Mr. Bennett expressed the hope that the older engineers would make a special effort to help these younger engineers by getting them interested in branch activities. He suggested that something might be published in the nature of a personal message from the president of The Engineering Institute of Canada to be presented to young engineering graduates when entering the profession.

Dean Young stated that it had been suggested to him that the Institute would be rendering a very great service to the engineering profession in Canada if every applicant for admission to an engineering school could be furnished with a copy of the booklet "The Engineering Profession in Canada." In his opinion this suggestion should receive careful consideration, and he suggested that the Finance Committee be consulted with regard to the possibility of undertaking this additional expense. Mr. Bennett pointed out that his committee had about five thousand copies of the booklet on hand so that such a distribution would not involve any additional expense for this year at least. Following some discussion it was unanimously resolved that the suggestion be referred to Mr. Bennett's committee for the necessary action and for possible consultation with the Finance Committee should it be decided to continue such a programme into another year.

Mr. Cameron expressed appreciation of Mr. Bennett's remarks regarding himself. He had had occasion to be particularly proud of the engineers in the government service, and especially his colleagues in his own department. He hoped the association would continue for many years.

The motion passed at the Annual Meeting of Council on the 10th was presented to this meeting for consideration. This motion stated that a committee to consider Institute policy relative to other professional engineering bodies, and in particular the American Institute of Electrical Engineers (A.I.E.E.), be selected by the incoming president.

Dean Young again outlined the developments leading up to the establishment of the A.I.E.E. section in Montreal and again emphasized the opinion of President Osborne of the A.I.E.E. that there might be established some affiliation between the members of both groups. A very full discussion followed in which Messrs. Young, Sills, Eadie, Armstrong, Gray-Donald, Heartz, Pitts and the president took part. Mr. Eadie spoke of the situation from the point of view of the Montreal Branch of the Institute, and indicated that the branch felt that the matter was one of national importance rather than local and therefore was inclined to wait for some guidance or leadership from Council before going into the situation locally. Finally, it was moved by Past-President Young, seconded by Councillor Armstrong, and unanimously agreed, that President Cameron be authorized to select an appropriate committee to examine the whole question of the Institute's relations with engineering bodies, and in particular the A.I.E.E., and to report to Council at the earliest opportunity regarding ways and means for evolving a programme and a policy for the Institute that will guarantee its position as the national engineering body, and that will best promote the general interest of the profession in Canada.

President Cameron briefly outlined some of the complaints which have come to the Institute with regard to rank and professional remuneration for engineers in the armed services. In the discussion which followed, many councillors participated and a special contribution was made by a friend of the Institute who was particularly well informed on these matters.

Council was sufficiently impressed with the seriousness of the situation that it was agreed that the president should name a committee to examine conditions, with particular reference to professional recognition and the establishment of a Corps similar to that working so effectively in the Imperial Army, known as the Royal Electrical and Mechanical Engineers (R.E.M.E.).

It was agreed that the recommendations of this committee would be taken up vigorously with the proper authorities in order to obtain for the members of the profession equality of treatment with other professions and at the same time increase the efficiency of those divisions of the forces which employ engineers professionally.

Councillor MacRostie drew the Council's attention to the fact that the government had set up, on behalf of the Treasury Board, an Advisory Committee to inquire into and report to the Board in respect of conditions of work and remuneration for employees in the Civil Service. Mr. MacRostie referred to the fact that many engineers in the government service are getting less pay than artisans. He thought the Council of the Institute should appoint a committee to study this whole question and, based on the committee's report, make a recommendation to the Advisory Committee referred to in Order-in-Council No. P.C. 2/584.

It was emphasized by different persons that some of the better qualified engineers were refusing to enter or were leaving the government service because of the inadequacy of the remuneration. The meeting thought this was putting a handicap on government operations and that a proper survey of the situation would indicate that it would be more economical if the government could retain a larger percentage of the highly trained engineers. On the motion of Mr. MacRostie, seconded by Mr. Vance, it was agreed that such a committee should be appointed.

On the motion of Mr. MacRostie, seconded by Mr. Murdoch, it was unanimously resolved that a hearty vote of thanks and an expression of appreciation be extended to the Toronto Branch and the Annual Meeting Committee for their hospitality during the Annual General Meeting.

On the motion of Mr. Vance, seconded by Mr. Armstrong, it was unanimously resolved that the thanks of Council be extended to the retiring president, the retiring councillors, and the retiring treasurer for their unselfish service. The Institute was greatly indebted to Dean Young for his excellent leadership during these trying times.

The Council rose at six fifteen p.m.

## ELECTIONS AND TRANSFERS

At the meeting of Council held on February 10th, 1943, the following elections and transfers were effected:

*Members*

**Bjarnason,** Barney Sveinn, B.Sc. (Elec.), (Univ. of Man.), test engr., Radio Inspection and Test Dept., Research Enterprises, Ltd., Leaside, Ont.

**Finch,** Gordon Holbrook, B.Sc. (Elec.), (Univ. of Man.), sales engr., Canadian Westinghouse Co. Ltd., Ottawa, Ont.

**Frost,** John George, chief dftsmn., Power Corp. of Canada, Ltd., Montreal, Que.

**Hanlon,** John Edward, B.A.Sc., (Univ. of Toronto), 2053 Metcalfe St., Montreal, Que.

**Labrecque,** Henri, B.A.Sc., C.E., (Ecole Polytechnique), consltng. engr., and professor, Ecole Polytechnique, Montreal, Que.

**MacKay,** Ernest, B.A.Sc., C.E., (Ecole Polytechnique), professor, Ecole Polytechnique, Montreal, Que.

**Robert,** René Antonio, B.A.Sc., C.E., (Ecole Polytechnique), asst., Physics Laboratory, Ecole Polytechnique, Montreal, Que.

*Junior*

**Boux,** John William, B.Sc. (Civil), (Univ. of Man.), staff engr., airport divn., Macdonald Bros. Aircraft, St. James, Man.

*Affiliates*

**Keane,** Edward Joseph, director and chief engr., Paul Curran Ltd., (Canada), Montreal, Que.

**Lawton,** Herbert Clarence, elect'l contractor, 68 Thorne Ave., Saint John, N.B.

**Mills,** Alfred Arthur, dftsmn. and plan surveyor, Inspection Branch, Quebec Provincial Government, Verdun, Que.

**Norton,** Alan Douglas, chief tool designer and methods supervisor, Canadian Car & Foundry Co. Ltd., Fort William, Ont.

**Reynolds,** Theodore, stationary enginemen examiner and asst. chief inspr. for boilers of the province of Quebec, Montreal, Que.

**Thomson,** Christian Aldrom, (Tri-State College), tech'l. supt., R. Campbell Brown & Co. Ltd., Montreal, Que.

*Transferred from the class of Junior to that of Member*

**Black,** William Steele, B.Eng. (Civil), (Univ. of Sask.), asst. engr., bldg. constrn. dept., Trinidad Leaseholds Ltd., Pointe-à-Pierre, Trinidad, B.W.I.

**Esdaile,** Hector Milton, B.Eng., (McGill Univ.), supt. of service and erection, Combustion Engrg. Corpn., Montreal, Que.

**Hutton,** John Robert, B.Sc. (Elec.), (N.S. Tech. Coll.), lamp engr., Canadian Westinghouse Co. Ltd., Hamilton, Ont.

**McKenzie,** Rolph Boynton, B.Sc. (Chem.), (Univ. of Alta.), manager, McKenzie Electric Co. Ltd., Lethbridge, Alta.

**Stirling,** L. Brodie, B.Sc. (Elec.), (McGill Univ.), asst. supt. of generating stations, Shawinigan Water & Power Co., Shawinigan Falls, Que.

**Stratton,** Leslie Robertson, B.Sc. (Civil), (Univ. of N.B.), res. engr. National Harbours Board, Ottawa, Ont.

*Transferred from the class of Student to that of Member*

**Carmichael,** James I., B.Sc. (Mech.), (Queen's Univ.), asst. chief inspr., Canadian Car & Foundry Co. Ltd., Fort William, Ont.

**Dunlop,** Robert John Forrest, B.Eng., (McGill Univ.), time study supervisor, Belding-Corticelli Ltd., Montreal, Que.

**Duranceau,** Charles Arthur, B.Eng., (McGill Univ.), civil engr. and manager, Chas. Duranceau Limitée, Montreal, Que.

**Haselton,** William Beverley, B.Sc., (Civil), (Univ. of N.B.), manager and operator, W. M. Haselton Granite Quarries, Beebe, Que.

**Pritchard,** Geoffrey Rowland, B.Sc. (Elec.), (Univ. of Man.), manager, western Ontario & Winnipeg district, Canadian Allis Chalmers, Ltd., and lighting service engr., Canadian General Electric Co. Ltd, Winnipeg, Man.

**Robert,** André, B.Sc. (Elec.), (Univ. of Sask.), system communication engr., Saguenay Transmission Co., Arvida, Que.

*Transferred from the class of Student to that of Junior*

**Duquette,** Roland Charles, B.Eng., (McGill Univ.), 753 St. Catherine Rd., Outremont, Que.

**Extence,** Alan Barr, B.A.Sc., (Univ. of Toronto), demonstrator in mech. engrg., University of Toronto, Toronto, Ont.

**Gray,** Laurence Frederick, B.A.Sc., (Elec.), (Univ. of B.C.), radio engr., transmitter development dept., Canadian Marconi Co., Montreal, Que.

**Horwood,** William Osmund, B.Eng. (Mech.), (McGill Univ.), design and dftng., Aluminum Co. of Canada, Ltd., Montreal, Que.

**Kinghorn,** William Wallace, B.Sc. (Civil), (Univ. of N.B.), aircraft inspr., (A.I.D.), Canada Car & Foundry Co. Ltd., Amherst, N.S.

**Kobylnyk,** Demetrius Frederick, B.Sc. (Elec.), (Univ. of Alta.), junior engr., Calgary Power Co. Ltd., Calgary, Alta.

**Macnabb,** Thomas Creighton, Jr., B.Sc. (Civil), (Univ. of Man.), transitman, Laurentian Division, C.P.R., Montreal, Que.

**Marchand,** Fernand, B.A.Sc., C.E., (Ecole Polytechnique), electronics and development engrg., Canadian Westinghouse Co. Ltd., Hamilton, Ont.

**Marshall,** Welsford Allen, B.Sc. (Civil), (Queen's Univ.), Lieut., R.C.O.C., 7th Division, O.M.E. Workshops, Debert, N.S.

**Mellor,** Alfred Geoffrey, B.Eng., (McGill), engineer officer (P/O), R.C.A.F., Vulcan, Alta.

**O'Donoughue,** Gerald, B.A.Sc., C.E., (Ecole Polytechnique), engrg. dftsmn., Inspection Board of the United Kingdom and Canada, Washington, D.C.

**Silverberg,** David M., B.Sc. (Elec.), (Univ. of Man.), engrg. dftsmn., Dept. of Transport, Winnipeg, Man.

**Trudeau,** Marc R. B.A.Sc., C.E., (Ecole Polytechnique), asst., Hydraulic Lab., Ecole Polytechnique, Montreal, Que.

*Students Admitted*

**Ashton,** Hugh Williams, (Univ. of Toronto), 276 Durie St., Toronto, Ont.

**Bateman,** John Lincoln, (Univ. of Man.), 508 Carlaw Ave., Winnipeg, Man.

**Black,** John Sawyer, (Queen's Univ.), 334 Reid St., Peterborough, Ont.

**Burgess,** Basil Arthur, (McGill Univ.), 4334 Harvard Ave., Montreal.

**Cordon,** Frank Roderick, (Univ. of Man.), 251 Scotia St., Winnipeg, Man.

**Cosman,** Ernest, (Univ. of Man.), 329 Carlton St., Winnipeg, Man.

**Davidson,** Fred William, (Univ. of N.B.), Beaverbrook Res., Fredericton, N.B.

**De Blois,** Jules-Noël, (Inst. Michaud), Box. 89, Sherbrooke, Que.

**Dyke,** John Morley, (Univ. of Toronto), 88 Woodside Ave., Toronto, Ont.

**Fowler,** Chas. Allison Eugene, (McGill), 3437 Peel St., Montreal, Que.

**Francis,** James Scott, (Univ. of Man.), 188 Langside St., Winnipeg, Man.

**Galloway,** Harry Sydney, (McGill Univ.), 5199 Globert Ave., Montreal, Que.

**Hardwick,** Alfred Perry, B.Sc. (Elec.), (Univ. of Man.), 380 Rubidge St., Peterborough, Ont.

**Hubbard,** Frederick Wilmot, (Univ. of N.B.), Beaverbrook Res., Fredericton, N.B.

**Legris,** J. A. (Univ. of Toronto), 89 George St., Toronto, Ont.

**Macdougall,** Douglas Keith, (Univ. of N.B.), 59 Charlotte St., Fredericton, N.B.

**Marshall,** Herbert Ansley, (N.S. Tech. Coll.), Box 321, Dartmouth, N.S.

**Muller,** Richard Alfred, (Univ. of Toronto), 140 Glenrose Ave., Toronto, Ont.

**Oxley,** Loren Arthur, (Univ. of Toronto), 372 Bay St., Toronto, Ont.

**Rispin,** W. E. A. (Univ. of Toronto), Trinity College, Toronto, Ont.

**Schwartz,** Hyman, (Sir Geo. Williams College), 5230 Clarke St., Montreal, Que.

**Scott,** Ronald E. (Univ. of Toronto), 39 Classic Ave., Toronto, Ont.

**Shane,** Walter Roulston, (Univ. of Man.), 325 Baltimore Rd., Winnipeg, Man.

**Shooner,** Jacques, (Ecole Polytechnique), 3454 St. André St., Montreal, Que.

**Smith,** Claude Harry Mortimer, (Univ. of Toronto), 171 Alexandra St., Oshawa, Ont.

**Stehling,** Kurt, (Univ. of Toronto), 235 Borden St., Toronto, Ont.

**Stonehewer,** John, (McGill Univ.), 3578 Shuter St., Montreal, Que.

**Telford,** Robert Brown, (Univ. of Toronto), 11 Blythwood Crescent, Toronto, Ont.

**Zimmerman,** George Douglas, (Univ. of Toronto), 144 Glendale Ave., Toronto, Ont.

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

*Members*

**Byers,** Willson Fitzgerald, B.A.Sc., (Univ. of B.C.), asst. instaln. engr., Northwestern Utilities, Ltd., Edmonton, Alta.

**Cameron,** Angus Johnstone, (Royal Tech. College, Glasgow), city engineer, Weyburn, Sask.

**Marshall,** James Lawrence, B.Sc., (Univ. of Man.), engineer-in-charge CBK, Watrous, Sask.

*Transferred from the class of Student to that of Junior*

**D'Appolonia,** Elio, B.Sc. (Civil), (Univ. of Alta.), instructor, Univ. of Alberta, Edmonton, Alta.

**Ford,** George, B.Sc., (Univ. of Alta.), sessional demonstrator in civil engrg., University of Alberta, Edmonton, Alta.

**McManus,** Ralph Norman, B.Sc. (Univ. of Alta.), sessional demonstrator in civil engrg., University of Alberta, Edmonton, Alta.

*Students Admitted*

**Casault,** Joseph McGill, (Univ. of Alta.), 10934-125 St., Edmonton, Alta.

**Chan,** Lloyd George, (Univ. of Sask.), soil mechanics lab., University of Saskatchewan, Saskatoon, Sask.

**Hiller,** Walter Andrew, (Univ. of Alta.), 9904-88th Ave., Edmonton, Alta.

**Hislop,** Richard H.,, (Univ. of Alta.), 10034-106th St., Edmonton, Alta.

**Morrison,** Lloyd Fletcher, (Univ. of Alta.), Cowley, Alta.

**Poole,** George E., (Univ. of Alta.), 11716-100th Ave., Edmonton, Alta.

**Simpson,** Jack Lloyd, (Univ. of Alta.), 9935-104th St., Edmonton, Alta.

**Wilkins,** Ernest Bertram, (Univ. of Alta.), 1407-4th Ave. S., Lethbridge, Alta.

**Willson,** Bruce Franklin, (Univ. of Alta.), 11134-87th Ave., Edmonton, Alta.

## ANNUAL FEES

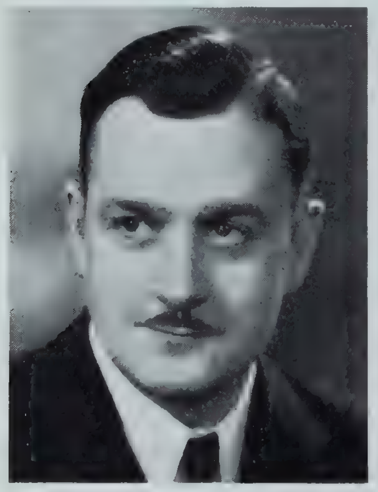
**Members are reminded that a reduction of one dollar is allowed on their annual fees if paid on or before March 31st of the current year. The date of mailing, as shown by the postmark on the envelope, is taken as the date of payment. This gives equal opportunity to all members wherever they are residing.**

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Professor J. A. Van den Broek,** M.E.I.C., was a visitor at Headquarters during the week of January 24th, last. Professor Van den Broek spent the week in Montreal, lecturing at the Ecole Polytechnique on the theory of limit design. Besides giving a series of lectures before the higher classes at the Ecole, the professor addressed an evening meeting of the Graduates Society at which members of the Institute had been invited. The exposé of his favourite subject which created such an interest at the Annual Meeting of the Institute last year, in Montreal, again provoked very lively discussion.

**Harold J. A. Chambers,** M.E.I.C., since 1940 chief engineer of the Hamilton Bridge Company Limited, was appointed, last month, general manager of the same company. One of the outstanding Canadian technical authorities in his field, Mr. Chambers' career in industry and public service includes executive posts with the Federal Department of Public Works, to which he was loaned by Canadian Bridge Company, Windsor. He was concerned with the construction of public buildings for Halifax and Ottawa. Mr. Chambers joined Canadian Bridge shortly after his graduation with honours from the University of Toronto, Faculty of Applied Science, in 1924 and was designing engineer of the company when he came to Hamilton Bridge. He holds the degrees of B.A.Sc. and M.A.Sc.



H. J. A. Chambers, M.E.I.C.

T. S. Glover, M.E.I.C.

Lt.-Col. L. S. McGregor, S.E.I.C.

**George H. Ferguson,** M.E.I.C., the newly elected chairman of the Ottawa Branch of the Institute is the Chief, Public Health Engineering Division of the Department of Pensions and National Health. Mr. Ferguson graduated at the University of Toronto with the degree of B.A.Sc. in 1906, and for the two succeeding years was engineer in charge of the layout of the buildings at the plant of the Dominion Radiator Company, Limited, Toronto. In 1908 Mr. Ferguson was employed as transitman on surveys in southern Alberta, and in 1909 was engineer-in-charge of the preliminary surveys for the Matabetchouan power development. Later in the same year he was appointed assistant to the hydraulic engineer of the Hydro-Electric Power Commission of Ontario, and in 1911 became hydraulic engineer to the National Conservation Commission. Mr. Ferguson secured a commission in the Royal Canadian Engineers, and served in France from 1915 to 1918, being awarded the Military Cross and promotion. At the conclusion of the war, he returned to his duties with the Conservation Commission but resigned in 1920 to accept a position as assistant to the chief traffic advisor of the Grand Trunk Railway Arbitration Board. The following year he was appointed inspecting engineer on rehabilitation of lines of the Toronto Transportation Commission, and in 1923 was appointed to the position which he holds.

In 1936 he was president of the Canadian Institute on Sewage and Sanitation.

**J. B. Stirling,** M.E.I.C., was re-elected president of the Canadian Construction Association at the Annual Meeting held in January.

Mr. Stirling is vice-president of E. G. M. Cape & Company, engineers and contractors, Montreal.

**N. C. Cowie,** M.E.I.C., is the newly elected chairman of the Sault Ste. Marie Branch. Born at Espanola, Ont., he was educated at the University of Toronto where he received the degree of B.A.Sc. in 1931. Upon graduation, he joined the staff of the Great Lakes Power Company Limited, at Sault Ste. Marie where he is still employed as engineer.

**T. S. Glover,** M.E.I.C., was recently elected chairman of the Hamilton Branch of the Institute for 1943. Born in England, Mr. Glover was educated at the University of Toronto where he graduated in 1922. Following graduation, he was engaged with Messrs. Fraser Brace Limited as assistant engineer on water power development in Newfoundland. In 1924, he received the Colonial Office appointment of assistant engineer in the Department of Public Works in Nigeria. He returned from Nigeria in 1927 and the following year he accepted the position of assistant sales manager with Sawyer-Massey Limited at Hamilton, Ont. Later he joined the staff of Russell T. Kelley, Limited, Hamilton, and became manager of their industrial department. He is at present on leave of absence from the company and is regional representative of the Wartime Bureau of Technical Personnel in Hamilton.

**Oliver A. Barwick,** M.E.I.C., has now returned to Montreal where he is employed with United Shipyards Limited. Lately he had been located in Toronto where he was in charge of plant expansion in Ontario for Wartime Merchant Shipping, Limited.

**A. L. Pierce,** M.E.I.C., of C. D. Howe Company, Limited, consulting engineers of Port Arthur, is now located in Hamilton, Ont., with the same company.

**W. H. S. Bird,** M.E.I.C., who is a resident technical officer with the British Air Commission in the United States, has recently been transferred from Brewster Aeronautical Corporation, Hatboro, Pa., to the Curtiss Wright Corporation at Buffalo, N.Y. Before joining the British Air Commission he was chief draughtsman in the aviation division of Canadian Car and Foundry Co. Ltd., at Fort William, Ont.

**H. S. Petford,** M.E.I.C., is now manager of Frontenac Breweries Limited, Montreal. He occupied previously the position of superintendent.

**Sub. Lieut. D. O. D. Ramsdale,** M.E.I.C., has recently been posted for sea duty and is based at St. John's, Newfoundland. Before his enlistment a few months ago, Mr. Ramsdale was employed with the English Electric Company Limited at Toronto.

**A. N. Budden,** M.E.I.C., has left the Inspection Board of the United Kingdom and Canada and has joined the Army Engineering Design Branch of the Department of Munitions and Supply at Ottawa. Before the war Mr. Budden was connected with the Dominion Engineering Company Limited at Montreal.

**Y. R. Anderson,** M.E.I.C., has joined the firm of Ward-McKee Engineering Limited at Toronto.

**Capt. W. L. Sheldon,** M.E.I.C., is an ordnance mechanical engineer and is at present attached to the Inspection Board of the United Kingdom and Canada. He is inspecting officer of small arms ammunition in Quebec City.

**Allan Tubby,** M.E.I.C., is now located at Montreal with the works and buildings branch of the Royal Canadian Air Force. He resided previously at Ottawa.

**Thomas Montgomery,** M.E.I.C., has recently retired from the position of chief engineer of Imperial Oil Limited at Sarnia, Ont., after almost forty-six years of service. He joined the Company in 1897 as mechanical superintendent and was in charge of the engineering department at the Sarnia plant. In 1914 he had direct charge of the preparation of plans and also of the construction of the Company's refinery at Vancouver, B.C. He was appointed chief engineer of the Company in 1915 and in the same year was responsible for the construction of the Company's refineries at Regina, Sask., Montreal, Que., and Dartmouth, N.S. In addition to engineering and construction work at refineries, Mr. Montgomery has been responsible in his position for all construction work in the marketing department of the Company.

Mr. Montgomery has always shown a great interest in the Institute and two years ago he was presented with a pin in recognition of the fact that he was one of the oldest members of the Border Cities Branch.

**G. L. Macpherson,** M.E.I.C., is the new chief engineer of Imperial Oil Limited at Sarnia, Ont., succeeding Thomas Montgomery who has retired.

**A. M. Mills,** M.E.I.C., who was employed with the Department of Highways of Ontario, is now superintendent of W. H. Harvey & Son, road builders and general contractors at Dawson Creek, B.C.

**M. N. McEwen,** M.E.I.C., has enlisted in the Royal Canadian Engineers. Previously he was an instrumentman with the Department of Highways at Kenora, Ont.

**Lieut. C. K. Hurst,** R.C.N.V.R., M.E.I.C., has recently been promoted to this rank and posted to Halifax. Previous to his enlistment a year ago, he was on the hydraulic staff of the canals branch of the Department of Transport at Ottawa.

**H. W. Burri,** M.E.I.C., of Mathews Conveyor Company, Limited, Port Hope, Ont., was elected to the Council of the Town of Port Hope for 1943 and has also accepted the chairmanship of the Civic Administration Committee for the Royal Canadian Sea Cadet Corps which is being formed in Port Hope.

**Frederic Alport,** M.E.I.C., is at the present time consulting engineer to the Director of the Naval Service in the Department of National Defence at Ottawa. Up until a few weeks ago, Mr. Alport was located in Halifax where, since 1938, he had been employed with the Department of Public Works of Canada as senior assistant engineer.

**R. K. Williams,** M.E.I.C., of Toronto has been appointed Executive Assistant to the General Manager at the Victory Aircraft in Malton, Ont.

**Flight-Lieutenant André Aird,** Jr.E.I.C., has recently been promoted from the rank of Flying Officer. He is at present stationed at No. 9 Repair Depot with R.C.A.F. at St. John's, Quebec. He is a graduate from Ecole Polytechnique, in the class of 1938.

**Sub-Lieutenant C. H. Vatcher,** R.C.N.V.R., Jr.E.I.C., is at present located in Halifax, N.S. He left the employ of Canadian National Carbon Company, Toronto, last October, to join the R.C.N.V.R. Mr. Vatcher is a graduate of the University of Toronto in the class of 1939.

**H. U. Ross,** Jr.E.I.C., is at present employed as a Metallurgical engineer with the Frobisher Exploration Company Limited at Ottawa.

**Sub-Lieutenant D. Lorne Lindsay,** R.C.N.V.R., Jr.E.I.C., is a gun mounting officer with the Director of Naval Ordnance at Naval Service Headquarters, Ottawa.

**Arthur G. Teskey,** Jr.E.I.C., has been transferred from Winnipeg to the Regina office of Canadian Westinghouse Company Limited. He is a graduate of the University of Manitoba in the class of 1937 and has been with the company ever since.

**Noel Campbell,** Jr.E.I.C., has joined the R.C.N.V.R. as a Sub-Lieutenant. He was previously employed in the engineering department of the Ford Motor Company of Canada, at Windsor, Ont.

**W. W. Ingram,** Jr.E.I.C., is the newly elected chairman of the Junior Section of the Montreal Branch of the Institute. Born at Winnipeg, Man., in 1917, he was educated at the University of Manitoba where he graduated in electrical engineering in 1939. Upon graduation, he joined the staff of Phillips Electrical Works, at Brockville, Ont., as an inspector and electrical tester. A few months later he was transferred to the Montreal plant as assistant to the plant superintendent and in 1942 he was made foreman in the lead and impregnating departments. Mr. Ingram has been connected with the Junior Section for the past few years having acted in the capacities of councillor, secretary and vice-chairman.

**Lieutenant-Colonel L. S. McGregor,** S.E.I.C., has recently been appointed in command of the Royal Electrical and Mechanical Engineers of the 1st Canadian Corps troop in England. Details about the organization of this new corps in the British Army appear on page 147 of this issue.

Colonel McGregor graduated in mechanical engineering from McGill University in 1936. Upon graduation he returned to Canadian National Railways, Montreal, where he had been employed as a draughtsman and a machinist apprentice before entering the Engineering Faculty. After working for some time at Turcot Yard he was transferred to the Department of Economics and Research of the company as assistant engineer. He went overseas in May, 1940, and won his captaincy in April, 1941. In June, 1942, he was promoted to the rank of major in the headquarters staff of the Canadian Army overseas.

**Joseph Van Damme,** S.E.I.C., is at present employed with the National Research Council at Ottawa as a junior research engineer. He graduated from Queen's University as a B.Sc. in mechanical engineering in 1941 and after spending a year at Rensselaer Polytechnic Institute, Troy, N.Y., he obtained the degree of M.Ae. Eng. in 1942.

**Sub-Lieutenant D. B. Sutherland,** R.C.N.V.R., S.E.I.C., is at present stationed at H.M.C. Dockyard at Sydney, N.S. He was previously employed with Guysboro Mines at Goldenville, N.S.

**Captain John J. Donovan,** S.E.I.C., has recently been promoted from the rank of lieutenant. He is at present serving overseas with the British Ministry of Supply. A graduate of Queen's University, in the class of 1940, he had been employed with Canadian Ingersoll-Rand at Sherbrooke, Que., before his enlistment.

**Alex. de F. Heron,** S.E.I.C., has joined the Royal Canadian Corps of Signals and is at present stationed at the Officers' Training Centre, at Brockville, Ont.

**Wilbur J. Cox,** S.E.I.C., is at present employed as a junior research engineer in the Division of Mechanical Engineering at the National Research Council, at Ottawa. He graduated from the University of Saskatchewan in 1942.

**R. J. Kenst,** S.E.I.C., who for the past fifteen months has been in Columbia, S.A., doing oil exploration work for the Tropical Oil Company, is now employed with Ford Motor Company as an electrical engineer in the automotive department, at Windsor, Ont. He is a graduate in electrical engineering from McGill University, in the class of 1939.

### VISITORS

**Past President Sam G. Porter,** M.E.I.C., Calgary, Alta., on February 3rd.

**Euclide Paré,** M.E.I.C., Hydraulic Service, Parliament Bldgs., Quebec, on February 4th.

**J. B. Wilkinson,** M.E.I.C., Hamilton, Ont., on February 4th.

**R. W. Boyle,** M.E.I.C., Director, Division of Physics and Electric Engineering, National Research Council, Ottawa, Ont., on February 4th.

**W. F. M. Bryce,** M.E.I.C., Sewer Engineer, City of Ottawa, Ottawa, Ont., on February 4th.

**W. G. Swan,** M.E.I.C., Consulting Engineer, Vancouver, B.C., on February 9th.

**G. G. Murdoch,** M.E.I.C., Consulting Engineer, Saint John, N.B., on February 13th.

**2nd-Lieutenant R. R. Willis,** M.E.I.C., Royal Canadian Engineers, Montreal, Que., on February 15th.

**H. L. Johnston,** M.E.I.C., Canadian Industries Limited, Windsor, Ont., on February 17th.

**E. L. Ball,** Jr.E.I.C., Field Engineer, Foundation Company of Canada, Arvida, Que., on February 17th.

**F. E. M. Thrupp,** M.E.I.C., Inspection Board, Ottawa, Ont., on February 18th.

**Norman Eager,** M.E.I.C., Assistant Sales Manager, Burlington Steel Company, Limited, Hamilton, Ont., on February 18th.

**Professor R. F. Legget,** M.E.I.C., Assistant Professor of Civil Engineering, University of Toronto, Toronto, Ont., on February 18th.

**Stewart Troop,** M.E.I.C., Consulting Mining Engineer, Manager Chibougamau Properties Limited and Cache Lake Chibougamau Lines Limited, St. Elie de Caxton, Que., on February 22nd.

**K. R. Chestnut,** M.E.I.C., Newfoundland Airport, Gander, Nfld., on February 25th.

**Lieutenant Raymond LeBel,** Jr.E.I.C., Royal Canadian Engineers, Petawawa, Ont., on February 25th.

**W. R. McClelland,** M.E.I.C., Bureau of Mines, Ottawa, Ont., on February 27th.

**T. M. Moran,** M.E.I.C., vice-president, Stevenson & Kellogg, Toronto, Ont., on March 1st.

**J. Hugill,** Jr.E.I.C., National Defence Headquarters, Ottawa, Ont., on March 1st.

# Obituaries

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

**Francis Charles Edward Burnett,** M.E.I.C., died at his home in Montreal, on January 20th, 1943. Born on April 16th, 1878, at Galashields, Scotland, he was educated at the Academy, Galashields, and received his engineering training at the Heriot-Watt College, Edinburgh.

After serving his apprenticeship with Waverly Ironworks at Galashields and with the Waverly Electric Company Limited, Edinburgh, he joined the staff of Siemens Brothers & Company Limited, London, England, as draughtsman. Three years later he went with Witting, Eborall & Company and acted as their resident engineer on a number of new power projects, including those for the Dublin Tramways, the Isle of Man and the Stalybridge Tramways and Electricity Joint Board. Later he joined Messrs. Kincaid, Watson, Manville and Dawson, consulting engineers, London, England. In 1907 Mr. Burnett came to Canada and acted successively as assistant to Mr. J. Kynoch, the chief engineer of the Canadian General Electric Company, and as power engineer for the Canada Cement Company, a position which he held for a number of years during which he was responsible for a large amount of development work.

From 1920 to 1929 he was engaged in iron foundry work on his own. In 1929 he built up a successful agency business in Canada, representing Messrs. George Ellison and other well known British firms. When the war placed many restrictions on the importing of British goods into Canada, he offered his services to Canadian Car & Foundry Company, of Montreal, where he was employed up to within a few days of his death.

Mr. Burnett joined the Institute as a Member in 1938.

Frederick Oxley Condon, M.E.I.C.

**Frederick Oxley Condon,** M.E.I.C., died suddenly at his home in Moncton, N.B., on January 12th, 1943. He was born at Moncton on July 21st, 1878, and was educated in the local schools. At the age of 15, he entered the service of the Intercolonial Railway, now part of the Canadian National Railways. From 1898 to 1912 he was employed as a draughtsman and later as assistant engineer in the maintenance department. In 1913 he became resident engineer on maintenance and construction at Moncton and later at Campbellton, N.B. He was appointed district engineer, at Moncton, in 1916, engineer of maintenance of way in 1923, principal assistant engineer in 1927, and chief engineer, Atlantic Region, C.N.R., in 1938. He retired from the Railway service on August 31, 1942.

In 1905 he married Jean Davidson Bruce. He is survived by his wife and three daughters, Margaret Elizabeth Bruce, Barbara Leslie Bruce, wife of Roscoe H. Allen, and Josephine Bruce, wife of Warrant Officer Kenneth W. McLaren, R.C.A.F.

Mr. Condon joined the Institute as a Member in 1922. He was chairman and councillor for the Moncton Branch, and a former vice-president of the Institute. He was also a past-president of the Association of Professional Engineers of New Brunswick

**William Kennedy,** M.E.I.C., died at his home in Montreal on January 31st, 1943, after an illness of a few days.

Born near Prescott, Ont., on January 4th, 1848, Mr. Kennedy belonged to a large family many of whose members have long been leaders in engineering progress in Canada. In 1858, his father (the Senior William Kennedy) founded the well-known engineering works at Owen Sound which are still maintaining their reputations for hydraulic machinery of high quality. After working with the firm for some years, William Kennedy, Junior, came to Montreal in 1893 and established a consulting practice. During the following thirty years he planned and supervised the construction of a score of dams, waterworks, and hydro-electric power plants, from Nova Scotia to British Columbia. His work included consultation, advice, reports and valuation of many questions of water power and supply.

In 1886 he took part in the movement which led to the formation of the Canadian Society of Civil Engineers, and with his older brother—who later became Sir John Kennedy—joined that body on its establishment in February of the following year. His long and successful professional career ended with his retirement in 1925.

Mr. Kennedy had been made a Life Member of the Institute in 1930.

**Dr. A. H. Harkness,** M.E.I.C.,passed away at Toronto, on February 28, 1943, in his 71st year, following a long period of uncertain health. While retaining his interest in engineering matters throughout, he had been forced to curtail his professional activities very considerably for the past two years.

Dr. Harkness graduated in architecture from the University of Toronto in 1895 and received the degree of Bachelor of Applied Science in 1897. Following some three years in an architect's office, he joined the designing staff of the structural department of the Canada Foundry Company, Limited, Toronto, remaining with this Company for eight years and attaining the position of Assistant Chief Engineer of the department.

Special interest and experience in building prompted him to enter into private practice as a Consulting Structural Engineer in Toronto in 1910. This practice he continued until his death; since 1929, in partnership with Major-General C. S. L. Hertzberg, M.E.I.C., under the firm name of Harkness and Hertzberg. During its long existence his firm was responsible for the structural work of many of the outstanding buildings of Canada, such as the Canadian Bank of Commerce, the C.P.R. Building, the Canada Life Building, the Dominion Bank Building, the east block of the Parliament Buildings, and the Western Hospital, at Toronto; the Sun Life Building and the Canadian Bank of Commerce Building, at Montreal; the Canadian Bank of Commerce Building and the Confederation Life Building, at Winnipeg; the Dominion Parliament Buildings and the Civic Hospital, at Ottawa.

In 1935 Mr. Harkness was awarded the Sir John Kennedy Medal by The Engineering Institute of Canada in recognition of his outstanding merit in the engineering profession and in 1937 the honorary degree of Doctor of Engineering was conferred upon him by the University of Toronto.

Dr. Harkness was a Past Vice-President of the Engineering Institute of Canada and a Past President of the Association of Professional Engineers of Ontario. Always anxious to promote the fortunes of the engineering profession and particularly those of the younger men in it, he gave much time and thought to matters outside the normal responsibilities of his practice. A kindly reception always awaited anyone who sought his assistance.

In Toronto he was known in a very wide circle as an enthusiastic gardener, having one of the finest iris gardens in the district. Every year, hundreds of people were welcomed to view his extraordinary display of rare varieties. For more than twenty years he cultivated this interest to his great personal satisfaction and the delight of his friends.

Dr. Harkness is survived by his widow and four daughters, three of whom are married. C. R. Young.

## AN APPEAL FOR BACK NUMBERS OF THE *JOURNAL*

**The *Journal* circulation extended, before the war, to several of the countries now occupied by the enemy. It consisted partly of paid subscriptions and partly of exchanges with other publications. Since the spring of 1940, the supply of engineering literature from these countries has ceased and we have likewise discontinued sending the *Journal*.**

**With a view to completing our file of foreign publications when the war is over, we have put aside, every month for the last three years, a number of copies of the *Journal* for exchange purposes, in the hope that foreign publishers are doing the same.**

**However, on account of urgent demands for the *Journal* in the last three years, we have had to part with some of those copies which we had laid aside.**

**In order to replenish our stock, we would be grateful to our members who could supply us with the following numbers:**

| 1941 | 1942 |
|---|---|
| JANUARY | JANUARY |
| MARCH | APRIL |
| MAY | MAY |
| JULY | AUGUST |
| AUGUST | |

**JANUARY, 1943**

**Parcels should be addressed to The Librarian, The Engineering Institute of Canada, 2050 Mansfield Street, Montreal, and may be sent collect.**

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## BORDER CITIES BRANCH

W. R. Stickney, m.e.i.c. - *Secretary-Treasurer*

The monthly dinner meeting of the Border Cities Branch was held at the Prince Edward Hotel, Windsor, January 22, 1943, at 6.30 p.m., 30 members and guests were present.

After dinner, the Chairman, G. G. Henderson, called on C. G. R. Armstrong who introduced the speaker for the evening, Mr. T. Hudson Strickland, Superintendent of Filtration, Windsor Utilities Commission. Mr. Strickland's subject was "Water Purification" and his talk dealt chiefly with the methods of treatment used in the City of Windsor, and of the problems and complaints encountered from time to time.

The production of pure water is actually a manufacturing process. It must be treated or conditioned to the point where it meets the specifications of public health bureaus and medical boards. This may be easy or it may be complicated. Foreign bodies may have to be taken out to make it safe or the composition of the water may have to be altered chemically to make it suitable for industrial needs.

A study of the various methods of water treatment showed that individual countries usually developed their own methods of water purification independently of neighbouring countries. The English method is generally to find the source of pollution and eliminate this; the German method is to take impure water and make it safe and pure; the French method is to find a source of pure water, preferably in the mountains and pipe this to their cities; while in North America we usually find a combination of these European methods.

There are three main clauses in specifications for pure water, namely; safety, attractiveness, and chemical characteristics. The latter should be such that the water is reasonably free of minerals and salts, and soft enough for economical domestic and industrial use.

The clause relating to safety is simple but exacting—"It must be safe," that is, free of harmful bacteria. Samples of the water are taken and the bacterial content is measured. Chlorine or its compounds in the proper proportions are added to remove the bacteria. In the Windsor plant the water is treated twice with chlorine and as a result the city and surrounding district is practically free of typhoid fever.

Pure water must also be attractive, i.e., clear and sparkling and free of objectionable tastes and odours. In some communities where large areas are available, the dirt or turbidity is removed by allowing it to settle. Where this is not possible, chemicals such as aluminium sulphate is usually added to the water. This forms aluminum hydroxide, a flocculent substance which coagulates around the dirt particles and this floc is then filtered off. In Windsor, the problem is not to remove the quantity of dirt but rather the type of dirt, quite often a form of colloidal clay which is very difficult to remove, since it prevents the formation of floc by the action of the aluminum sulphate. This, then requires other chemicals to be added to the water.

The removal of tastes and odours is a more complicated process. These come from industrial waste waters, swamps, algae and plants, and vary greatly in intensity from day to day. Treatment which will remove taste and odour resulting from one of the above causes will often accentuate those resulting from another, so that a constant check on this type of pollution is required.

Most of the tastes and odours are removed by chloramine treatment; i.e., ammonium sulphate is added to the water after it has been treated with chlorine. This forms chloramine which is very effective in removing tastes and odours; but at times such impurities can only be removed by treatment with activated carbon, a finely divided form of carbon or charcoal. The gases and impurities are absorbed on the surfaces of carbon particles, which are then filtered off before the water enters the mains.

Mr. Strickland then related several amusing incidents about various complaints they had received from time to time.

After a discussion period in which several members told of similar experiences with water supplies and purification, H. L. Johnston moved a vote of thanks to the speaker.

The meeting adjourned on motion of E. M. Krebser.

## CALGARY BRANCH

K. W. Mitchell, m.e.i.c. - *Secretary-Treasurer*
J. N. Ford, jr.e.i.c. - *Branch News Editor*

A meeting of the Calgary Branch of The Engineering Institute of Canada was held in the Palliser Hotel on January 14th, 1943, at eight o'clock. The evening's programme was conducted by the affiliate members, who arranged for two speakers.

Mr. Saffran, head of the Service Department of the Institute of Technology and Art, gave a very interesting talk on **Synthetic Rubber.** Mr. Saffran pointed out that contrary to common knowledge, synthetic rubber is not chemically the same as pure rubber, although it performs the same functions. There are various types under process of manufacture to-day known as Thiokal, Neoprene, Batyl, Buna N. and Buna S. Manufacturing plants in the United States are now set up for production of over a million tons of these various forms of rubber in 1943. Most of these are unsuitable for use as tires due to poor resistance to abrasion, but they make excellent insulators. Neoprene, due to its excellent abrasive qualities and resistance to oil, is the best for tire manufacture. Mr. Saffran concluded by a series of slides showing steps in the manufacture of these synthetic rubbers.

Mr. Ainlay, Chief Instructor of wireless air gunners at the Provincial Institute of Technology, spoke on **Radio Development.** He outlined the extensive use of radio equipment in all forms of science. Mr. Ainlay pointed out that calculations have been made, by those who should know, with the conclusion that, if the war lasts for three or four more years, 60 to 70 per cent of the radios will be out of use due to lack of parts. The speaker also intimated that by 1950 television would be general but much more expensive due to the elaborate arrangements which would have to be made in conducting a television programme.

Mr. McEwen, the Branch Chairman, expressed the appreciation of the meeting for a very interesting evening's programme.

On February 12th, 1943, in the Palliser Hotel, Mr. W. Allen, Physicist at Western Canada High School, addressed a branch meeting on **Some Aspects of Modern Physics.**

Mr. Allen gave a complete history of the physicist's progress in the study of the atom from the early 19th century to the present day. In the early 19th century 92 elastic sphere atoms explained all elements. The Quantrid Planetary Theory replaced this belief by setting up the atom as a miniature solar system which explained the spectra, properties of elements and transmutation. The discovery of the positive electron by Anderson and the neutron by Chadwick later led to the use of artificial radio-activity by the medical profession. Through the invention of "Induction Acceleration" rays were made to pierce heavy armour plating and this is used extensively to discover flaws in ship building materials.

Present day physicists are prying into the science of "Wave Mechanics" which gave us the electron microscope and enabled us to see hitherto invisible germs. The speaker pointed out that the physicist's production of the aeroplane locator saved Britain, just as the astrologer's golden cockerel saved the King in Rimsky-Korsakow's opera "Le Coq d'Or." Mr. Allen concluded his address by the remark that "it is hoped that the physicist receives his reward instead of being cast off like the astrologer in the opera. Adequate financial aid should continue to be awarded our physicists for the furtherance of pure science in our universities at the conclusion of the present conflict.

## HALIFAX BRANCH

S. W. Gray, M.E.I.C. - - *Secretary-Treasurer*
D. C. V. Duff, M.E.I.C. - *Branch News Editor*

A combined buffet supper, followed by a programme of entertainment at the Nova Scotian Hotel on the evening of January 28th, was attended by 250 members and invited guests.

This year, due to wartime conditions, it was impossible to hold the usual combined dinner and speaker, but the committee in charge deserve much credit for the well-arranged buffet supper and the mixed programme of entertainment which was presented. Each number on the programme received generous applause. Mr. Kenneth Dawson acted as Master of Ceremonies and handled the programme in a pleasing and capable manner.

Prof. A. E. Flynn, chairman of the branch, presented Dr. A. E. Cameron, newly elected president of the Association of Professional Engineers of Nova Scotia. Representatives of other societies present as guests of the branch were: G. G. Bowser, President of Nova Scotia Mining Society; H. A. Russell, President of Nova Scotia Architects Association; Dr. E. P. Lenton, Chairman of Maritime Section of Canadian Institute of Chemistry; Dr. E. Hess, President of Nova Scotia Institute of Science.

The appointment of Major R. L. Dunsmore, now Superintendent of the Dartmouth Refinery, to Ottawa, as Director of Naval Fuel Supplies with the rank of Acting Commander, was also announced by the chairman. This announcement received hearty applause. Commander Dunsmore has taken a keen interest in all activities of the Branch and his active participation will be missed.

Music for the evening was supplied by Harry Cochrane and his six-piece orchestra.

## MONTREAL BRANCH

L. A. Duchastel, M.E.I.C. - *Secretary-Treasurer*
W. W. Ingram, M.E.I.C. - - *Branch News Editor*

On Thursday, January 14th, the branch held its annual meeting. The annual statement and financial report were read and accepted. Mr. Lalonde, the branch chairman, then introduced Dean C. R. Young, president of the Institute who addressed the members.

Dean Young spoke first of the pleasure with which he had visited the various branches as president of the Institute. He then outlined the various committees of council and the great variety of work that they were doing. New committees had been set up to deal with the many problems created by the war. Of the new activities engaged in by the Institute due to war conditions, the Webster Lectures, had been the most notable.

In a more general approach, Dean Young drew attention to the great number of people trained to a technical level in war industries. This constituted a definite asset on the side of personnel. New methods and new procedures for the utilization of Canada's natural resources will have an immense backlog of demand when peace comes. New types and new forms of machinery and appliances will be required for civilian use. The manufacture of these items will take care of the vast amount of technical personnel now in war work. Many new processes and inventions such as multiple tooling of one piece of work, spinning molds, electronics in industry, new plastics and new alloys such as tinless bronze, resulting from war stimulus will carry over to peace activities.

The legal aspects of engineering are the province of the Corporation of Professional Engineers. The Institute's work emphasizes professional development.

As engineers we need to improve our humanistic outlook and look at our work as a layman would look at it. The era after this war will be the era of the common man. The engineer is the originator and creator of wealth due to his work, while the economist uses figures made possible by these works. It is the business of the engineer to give hard and constructive thought to the fields of endeavour, to think out the consequences of his schemes, projects, etc., and their contribution to the country.

On Thursday, January 21st, Dr. L. M. Pidgeon of the National Research Council spoke on **New Methods for the Production of Light Metals,** with particular reference to aluminum and magnesium. Sodium and potassium, which are high up in the electrochemical series, are too reactive for structural uses, while beryllium and silicon are too brittle.

The Canadian raw materials from which magnesium could be obtained commercially are brucite, magnesite, dolomite (which is incidentally a very pure mineral) serpentine and sea water. It is interesting to note that aluminum and magnesium were first isolated by thermic reduction methods and first produced commercially by electrolytic methods. The chemical purification of the raw materials is much easier for magnesium than aluminum. In the electrolytic cell for the production of magnesium the electrolyte is melted magnesium chloride. The preparation of the chloride for the cell is rather difficult due to the water of crystallization, which is very hard to remove without loss of H C1. One method of overcoming this difficulty is the direct manufacture of the anhydrous $Mg\ C1_2$ from magnesium oxide, carbon and chlorine in an electric furnace. The molten chloride produced in this way is tapped off and taken to the electrolytic cells. This method involves the handling of large quantities of chlorine which is difficult in a metallurgical plant.

After fifty years of the commercial production of aluminum there has been very little change in the electrolytic method. In the production of magnesium, however, thermic methods are making their appearance. This is due to the following (a) magnesium boils at approximately 1100°C. compared with 2300°C. for aluminum, (b) magnesium does not react with carbon while aluminum does to form an aluminum carbide. The electrolytic method is also unfavourable due to the plating out of lower metals in the series iron silicon, etc.

One thermic method involves the reduction of magnesium oxide with carbon. This reaction takes place at 1900°C. giving carbon monoxide and gaseous magnesium. This reaction reverses on cooling to give the original substances. To prevent the reverse reaction, shock cooling by hydrogen jets on the gases escaping from the reduction chamber is used. This gives a mixture of magnesium in the form of a fine powder along with magnesium oxide and carbon as impurities. Crystalline magnesium, which is very easily melted, is obtained by a vacuum distillation of the above mixture. This process is being developed in California by H. J. Kaiser.

The process recently developed by Dr. Pidgeon makes use of a different reducing agent. In his method the magnesium oxide is reduced by means of silicon, giving an oxide of silicon, which is a solid, as a by-product and gaseous magnesium which is condensed under vacuum in the reduction chambers.

The magnesium now produced in Canada is used entirely for war purposes. It is used for flares and incendiary bombs in the pure form. It is also used in aeroplane castings. When alloyed with aluminum it is used extensively in aeroplane parts and light metal parts in numerous machines. Magnesium can be easily machined, can be acetylene welded under a flux and compared on a basis of weight is much stronger than steel and makes stiffer structures even than aluminum. However, it corrodes rather readily and must have a protective coating.

On Thursday, January 28th, 1943, Mr. Devores of the U.S. Rubber Company gave a paper on **Structural Rubber for Vibrations and Shock.**

The use of rubber as a structural material is made possible by the use of special compounds developed for certain specific uses. The greatest uses of structural rubber are the reduction of the transmission of vibration, impact shock and noise. Noise may be reduced by any one or a combination of three methods (a) proper springs, (b) secure anchorage to large foundations, (c) counter vibrators. The most economical method is by the use of resilient supports or rubber springs.

Mr. Devores illustrated his paper with slides, motion pictures and practical demonstrations which brought out a number of important facts on the uses of the various types of mountings and materials used. The best structural rubbers are made from crude rubber as no synthetic compounds have yet been made with the necessary resiliency. In use the structural rubber usually is made to adhere to steel to form individual mounting units. In certain cases the units are much more efficient when operated under a lateral stress.

On Thursday, February 4th, 1943, Professor P. E. Nobbs, President of the Province of Quebec Association for the Protection of Fish and Game addressed a Branch Meeting on **Fishway Problems on the Quebec Rivers.**

In introducing the subject, the speaker referred to poaching, pollution and obstructions, such as dams, as the three enemies of fish life. Legitimate angling, he considered, rarely reduced stock seriously. He remarked (1) on the rivers in the farming country where the grandparents of the present inhabitants had plenty fish at their doors, (2) on the trout streams ruined by lumber dams, (3) on the salmon rivers which storage dams and industries had put out of business, and (4) on the commercial fisheries of the great rivers blocked by power developments. To much of this reduction of fish stock the answer was the fishway.

Among the many dams in the Province, at least 180 needed fishways, while 18 only were as yet so equipped. He attributed this to a certain prejudice against fishways, largely due to official recognition of an obsolete type, dating from 1874.

Practically all fish were migratory, more or less, for food, for breeding, or for both. Dams tended to cut off feeding grounds and spawning grounds and so stock perished. The climatic effects on certain types of fishway were then referred to as limiting factors on the design of fishways here and the comparative costs of concrete and wood construction were stated.

The three things to avoid in a fishway were stated to be undue speed of flow, turbulence and aeration. Ease and comfort for the fish were essential to success.

Nine recognized types of fishway were next described. Some of these were obsolete and some were not practical in this climate.

The speaker recommended that all fishway construction should be put in the hands of the Quebec Streams Commission, that fishways should become Government property and that they should be regulated as to flow by the game wardens. The ease with which a fishway could be converted into a fish-trap was commented on.

In conclusion Mr. Nobbs had something to say about storage dams in which water levels dropped in winter and to which fishways were rarely applicable. In such cases, other remedial works might well be insisted on to maintain fish stock as is the practice in Scotland.

The address was illustrated. Among the examples shown was a fishway 700 feet long to take fish up 68 feet at a waterfall on the English River at Comeau Bay. This fishway, recently constructed from Mr. Nobbs' design, was passing fish up a week after the water was turned on.

On Thursday, February 11th, Mr. Goddard of the Canadian General Electric Co. Limited, presented a paper on the **History and Fundamentals of Resin Chemistry, and Fabrication Problems of Phenol Formaldehyde Plastics.**

The materials known as plastics can be forced into any desirable shape and will retain that shape under suitable conditions. They contain a synthetic or organic resin.

Plastics are composed essentially of the five elements: carbon, hydrogen, oxygen, nitrogen and chlorine. They may be divided into two groups thermosetting which solidify with heat and are then no longer meltable, and thermoplastic which melt on heating. Bakelite is prepared from phenol, formaldehyde and a catalyst. These are heated together after which the material is run out and cooled. In this stage it is a thermoplastic. After heating up to 350 deg. F. this material then becomes thermosetting.

Thermosetting plastics are moulded by compression, using a heated die. Thermoplastics are moulded by an injection process using a cold die. Plastics are available in many shapes also as rods, tubes, sheets, etc.

Plastics in war are used to relieve the shortage of metals, copper, steel, aluminum, and also for their strength and transparency. In aircraft they are used for making resin-bonded plywood.

On Thursday, February 18, Mr. K. M. Cameron, Chief Engineer of the Department of Public Works of the Dominion of Canada and President of the Institute, addressed the branch on **Post-War Reconstruction.** Mr. Cameron is Chairman of the Sub-Committee on Construction of the Federal Committee on Post-War Reconstruction.

In his paper, Mr. Cameron pointed out that during the last war no measures were taken for the reestablishment of the returning soldier until October, 1918. The scheme which was then developed was not very successful, and this, with the failure of the peoples of the democracies to apply sound economic principles, helped to produce the boom of 1929 and the depression of the thirties. The countries will have to align themselves on a world rather than a group basis. The present war has brought about a reversal of economic thinking, leading to the doctrine of full employment as advocated by Sir William Beveridge in England. For this purpose a reasonable standard of living and employment must be obtained, under which not more than eight per cent of the people unemployed. The post-war problems of the armed forces is being studied under a cabinet committee on Demobilization and Rehabilitation.

The Advisory Committee on Post-War Reconstruction, under the Chairmanship of Dr. James of McGill University, is a committee separate from the Government which reports to the government. It has set up various sub-committees as follows:

(a) Agriculture. This committee studies the western wheat problem, various rural problems, markets for agricultural products, and their use for proper nutrition.

(b) Development and Utilization of our Natural Resources, as Forestry, Waterpower, Mining, Fisheries. These matters are Provincial affairs and there is the need of research in mining and forestry.

(c) Post-War Employment Opportunities Committee dealing with vocational guidance, employment, regulations, old age pensions, ex-service men and unemployables.

(d) Committee on Special Problems of Employment which deals with the problems of women.

(e) Committee on Reconstruction. This committee advises the main committee on Post-war Reconstruction.

The question of the civil reestablishment of the munition workers and those in the armed forces is a large one. As yet industry has not shown much interest in post-war problems. Obviously we must have a plan and a post-war work programme. We should put the same endeavour into winning the peace as into winning the war. Post-war problems should not be dismissed merely because they are in the future and are very difficult.

## NIAGARA PENINSULA BRANCH

J. H. INGS, M.E.I.C. - - *Secretary-Treasurer*
J. W. BROOKS, Jr.E.I.C. - *Branch News Editor*

The first dinner meeting of the current year was held on February 19th in the Blue Room of the General Brock Hotel, under the chairmanship of Mr. C. G. Cline. The Branch was privileged to hear a most excellent address on **Mathematics and the Engineer,** by Professor J. L. Synge, M.A., Sc.D., F.R.S.C., Professor of Applied Mathematics at the University of Toronto.

The speaker approached his subject with a brief synopsis of that invaluable engineering tool, the slide rule. The compilation of natural logarithms by James Napier in 1614, and their conversion to common logarithms by Briggs, were both necessary precedents to the invention of Gunter's Rule in 1632. This new instrument did not become popular with engineers for more than two centuries, for it was not until 1850 that Mannheim's slide rule was adopted by the French artillery, and English engineers followed suit in 1870. At this point the speaker introduced the rather disturbing thought that perhaps, to-day, there exist similar innovations which are not being used to full advantage by engineers, and as an example he cited the new Differential Analyzer, invented by Dr. Bush of the Massachusetts Institute of Technology.

Professor Synge went on to say that the multitude of formulæ found in engineering handbooks is the result of certain basic hypotheses, followed by mathematical theory and experimental proof, giving such illustrations as the area of a circle, the amplitude of a pendulum, and the deflection of a cantilever beam. He stressed the fact that every formula is set up under ideal, not practical, conditions, and added a word of warning to the effect that a formula must not be used beyond its range of applicability. For example, the old familiar $\pi_r{}^2$ will not hold true for the area of a circle on a spherical surface.

The complex problems encountered in electrical, radio, and aeronautical engineering indicate that there is room for much more research in these fields, and the speaker suggested that this was a job for what he termed a "theoretical engineer"—that is, a man with engineering knowledge combined with a brilliant flare for mathematics. It was Professor Synge's opinion that Canadian engineers have been so busy with practical problems that research has suffered, and also that our so-called "education for the average man" results in rare talents being neglected. He therefore suggested that we import say half a dozen of these theoretical engineers to our universities, where they would be given every opportunity of doing research. A few brilliant students would be naturally attracted to these men and their methods, and hence the work would continue.

Vice-chairman George Griffiths introduced Professor Synge, and a vote of thanks was extended by Councillor A. W. F. McQueen.

## OTTAWA BRANCH

A. A. SWINNERTON, M.E.I.C. - *Secretary-Treasurer*
R. C. PURSER, M.E.I.C. - - *Branch News Editor*

At an evening meeting held on January 21st at the auditorium of the National Research Laboratories J. C. Cameron, associate professor and head of the Industrial Relations Section of Queen's University, gave an address on **The Engineer and Industrial Relations.** G. H. Ferguson, newly-elected chairman of the branch for the 1943 term presided. The address proper was followed by an extensive period of discussion participated in by many of the members, as well as the speaker of the evening.

With profits as the motive force to economic endeavour in industry and business, production technique has been given a great deal of attention, whereas the technique of human administration has received very little. But personnel science is now rapidly teaching us that industrial goodwill is the first requisite of productive enterprise.

"Personnel science is constructed on the basic belief that labour is not a commodity", the speaker stated. For the term 'labour', after all, refers to human beings with minds, personalities, self-respect, a desire for improvement and membership in a civilized community. Although labour may resemble a commodity in that, like other objects of exchange, it commands a price on the market still this fact does not reduce these human beings to the level of impersonal things. The energy and skill which are sold by the labourer are inseparable from his life and personality; they are essentially a part of himself. Thus when a man sells his labour power he must accompany what he sells and the conditions and methods of its use are of vital concern to him. His own immediate welfare, the welfare of his family, his future and consequently, the future of those who depend upon his economic efforts, his health, and his very life—all are involved in such a transaction.

In other ways, too, labour falls outside the category of a commodity. For instance it is not, like a commodity, a passive object. "Active and alert to new sources of satisfaction and happiness", as the speaker expressed it, "workers as human beings are naturally sensitive to new comforts, new pleasures and improved standards of living which education and acquisitive industry and business bring to their attention. Moreover, workers are as capable of resentment as they are of co-operation; hence, they will not accept willingly any attempt either to depress their established standards of living or to prevent progressive improvement in their ways of life".

Personnel managers know that the solution of problems in industrial relations, revolving as they invariably do about the human equation, are often most perplexing. The equation itself involves the relation of the worker to his job, his immediate supervisors, his company, his community and, in turn, their relations to him. In a democratic country, moreover, the worker is endowed with a large number of rights, privileges, and opportunities which he expects his boss to recognize and respect.

However, personnel science is constructed in part on the theory that it is quite possible to apply to the management of human relations certain rational principles and methods of procedure. One of the principal assumptions is that the basic interests of employers and employees are identical—this in spite of the fact that it is usually contended that "the employer desires to get as much work done as possible for as little pay as is necessary, whereas the worker desires to get as much pay as possible for as little work as is necessary".

Personnel science assumes that both parties would receive greater economic advantages if they would frankly recognize their mutual interests in efficient production, economic operation, profitable enterprise, and desirable standards of work, hours and pay. In other words, the substitution of industrial co-operation for industrial conflict would yield greater net returns for both capital and labour.

Professor Cameron briefly summarized some of the basic needs and desires of employees, employers, and "that heterogeneous mass commonly referred to as the public", maintaining that a knowledge of these is a necessary condition to a solution of labour problems.

The wage-earner, he said, wants security more than anything else. This would include protection against unjust and indiscriminate discharge, freedom from fear of unemployment, wages sufficient to ensure a decent standard of living for himself and dependents, a reasonable income in times of illness and accident, ample provision for the exigencies of old age, a decent burial, and a measure of economic protection for his family after his death. He also wants physical security in the way of protection against physical injury, occupational disease, and accidental death. He would like to have congenial and happy relationships in his work. And, finally, he wants some form of representation in the councils of industry.

"If industrial industry has taught any lesson", said Professor Cameron, "it is that workers want established channels of communication between themselves and the management. This involves the right to select their own representatives for joint conferences with the management concerning such vital matters as wages, hours, conditions of work, and dismissal".

The employer wants the greatest possible output at the least possible cost, recognition of and respect for his traditional rights and powers in the organization and management of his enterprise; freedom to develop new ideas, processes and equipment without interference from either labour unions or governments; sustained growth of his industries and businesses, and the unreserved co-operation of his employees.

The public wants an uninterrupted flow of goods and services at reasonable prices.

In concluding this portion of his address Professor Cameron stated that "any study of the problems of personnel relations must proceed primarily from the standpoint of management. This is because problems of procedure in handling human relations are essentially problems of managerial technique. To be complete the analysis must attempt to interpret to the worker the difficulties of management, and to management the difficulties of the worker. It must, moreover, take cognizance of the larger social interests which impinge at various points on equitable relations in industry and business.

"The economic organization of a country is a means to an end rather than an end in itself", he continued. "That end is dominantly social; it is the enrichment of human life through the satisfaction of wants and desires. From a social point of view, however, the achievement of that end through the exploitation of the workers is undesirable and, consequently, unjustifiable. Industry cannot be a vehicle of genuine social progress if its own advance is at the expense or sacrifice of those who are largely responsible for its success".

In elaborating further upon the general subject of democratic control of industry, Professor Cameron said: "modern organization urgently needs some form of joint control which will bring management and men closer together in the conduct of the business". Employee participation in the formulation and execution of the rules and regulations that govern their everyday employment conditions is essential to harmonious relations. But if the workers are to be given a voice, they must accept responsibility for making industry economical and efficient and for sustaining an active interest in its government.

But what the pay of the worker himself should be, he felt, "must remain primarily a matter of negotiation and expedient adjustment and compromise. Customary and prevailing wages, labour supply and demand, the value of services and standards of living—all deserve consideration, but none of these nor any other like principle can be accepted as determining what is 'just and fair'. The state may set a minimum wage to prevent employers from paying labour 'depressed' wages, but its attempts to fix the rewards of labour generally have proved (even in wartime) as unacceptable to working people as the wages that are dictated by employers. And Government wage fixing has (even in wartime) proved equally unacceptable to employers. For when the rewards of labour are determined, the rewards of management and of investors are also determined, and there are effects on the incomes of consumers. And in these controversies over the division of the income of industry, not only wages and earnings are involved, but also the sharing of economic authority."

## PETERBOROUGH BRANCH

A. R. Jones, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, S.E.I.C. - *Branch News Editor*

The Junior section of the Peterborough Branch met at the Kawartha Club, January 15th, to organize for 1943. Mr. A. Hailey was elected Chairman, and Mr. D. Gardner Secretary-Treasurer. Senior members were invited to the latter part of the meeting which consisted of an address by Mr. J. M. R. Fairbairn, former Chief Engineer of the C.P.R., on **Early Problems in Railway Engineering.**

The Kawartha Golf & Country Club was the scene of the Annual Party on Saturday, January 30th. This event is becoming a pleasant institution with the Branch and was attended by around 50 couples. Dinner was served in the early evening, followed by an entertainment and dancing. A new feature was introduced this year in the person of Mr. El. Jones, Master of Ceremonies and Funnyman, who devoted his great bulk to seeing that there would never be a dull moment. A magician of parts, Mr. T. Van Russell, was such a hit that after his performance he spent the evening demonstrating his skill to small groups of delighted spectators. Members of the Branch contributed their part to the entertainment also. Messrs. McHenry, Drynan, Wilson, Wright and Pope gave a nostalgic rendition of some of the old, and not-so-old ballads, including the Strip Polka, under an imitation street-light. It is felt that this party adds a desirable social element absent from the technical meetings.

On Thursday, February 4th, the Branch was addressed by Mr. C. F. Cline of the Norton Company, on **Engineering, of Abrasive Production.** Mr. Cline outlined the methods of production of the three chief abrasive products of the Norton Company, silicon carbide, aluminum oxide and boron carbide. All three involve the use of large quantities of electric power for heat in carrying out the chemical reactions, and in preparation of grinding wheels and other products. Silicon carbide is one of the early industrial abrasives, made from silica sand and coke and is particularly useful in grinding very hard material. Aluminum oxide is of great importance to-day, especially for use with mild steel, but it has various applications, ranging down to dentists' wheels. It is made from bauxite, the ore of aluminum. Boron carbide has the distinction of being the next hardest material to diamonds and has great future possibilities, as well as its present important application as an abrasive and refractory. Abrasives are an unobtrusive, but nonetheless important element of wartime manufacture, entering as they do into practically every fighting tool. Mr. G. C. Tollington thanked the speaker for his excellent paper.

## SAGUENAY BRANCH

A. T. Cairncross, M.E.I.C. - - *Secretary-Treasurer*
Georges Archambault, Jr.E.I.C. - *Branch News Editor*

On January 28th, 1943, at Arvida, the Saguenay Branch of the Institute held a joint meeting with the Women's Canadian Club of the Saguenay to hear Dr. Ivan H. Crowell, Director of Handicrafts, MacDonald College, speak on **Handicrafts.**

The Branch Chairman, Mr. R. H. Rimmer, presided. The meeting opened with the singing of "God Save the King," and then Mr. Rimmer called upon Dr. Helen Cairncross, President of the Women's Canadian Club, to introduce the speaker.

Dr. Cairncross said that Dr. Crowell was a manual training teacher before he took his Science Degree and later his Doctorate of Philosophy in Plant Pathology. After leaving university, Dr. Crowell kept up his interest in woodwork, and organized a handicraft club among his associates, from which sprang the Department he now leads.

Dr. Crowell outlined the known history of handicrafts in Canada, which is centred in Quebec and the Maritime Provinces. The early settlers did not consider good handwork a craft because most of the work done was for home improvement. Organized handicraft in Canada was probably founded at Quebec when Ursuline nuns from France opened a girls' school and taught gold and silver thread embroidery. The work of the school expanded, and in many Quebec Roman Catholic Churches are to be found artistic treasures made by persons who came under its influence and worked in embroidery, birch bark, wood, porcupine, leather, and moose hair.

In the present generation handicraft is looked upon as an art that can be used to advantage in several ways. It takes first place as a hobby in providing the task worker with an outlet for using his hands and ingenuity. Handicraft provides a means of recreation which during times of depression often provides for self-support. In hospitals, handicraft taught by trained occupational therapists gives the injured new interests and a means of providing for themselves.

Immediately following the address, many questions were asked, and a motion was passed by the audience authorizing the Chairman to appoint a representative committee to investigate the possibility of forming a Handicraft Guild at Arvida.

Mrs. R. O. Kennedy moved a motion of thanks to Dr. Crowell, which was seconded by Mr. M. G. Saunders and Rev. M. W. Booth.

Dr. Crowell brought from MacDonald College a collection of handicraft articles made by the students. These were displayed together with handicrafts in wood, embroidery, weaving, painting, model railroading, pottery and bookbinding done by local residents. The exhibition attracted much attention and indicated that talent was available for the proposed guild.

### SASKATCHEWAN BRANCH

Stewart Young, M.E.I.C. - *Secretary-Treasurer*

The regular monthly meeting of the Saskatchewan Branch was held jointly with the Association of Professional Engineers in the Hotel Kitchener, Regina, on Wednesday evening, January 22, 1943. The meeting, at which the attendance was 32, was preceded by a dinner.

Several musical numbers were rendered by Mr. Norman Ayres, accompanied by Miss Fleming; following which Mr. Charles Eder, Assistant Manufacturing Superintendent, Regina Industries, Ltd., addressed the meeting on **Industrial Relations.**

Pointing out that management-labour relations in all democratic countries had passed through a period of evolution, from fear being a control factor at the close of the last war, to co-operation, Mr. Eder proceeded to explain the several features of a well co-ordinated plan of co-operation which must include personal interest of the workman, proper instruction and fair wages, adequate equipment and proper material with fairness on the part of the foremen and those in authority. The address proved of more than usual interest and elicited numerous questions.

The meeting concluded with two sound films, one on Argentina and the second on the Icelandic population of Western Canada.

Due thanks were conveyed by the Chairman, A. P. Linton, to Mr. Eder for his excellent address and to Mr. Armstrong, Principal, Lakeview School for operating the projector. The films were on loan from the Visual Education Branch, Department of Education.

The Twenty-Sixth Annual Meeting of the Saskatchewan Branch was held in the Hotel Saskatchewan, Regina, at 4.00 p.m. on February 19th, 1943. The Chairman, A. P. Linton, presided.

Afterwards, those in attendance met for a social hour with the members of the Association of Professional Engineers and, at 6.30, all gathered for the joint annual dinner. The total attendance was 69. The newly elected Chairman and President of the Association, A. M. Macgillivray, presided. Following a programme of music and entertainment, Mr. G. N. Griffin, Principal, Normal School, Regina, addressed the meeting on **The Challenge of Democracy.**

Stating that the democratic way of life was an outgrowth of the teachings of Christianity, developed during the last 150 years, Mr. Griffin proceeded to point out certain accompanying characteristics at variance with the ideals on which the system was based. Among these he mentioned rugged individualism as opposed to the principles of the brotherhood of man; competition in trade versus co-operation; the supplying of medical services on the basis of ability to pay rather than as a function of the state available to all. In concluding his address, Mr. Griffin stated that in the post-war world of free democratic nations, if we are to survive, there must be a changed attitude within each person from selfish individualism to the principles laid down nearly 2,000 years ago in Palestine.

During the course of the meeting an Institute pin was presented *in absentia*, to F/Lt. R. A. McLellan, the retiring Past Chairman.

### SASKATOON SECTION

G. W. Parkinson, M.E.I.C. - *Secretary-Treasurer*

The Saskatoon Section held four meetings during the past year. The dates of the meetings, speakers and topics are listed below:

Mar. 19th, 1942—**Urban Transportation—Past, Present and Future,** by G. D. Archibald.

April 8th, 1942—**Report of the Activities of the Engineering Institute of Canada,** by Dean C. R. Young.

Dec. 3rd, 1942 —**Insulation,** by Dr. N. B. Hutcheon.

Feb. 12th, 1943—**Saskatchewan Soils,** by Dr. J. L. Mitchell.

The average attendance at these meetings was 42. Mr. A. M. Macgillivray has acted as President of the local section and the programmes were arranged by a committee composed of C. R. Forsberg, B. Chappell and the Secretary. The number of students attending the dinner meetings has been somewhat larger than usual. This is surprising when one considers the time required for academic work and military training.

### SAULT STE. MARIE BRANCH

O. A. Evans, Jr.E.I.C. - *Secretary-Treasurer*
N. C. Cowie, Jr.E.I.C. - *Branch News Editor*

The first regular meeting for the year 1943 was held in the Windsor Hotel on Friday, January 29, at 6.45 p.m., when twenty-seven members and guests sat down to dinner.

At the beginning of the dinner Chairman N. C. Cowie, requested the members to rise and drink a toast to the King.

At the conclusion of the dinner the members were entertained by a duet consisting of Mrs. Albert Cartmill, pianist, and Mrs. H. M. Jourdin, who played the guitar. A number of pieces were played and everyone enjoyed them. This was under the auspices of Paul Martin of the Entertainment Committee.

The minutes of the last regular meeting were then read and adopted on motion of A. M. Wilson and L. R. Brown. The following bills were passed on motion of J. L. Lang and A. E. Pickering, Cliffe Printing $3.56 for 140 cards, Cliffe Printing $8.64 for 150 membership cards and petty cash to Secretary $5.00.

The Chairman, then, called upon A. E. Pickering to introduce the speaker of the evening, H. R. Sills of Peterborough, Ontario. Mr. A. E. Pickering said that H. R. Sills had a notable career in the electrical field, as a designer. He also told the members that the speaker had taken an active part in Institute affairs.

Mr. H. R. Sills had for his topic, **The Design and Construction of Synchronous Machine.** The following is a résumé of H. R. Sills' paper.

The paper sketched the electric and magnetic circuits of the synchronous machine and explained that such machines were characterized by possessing one direct circuit and one alternating current circuit and a common magnetic circuit.

Synchronous machines must operate in synchronism or, in step with, the frequency of the alternating current voltage irrespective of load. Hence the name synchronous.

The simplicity of the magnetic circuit permits making synchronous machines to large sizes governed, so far, by the sizes of the connecting machines. The source of electric power in Canada is from synchronous generators driven by water wheels. Of the approximate 10,000,000 h.p. developed in Canada about two-thirds is developed by units of 40,000 h.p. or more, each. These large units occupy such a vital place in the power supply that they are worthy of a more than casual description and, as the design and construction of the small machines was a simplification of the large ones, a story of the large machines would be representative of the whole.

Synchronous machine design is in a continual state of development and modern machines are lighter and more compact than their predecessors of the same size were. There is a tendency for machines of any praticular make to develop in accord with that tangible "way of thought" or "know how," that characterizes the men and products of individual manufacturers. The processes and structures illustrated are those characteristic of one manufacturer.

The characteristics of the basic materials of construction, the iron, the steel, the copper, are much the same as thirty years ago. Hence, the development is largely a matter of arrangement of the materials to best utilize their characteristics, and treatment to enhance the desirable characteristics and to eliminate the undesirable ones. The process of converting mechanical into electrical energy involves several intermediate steps and as the synchronous machine is, in abstract, an intricate inter linkage of five circuits, magnetic, electrical, mechanical, thermal and ventilation. The importance of the arrangement of these circuits to best utilize the potentialities of the material cannot be over emphasized. This was illustrated by series of slides showing process and arrangements used in the manufacture of the 40,000 K.V.A. generators for the St. Maurice Power Company at LaTuque. A certain historical background was added by showing slides portraying examples of construction as used 10 to 20 years previously. This was followed by several slides illustrating the diversity of forms in which the synchronous machine is used.

At the conclusion of the speech the members took a lively interest by asking the speaker many questions.

J. L. Lang moved a vote of thanks to the speaker and thanked him for his interesting speech. Chairman N. C. Cowie thanked the speaker on behalf of the Branch.

R. A. Campbell moved the adjournment.

### ST. MAURICE VALLEY BRANCH

VIGGO JEPSON - *Chairman and Acting Secretary-Treasurer*

On Tuesday night, February 2nd, the Canadian General Electric Co. film "The Inside of Arc Welding" was shown to members of the Branch and other interested parties, by Mr. R. N. Fournier and Mr. R. McBrien of the Canadian General Electric Co. The meeting was held in the Auditorium of the Shawinigan Technical Institute, Shawinigan Falls, where the film was also shown to students of that Institution in the afternoon.

The meeting was presided over by the Branch Chairman, who introduced the representatives of The Canadian General Electric Co.

The introductory remarks were given by Mr. Fournier, who also delivered a short speech on the **Conservation of Welding Rods** during the intermission.

At the close of the meeting a hearty vote of thanks was extended to the Canadian General Electric Co., and, in particular, Messrs. Fournier and McBrien, by Mr. E. T. Buchanan.

The meeting was attended by 130 people.

### TORONTO BRANCH

S. H. DEJONG, M.E.I.C. - *Secretary-Treasurer*
G. L. WHITE, Affi.E.I.C. - *Branch News Editor*

**War Industry Problems** was the subject of a paper presented before the Toronto Branch of the Engineering Institute of Canada at Hart House, on January 7th, by T. M. Moran, Vice-President of Stevenson and Kellogg, Ltd., Management Engineers, and President of United Tool Engineering and Design, Ltd.

The meeting was opened by the Chairman of the Toronto Branch, Col. W. S. Wilson, who then turned the Chair over to Wills Maclachlan, Chairman of the Institute Committee on Industrial Relations.

In introducing the speaker, Mr. Maclachlan made reference to the many important industrial and Government jobs which Stevenson and Kellogg, Ltd., had undertaken and congratulated the Toronto Branch upon securing Mr. Moran to deal with a subject of such vast importance in war production.

Mr. Moran outlined in detail the problems that face industrial managers relative to organization, planning, production and personnel. Special emphasis was placed upon the human factor in industry and factual data was presented relating to the employment of women in industry and the implications of absenteeism. The speaker stated that these problems are best solved by industry as a whole, placing its shoulder to the wheel and adopting affirmative, horse-sense approach to the problem. There is no substitute for the understanding of the situation obtained in this manner and too often Government and external agencies are expected to supply the solution.

The speaker asserted that the engineer has a real place in industry and industrial management, and must realize more fully that he is very valuable in the field of management as well as in the field of technology. There should be more engineers working as foremen, superintendents and works managers—capacities in which their services are urgently required.

In conclusion Mr. Moran stated that industry must face the issue and organize itself on a sound fundamental basis. All operations must be centered around this fundamental industrial pattern. Management is a profession and as such demands adherence to its basic principles if an efficient war enterprise is to be the result.

The active discussion period which followed the address was an excellent indication of the interest taken in the subject by members of the Toronto Branch. During the discussion period further light was thrown upon the question of absenteeism, labour management committees for increasing production, and the appointment of someone in an organization to plan for the future.

The vote of thanks to Mr. Moran was moved by Dean C. R. Young, President of the Institute, who emphasized the importance of greater attention to human factors on the part of engineers.

The Toronto Branch was fortunate in having two special meetings in January which were of great interest to young engineers. The first of these was the Annual Student's Night of the Branch held in the Debates Room at Hart House on Thursday, January 21, 1943. The second was the Inaugural Meeting of the newly instituted Junior Section of the Toronto Branch, also held in the Debates Room at Hart House on Wednesday, January 27, 1943. Both these meetings constituted worthwhile contributions to the development of young engineers, in whose hands the future of the Engineering Institute of Canada and of the engineering profession generally rests.

About ninety young engineers attended the Inaugural Meeting of the new Junior Section of the Toronto Branch of the Engineering Institute of Canada. In discussion it was found that all the main branches of the profession and most

Canadian Universities were represented by those present. The gathering was called to order by Professor Robert Legget who explained briefly that the meeting was the culmination of a series of discussions amongst a small group who were concerned at the lack of any facilities in Toronto for the assembling of young men in all branches of the engineering profession to discuss their common problems and matters of general professional interest. Tribute was paid to the work done by the Junior Section of the A.S.M.E., and by the Junior Discussion Group of the A.I.E.E. in Toronto. Contact had been made with both these organizations in order that there should be no overlapping of activity, the aim being to supplement existing technical organizations and in no way to supplant them. Reference was made to earlier attempts to start a Junior Section in Toronto, and to the development of the corresponding Junior Section in Montreal.

The meeting was then turned over to Erwin E. Hart, as Chairman of the provisional committee, who outlined the aims and objects of the Section. He introduced Dean C. R. Young, President of the Institute, who expressed his pleasure at the start of the Junior Section. He explained the emphasis now being placed upon the place of the young engineer in professional circles, mentioning particularly the recent appointment of two young members of the Institute to one of the main committees of the E.C.P.D. Lt.-Col. W. S. Wilson, Chairman of the Toronto Branch, expressed corresponding pleasure at the inauguration of the Section on behalf of the Branch.

Professor Griffith Taylor, Professor of Geography at the University of Toronto, was guest speaker at the meeting, being introduced by J. VanWinkle, member of the provisional committee and Chairman of the Toronto Junior Section of the A.S.M.E. Professor Taylor spoke on **Geopolitics** with special reference to Canada. He traced the development of geographical studies in association with political objectives, paying special attention to the early work of Sir Halford Mackinder. Turning to Canada, Professor Taylor showed its importance in world politics from its geographical features and he discussed future possibilities for Canadian development stressing the importance, in his view, of the Alberta coal resources. An interesting and prolonged discussion followed the address, which was illustrated by many lantern slides, the speaker being finally thanked by R. Scott.

After a short interval, during which the senior guests retired, the meeting proceeded to discuss the future of the new Section after the Chairman had outlined the proposed constitution. Many suggestions were advanced, and it was finally decided to hold monthly meetings for the remainder of the winter season. It was generally agreed that this meeting provided the Section with a very useful start.

For the first time the Annual Student's Night was held as a joint meeting with the Engineering Society, University of Toronto. The speakers of the evening and the Executive of the Engineering Society were guests of the Toronto Branch at dinner in the Graduate Dining Room prior to the meeting.

The meeting was opened by Lt.-Col. W. S. Wilson, Chairman of the Toronto Branch, who immediately placed proceedings in the hands of Prof. R. F. Legget, Department of Civil Engineering, University of Toronto. Professor Legget introduced the judges, Messrs. J. T. Cawley, D. D. Stiles, Jr., and E. A. Cross, and the speakers in the Senior and Junior Competitions.

The speakers and their papers were as follows:

Senior Competition

John M. Dyke—**The Sold Fuel Combustion Engine**

Ronald Scott—**Electronic Devices**

R. B. Telford—**Deep Wells**

Junior Competition:

J. A. Legris—**The Place of the Engineer in the Post-War World**

W. E. A. Rispin—**Synthetic Rubber**

K. Stehling—**Underground Gasification of Coal**

In the Senior Competition the judging was for a draw between R. Scott and J. M. Dyke with first and second prizes divided between them; and third prize to R. B. Telford.

In the Junior Competition the first prize was awarded to W. E. A. Rispin, with second prize a draw between J. A. Legris and K. Stehling, who divided second and third prizes between them. Professor R. F. Legget who announced the judges' decision also announced the award of one year Student Membership and one year's subscription to *The Engineering Journal* to R. A. Muller and J. J. Hurley, who presented excellent papers but were eliminated from the competition.

Lt.-Col. W. S. Wilson presented the certificate for the Engineering Institute prize to J. M. Ham. During the interval while the judges were reaching their decision, two films—**The Wardens of Power** and **The Master Plan**—were shown through the courtesy of the Hydro Electric Power Commission of Ontario.

## VANCOUVER BRANCH

P. B. Stroyan, m.e.i.c. - *Secretary-Treasurer*
A. Peebles, m.e.i.c. - - *Branch News Editor*

On Thursday, February 18th, at a meeting held in the Medical-Dental Building, presided by the Branch Chairman, Mr. W. N. Kelly, Mr. Gerald H. Heller, Personnel Supervisor, Dominion Bridge Co., Ordnance Plant, Vancouver, delivered an address on **Industrial Relations.**

Mr. Heller, who has had an interesting career as a journalist, spoke in general terms on his subject. He opened by relating some experiences and impressions gathered during an extensive journalistic tour of Central Europe in 1938, and in Japan the previous year. He visited Germany, Sweden, France, Italy and some of the smaller countries, at a time when war was in the making. In Germany especially, industry was working in high gear, its obvious purpose being maximum production of war materials and implements. Employees were regimented to a high degree, yet the psychological effects of this were not wholly ignored. Morale building propaganda was dispensed freely, and an industrial psychology was developed which, operating in conjunction with the new political training of the period, made their tremendous production effort possible.

In the democratic countries the same degree of civilian regimentation is not possible, but by an intelligent use of psychology in industrial relations, as great or greater production efficiency can be achieved. The rapid expansion of industry has necessitated a careful study of the effect on employees. As long as industrial growth was at a normal rate, employees worked their way into factories gradually and over a period of years were trained in factory methods, and environment. Now, large numbers of workers have been suddenly transferred from mines, farms, forests, offices, schools, and even from the kitchen, and placed in a new type of work where their movements are much more restricted, and they are forced to conform to the pattern of organization of the industrial plant. This change has given rise to certain difficulties for the individual employee which he cannot completely overcome by himself. Management is compelled to study and solve many problems which formerly were not considered one of its functions.

Some of these difficulties are problems of training unskilled persons while others pertain to the building up and protecting of morale. To mention some of the new phases of industrial management which deal with personnel the following are the most obvious. A large percentage of unskilled labour must be trained in a very short time. Transportation of employees must be arranged in many cases by the management. The employment of women where none were used before requires new regulations and new facilities for their use and comfort. In all cities housing is a present problem which reacts on working efficiency. Men are drafted into the armed forces on short notice and must be replaced by an untrained person. Plants must be protected against sabotage and the inquisitive outsider. Greater protection for employees is necessary because of crowded space, lesser skill on their part, and lack of experience of the world of machines. Recreational facilities must be provided in isolated plants, or where the community facilities are overtaxed. Absenteeism is serious in some cases and must be carefully handled. Meals must be provided for large numbers of persons. Certain outside activities such as appeal campaigns, also impinge upon the management.

The speaker expressed the view very emphatically that many of the above features of industrial relations will remain permanently. The old relationship between employer and employee, that of master and servant will never return, even during slack periods when there is no shortage of labour. Employees must be given a larger voice in some aspects of management, because they are relating their daily employment to life as a whole, and expect it to provide a reasonable amount of comfort and security. In developing such a broad attitude, management must frequently take the initiative, rather than the employees. This will avoid much of the bitterness which usually characterises any attempt on the employees' part to improve working conditions.

Considerable discussion followed the address, and a hearty vote of thanks was proposed by Mr. C. E. Webb. About twenty-five members were present.

# News of Other Societies

**Items of interest regarding activities of other engineering societies or associations**

R. H. Field, M.E.I.C.

### SURVEYORS ELECT OFFICERS

At the 36th annual meeting of the Canadian Institute of Surveying held at Ottawa, on February 3rd, 1943, R. H. Field, M.E.I.C., was elected president for the year 1943-44. He succeeds C. H. Fullerton, Surveyor-General, National Research Council, Ottawa.

Other officers elected at the meeting are: H. E. Beresford, Winnipeg, first vice-president; R. D. Davidson, Ottawa, second vice-president; and W. L. McIlquham, Ottawa, secretary-treasurer. Councillors: B. H. Segre, M.E.I.C., W. B. Dingle and R. C. McDonald, all of Ottawa; George McMillan, Medicine Hat, Alta.; G. P. Tassie, Vernon, B.C.; W. Humphreys, Winnipeg, Man.; D. H. Hudson, Edmunston, N.B.; R. J. Milgate, Halifax, N.S.; J. W. Pierce, M.E.I.C., Peterborough, Ont.; H. E. Miller, Charlottetown, P.E.I.; A. C. Crépeau, Sherbrooke, Que.; W. M. Stewart, M.E.I.C., Saskatoon, Sask.

# Library Notes

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**Foremanship and Safety:**
*C. M. MacMillan. N.Y., John Wiley and Sons, (c. 1943). 5½ x 7½ in. $1.00.*

**Transients in Linear Systems:**
*Vol. 1—Lumped-constant systems. Murray F. Gardner and John L. Barnes. N.Y., John Wiley and Sons, 1942. 6 x 9 in. $5.00.*

**A Start in Meteorology:**
*An introduction to the science of the weather. Armand N. Spitz. N.Y., Norman W. Henley, 1942. 5½ x 8 in. $1.50.*

**Air Navigation for Beginners:**
*A ground school primer for the aerial navigator. Scott G. Lamb. N.Y., Norman W. Henley, 1942. 5½ x 8 in. $1.50.*

**Alternating-Current Circuits:**
*Earle M. Morecock. N.Y., Harper and Bros., (c. 1942) (Rochester Technical Series). 6 x 9½ in. $2.75.*

**Tool Design:**
*Cyril Donaldson and George H. LeCain. N.Y., Harper and Bros., (c. 1943) Rochester Technical Series). 6 x 9½ in. $3.75.*

**Photogrammetry:**
*3rd ed. H. Oakley Sharp. N.Y., John Wiley and Sons, (c. 1943). 8½ x 11 in. $3.50.*

**1942 Book of A.S.T.M. Standards:**
*Including tentative standards. Part 2: Nonmetallic materials — Constructional. American Society for Testing Materials, 1943.*

**Bibliography on Automatic Stations, 1930-1941:**
*American Institute of Electrical Engineers, December, 1942. 26 p. 50c. (E.I.C. members may obtain copies at Headquarters at 25c.)*

**Canadian Engineering Standards Association:**
*B63-1942: Specification for welded and seamless steel pipe.—B71-1942: Specification for standard dimensions of small rivets.*

### TRANSACTIONS, PROCEEDINGS

**Institution of Naval Architects:**
*Transactions, volume 84, 1942.*

**Institution of Mechanical Engineers:**
*Proceedings, volume 147, January-June, 1942.*

**Junior Institution of Engineers:**
*Journal and Record of Transactions, volume 52, 1941-1942.*

**American Society of Civil Engineers:**
*Transactions, volume 107, 1942. (Volume 68, No. 8, part 2 of the Proceedings.)*

**Royal Society of Canada:**
*Transactions, volume 36, section 3 and 4, May, 1942.*

**Nova Scotian Institute of Science:**
*Proceedings, volume 20, part 4, 1941-1942.*

### REPORTS

**Canada—Department of Mines and Resources:**
*Report of the Department including report of Soldier Settlement of Canada for the year ended March 31, 1942.*

**Canada—Minister of Public Works:**
*Report of the Minister on the works under his control for the year ended March 31, 1942.*

**Canada—Department of Mines and Resources—Dominion Water and Power Bureau:**
*Water resources paper No. 83—Atlantic drainage, south of St. Lawrence river.*

*(Continued on page 179)*

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

February 27th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the April meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

ADAMSON—FRANCIS STANLEY, of 300 Waterloo St., Winnipeg, Man. Born at Nassaguaya, Ont., April 7th, 1902; Educ.: B.Sc. (C.E.), Univ. of Man., 1926; R.P.E. of Man.; 1920 (summer), C.P.R.; 1923 (Sept.-Nov.), inspr., Winnipeg Electric Co.; 1924 (Jan.-Aug.), elec. consultant, Chicago Engineering Works; 1925 (May-Sept.), asst. field engr., Kelker, Deleuw & Co., Chicago; 1926 (June-Nov.), field engr. for same company i/c munic. work; 1926-32, designing engr., Concrete Steel Co., Akron and Youngstown, Ohio. Designing, detailing, estimating, office engr., and asst. sales mgr.; 1934-35, dftsman., Cowin & Co. Ltd., Winnipeg; 1935-39, designing engr., Greater Winnipeg Sanitary District; 1939-42, asst. engr., i/c design and dfting. room, city engr's. dept., City of Winnipeg; June, 1942, to date, as above, also i/c sewer mtce., and chief bldg. and plumbing inspr.

References: W. P. Brereton, W. M. Scott, W. D. Hurst, D. L. McLean, C. V. Antenbring, G. R. Fanset, H. L. Briggs, D. M. Stephens.

BEAUDOIN—MAURICE, of 81 Guillaume St., Longueuil, Que. Born at Montreal, June 21st, 1911; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1935; R.P.E. of Que.; 1935, engr., 1935-37, asst. divnl. engr., and 1937 to date, divnl. engr., Dept. of Roads, Prov. of Quebec.

References: E. Gohier, A. Gratton, J.-O. Martineau, J.-A. Lalonde, L. Trudel.

BILLICK—PAUL GEORGE, of 1209 Mackay St., Montreal, Que. Born at Odessa, Russia, Jan. 26th, 1915; Educ.: 4-year course, aeronautical engrg., I.C.S.; 3 years (nights), Montreal Technical Institute, internal combustion engines; 1938-40 (24 mos. day course), Roosevelt Aviation School, Miniola, L.I., N.Y., diploma in Aeronautical Design, Sept., 1940; 3 mos. instructor at above school, in elementary aerodynamic theory; 1941-42, senior dftsman., design and stress analysis, and Feb., 1942, to date, engr. i/c technical dept., Canadian Vickers Ltd. (The work of this group is to handle matters in connection with the design of aircraft which are of a technical nature—materials and specifications, processing, stress analysis and aerodynamics.)

References: P. F. Stokes, J. R. Hartney, R. C. Flitton.

BOULTBEE—JAMES GREER, of 1471 Closse St., Montreal, Que. Born at Toronto, Jan. 6th, 1920; Educ.: B.A.Sc., Univ. of Toronto, 1941; with Federal Aircraft Ltd., as follows: Mar., 1941, to Mar., 1942, expediting production and delivery at Ottawa Car & Aircraft, and Mar., 1942, to date, i/c scheduling and distribution of all-metal wing fittings on trainer aircraft.

References: R. F. Legget, C. F. Morrison, C. R. Young.

BRODIE—LeSUEUR, of Ottawa, Ont. Born at Montreal, April 13th, 1905; Educ.: B.Sc. (Eng. Phys.), McGill Univ., 1926; R.P.E. of Ont.; with Bell Telephone Co. of Canada as follows: 1926-31, transmission engr., Montreal, 1931-35, sales engr., Toronto, 1935-40, asst. rate engr., Montreal, 1940-41, mgr., Brantford office; 1941-42, Capt., R.C.C.S., O.C., Wireless Wing A9 C.A.C.T.C., Camp Borden; 1942 to date, Major, R.C.O.C., TS02, i/c telecommunications section, Dept. of Mech. Mtce., M.G.O. Branch, Dept. of National Defence, Ottawa.

References: J. L. Clarke, C. V. Christie, D. J. McDonald, R. V. Macaulay, R. D. Harkness, A. B. Hunt, H. Miller.

CAMERON—WILLIAM JOHN DUNCAN, of Winnipeg, Man. Born at Winnipeg, July 26th, 1910; Educ.: B.Sc. (Civil), Univ. of Man., 1934; R.P.E. of Man.; 1928-31, rodman and instr'man., C.N.R.; 1935-37, engr., 1937 to date, supt., i/c plant operation, production, etc., Anthes Foundry Ltd., Winnipeg, Man.

References: C. V. Antenbring, A. J. Taunton, W. P. Brereton, W. D. Hurst, E. S. Kent.

CHAGNON—JEAN CHRISTOPHE, of Montreal, Que. Born at Ste-Théodosie, Que., Jan. 18th, 1901; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1926; R.P.E. of Que.; 1926-27, Ottawa-Montreal Power Co.; 1927, Collette Frères; 1927 to date, with the Quebec Streams Commission; 1929-30, supervising constrn. of Cedars Rapids Dam, 1931-42, surveying work in connection with water power developments.

References: O.-O. Lefebvre, S. F. Rutherford, J. E. Gill, J.-P. Lalonde, L.-A. Dubreuil.

CHRISTMAS—LYNWOOD MacDONALD, of 248 Albert St., Ottawa, Ont. Born at Boston, Mass., Jan. 18th, 1910; Educ.: B.Sc. (C.E.), Univ. of N.B., 1933; 1929 (Feb.-Sept.), office work and summer survey, Canadian International Paper Co.; 1930 (summer), surveys, Dominion of Canada Forestry Branch; 1933 to date, with the Dibblee Construction Co. Ltd., as engr. and supt. of road, airport and misc. contracts in Ontario, Quebec and Nova Scotia, and from 1941 to date, chief engr. of the company.

References: N. B. MacRostie, W. H. G. Flay, J. McLeish, G. H. Chalmers, F. C. Askwith, W. L. Saunders.

ELLIS—DAVID EDWARD, of Three Rivers, Que. Born at Ottawa, Ont., Feb. 4th, 1905; Educ.: B.Sc. (Elec.), McGill Univ., 1931; 1924, topogl. surveys; 1925, rodman, Gatineau Power Co.; 1925-26 and 1930, surveys and electrn's helper, Morrow & Beatty; 1931-34, ap'ticeship course, and from 1934 to date, engrg. office, commercial and distribution dept., and at present, asst. distribution engr., Shawinigan Water & Power Company.

References: J. H. Fregeau, A. C. Abbott, F. W. Bradshaw, J. F. Wickenden, C. V. Christie, C. H. Champion.

FEIFFER—FRED, of 329 Eglinton Ave. East, Toronto, Ont. Born at Regina, Sask., Feb. 26th, 1917; Educ.: B.A., 1938, B.Sc. (Engrg. Phys.), 1940, Univ. of Sask.; 1940 (4 mos.), aeroplane runway inspection, cost estimating of switchboards and panels; 1940 to date, instrument design and glass engrg., optical lens tools, Research Enterprises Ltd., Leaside, Ont.

References: D. C. R. Miller, C. J. Mackenzie, I. M. Fraser, R. A. Spencer, E. K. Phillips.

FLOYD—EDWARD, of 1431 Dobson St., Vancouver, B.C. Born at Normanby, Yorks., England, March 17th, 1874; Educ.: 1895-96, Durham College of Science, Newcastle, England. 1896-97, City & Guilds of London Institute—Mining Engr., Mine Surveyor, 1897; R.P.E. of B.C.; 1885-1905, mining experience, through every grade to district manager, Ashington Collieries, Northumberland; 1905-15, consltg. engr., Miners' Executive Committee and Federation of Great Britain; 1915-17, Royal Army Medical Corps; 1918-19, returned to mines, and loaned for two years to Canada to work for the late Lord Shaughnessy, President, C.P.R., attached to the Sydney Junkins Construction Engrs., Vancouver office; 1920-28, private practice, chiefly valuations and reorganizations, Vancouver, B.C.; 1928-30, engaged to open up a coal area and drive a tunnel for the Ashington Coal Co. Ltd., New Westminster; 1930-31, returned to England; 1933-35, made an appraisal and valuation of the Maple Leaf Iron Works, and gen. mgr. of Maple Works, Vancouver; at present, director, as mining engr. on Board, and consltg. mining engr. to the West Coast Collieries, Vancouver, B.C.

References: A. D. Creer, A. S. Gentles, A. S. Wootton, A. E. Foreman, W. N. Kelly, P. B. Stroyan.

FOURNIER—EMMANUEL JOSEPH, of 509 Third Ave., Quebec, Que. Born at St. Magloire, Que., Oct. 18th, 1901; Educ.: B.S. in M.E., Univ. of Mich., 1930; R.P.E. of Que.; 1915-17, foundry work; 1920-22, tool making; 1922-23, divn. sec'ty., Cie. Electrique Bellechasse; 1923-25, station service, Quebec Power Co.; 1925-32, machine tool and die design, Ford, Continental, Wolverine, etc.; 1932-36, sales, design and service engr., J. A. Y. Bouchard Ltée., Quebec; consltg. engr. on metal parts production, design, constrn. and management of heating, power, ventilating and refrigeration plants, also teacher in thermodynamics and refrigeration, Ecole Technique, Quebec.

References: P. Méthé, Y.-R. Tassé, A. Laframboise.

FRASER—KENNETH WALKER, of 5145 Côte St. Luc., Montreal, Que. Born at Pembroke, Ont., Oct. 19th, 1902; Eudc.: B.A.Sc. (E.E.), Univ. of Toronto, 1927; 1927-30, various plants and sales offices, Westinghouse Electric & Mfg. Co.; 1929 to date, technical sales, and at present, Montreal District Manager, Canadian Westinghouse Co. Ltd., Montreal.

References: H. A. Cooch, W. P. Dobson, A. D. Ross, D. Anderson, J. B. Challies, R. E. Heartz, G. A. Gaherty.

HOUGH—AYTON LLOYD, of Montreal, Que. Born at Cookshire, Que., Sept. 29th, 1905; Educ.: B.Eng. (Elec.), McGill Univ., 1933; 1922 to date (except when attending McGill), with the Shawinigan Water & Power Company—1934-37, system operator, 1937-38, asst. supt., and 1938-39, supt., terminal stns., Montreal, and 1939 to date, asst. supt., distribution stns., Montreal.

References: S. S. Scovil, W. R. Way, J. Morse, L.-A. Duchastel, H. M. Finlayson.

HOWLEY—JAMES THOMAS, of 1447 Metcalfe St., Montreal, Que. Born at Arthabaska Landing, Alta., May 28th, 1913; Educ.: B.Eng., N.S. Tech. Coll., 1935; B.A., Oxford Univ., 1939; 1939-40, asst. elec. engr., Bowater's Nfld. Pulp & Paper Mills, Corner Brook, Nfld.; 1940-41, dftsman., and May, 1941, to date, asst. engr., plant layout and design, Defence Industries Limited, Montreal.

References: H. C. Karn, J. R. Auld, P. Varley, A. G. Moore, F. H. Sexton.

JACKSON—CLYDE BRUCE, of 953 Dominion St., Winnipeg, Man. Born at Grand Forks, N.D., April 22nd, 1908; Educ.: B.Eng. (Civil), Univ. of Sask., 1931. 1928-31 (summers), dftsman., designer, instr'man., etc., with C. M. Miners Constrn. Co. Ltd., J. Melrose Morrison, Architect, and City Engr's. Dept., Saskatoon; 1931-33, designing engr., City Engr's. Dept., Saskatoon; 1934, designing engr., reinforced concrete and struct'l. details, 4-storey hospital, Prince Albert, Sask., for G. J. K. Verbeke, Architect; 1935, designing engr. and dftsman., filtration plant and storage reservoir, at Swift Current, for Underwood & McLellan, consltg. engrs., Saskatoon; June, 1941, to date, district engr., Aluminate Chemicals Ltd., Toronto, Ont., supervising and consltg. water treatment engrg. and chemicals, servicing, war industries. City and industrial power plants, hospitals, packing plants, oil refineries, etc., Port Arthur to West Coast.

References: C. J. Mackenzie, G. D. Archibald, E. W. R. Butler, R. A. Spencer, B. A. Evans, W. L. Foss.

JOHNSON—ROBERT ERNEST LACEY, of Toronto, Ont. Born at Montreal, June 30th, 1909; Educ.: B.Eng. (Elec.), McGill Univ., 1932; R.P.E. of Ont.; 1929-30, operations engr., Northern Electric Co. Ltd.; 1933-35, radio production engr., Electric Auto-Lite, Sarnia, Ont.; 1935-36, sales engr., tech. equipment, engrg. products, govt. contracts engrg., and 1936-41, mgr., industrial divn., R.C.A. Victor Co. Ltd.; 1941-42, senior management engr., and 1942 to date, supervising management engr., Stevenson & Kellogg Ltd., Toronto, Ont.

References: T. M. Moran, P. Kellogg, H. W. Lea, J. E. Dion, S. R. Frost.

JUPP—ERNEST H., of 2015 Inglewood Ave., Hollyburn, B.C. Born at Orillia, Ont., Nov. 22nd, 1891; Educ.: B.A.Sc. (Civil), Univ. of Toronto, 1915; 1916-18, Candn. Rly. Troops; 1919, McIntyre Mine, Timmins; 1920, storm sewer constrn., Orillia, Ont.; 1923-28, field engr., 1930, dftsman., Sydney E. Junkins Co. Ltd., Vancouver; 1931, instr'man., Water Rights Br., B.C.; 1931, inspr., dam constrn., Irrig. Dist. of Winfield, B.C.; 1935-36, field engr., Carter Halls Aldinger Co. Ltd.; 1937, field engr., Armstrong & Monteith, Vancouver; 1940, res. engr., and 1941 to date, asst. district airway engr., civil aviation divn., Dept. of Transport, Hollyburn, B.C.

References: P. B. Stroyan, C. R. Crysdale, C. E. Webb, H. N. Macpherson, G. T. Chillcott.

KEIL—HUGH DOUGLAS, of 983 Bruce Ave., Windsor, Ont. Born at Brock, Sask., May 1st, 1915; B.A.Sc., Univ. of B.C., 1937; R.P.E. of Ont.; 1937-40, engrg. ap'tice course, Canadian Westinghouse Co. Ltd., Hamilton, Ont.; Feb., 1940, to date, elec. engr., Windsor plant, Canadian Industries Ltd., Windsor, Ont.

References: H. L. Johnston, A. H. Pask, J. F. Bridge, D. W. Callander, J. R. Dunbar.

KELLETT—WILFRED MELVIN, of 3437 Peel St., Montreal, Que. Born at Woodstock, Ont., June 3rd, 1907; Educ.: B.A.Sc., Univ. of Toronto, 1934; 1934-38, production engr., Brownsburg, and 1938-41, mtce. engr. and methods engr., Montreal, Canadian Industries Ltd.; 1941-42, supt. of labour, transportation and personnel, Winnipeg, and at present, production engr., small arms ammunition administrative dept., Defence Industries Ltd., Montreal.

References: H. B. Hanna, C. H. Jackson, E. L. Johnson, A. C. Rayment, M. V. MacDonald.

MAINGUY—WILLIAM FRANCIS, of Montreal, Que. Born at Minneapolis, Minn., July 27th, 1905; Educ.: B.Sc. (Elec.), Queen's Univ., 1928; R.P.E. of Que.; with Shawinigan Water & Power Company as follows: 1928-29, gen. elec. layout and relay protection work; 1929-31, technical and economic studies of proposed Upper St. Maurice power developments; 1932-36, gen. sales development work as power sales engr. i/c power sales divn., 1937-42, power sales mgr., commercial and distribution dept., and at present, personnel co-ordinator for Shawinigan and associated companies.

References: J. B. Challies, P. S. Gregory, J. A. McCrory, R. E. Heartz, C. R. Reid, L.-A. Duchastel.

MOSS—FRANCIS W., of Montreal, Que. Born at Preston, Ont., Dec. 16th, 1900; Educ.: B.A.Sc., Univ. of Toronto, 1923; 1923-24, Cambridge Univ., England; 1920-25 (summers), with James, Proctor & Redfern, Toronto; 1925-30, president, Moss Engineering Co., Toronto, combustion engrg., stokers, blowers, etc.; 1930-37, vice-president, Construction & Maintenance Ltd., gen. contractors, Montreal; 1937 to date, engr. and salesman, Just Equipment & Supply Co., Montreal; at present, mgr., Ready Mix Concrete Ltd., Montreal, Que.

References: R. B. Young, E. S. Miles, A. J. Grant, Jr., J. M. Breen, W. W. Timmins.

McGEE—GEORGE LESLIE, of 551 Broadview Ave., Ottawa, Ont. Born at Toronto, July 10th, 1894; Educ.: B.A.Sc. (Civil), Univ. of Toronto, 1921; R.P.E. of Ont.; 1910-11, land surveying; 1913-14, 1915 and 1920 (summers), roadway section, Toronto Public Works; 1922-23, rodman, instr'man., Illinois Central R.R.; 1923-25, cost clerk, 1925-27, asst. constrn. mgr., Geo. A. Fuller Co., Chicago-New York; 1927-30, estimator, supt., Foundation Co. of Canada Ltd., Montreal; Supt. of bldg. constrn., as follows: 1930-31, C.P.R., 1931-32, Thomson Bros., 1932-33, Richardson Construction Co., 1933-36, Dept. of National Defence; 1936 to date, supervising engr. of aerodromes, Dept. of Transport, Ottawa, Ont.

References: C. P. Edwards, K. M. Cameron, E. P. Murphy, F. G. Goodspeed, W. H. G. Flay.

PAQUETTE—GEORGES, of 90 St. Joseph Blvd. East, Montreal, Que. Born at Montreal, June 16th, 1905; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1929. R.P.E. of Que.; Summers—1925 and 1927, surveying, Quebec Streams Commission, 1926, constrn. work, J. A. A. Leclair & Dupuis, office work, Montreal Tramways; 1929-30, survey and constrn., Associated Engineers; 1930-32, constrn. supervn., new bldg., Univ. of Montreal, for E. Cormier, M.E.I.C., Architect; 1932-38, with Ulric Boileau Ltd., gen. contractors, as res. engr., estimator and gen. supt. on various projects; 1938 to date, with the City of Montreal—1938-42, technical dept., bldg. estimation for assessment purposes, 1942 to date, hydro-electrical operation divn., new constrn., supervn. and gen. engrg.

References—J.-G. Caron, J.-A. Jetté, J. Comeau, F. V. Dowd, D. Desormeaux.

PEARSON—ARTHUR, of 4077 West 13th Ave., Vancouver, B.C. Born at Clydebank, Scotland, Nov. 4th, 1905; Educ.: B.Sc. (1st Class Honours—Civil Engrg.), Glasgow University, 1927; A.M., Inst. C.E. (London); R.P.E. of B.C.; 1924-25-26 (summers), and 1927-28, junior engr., asst. engr. on survey and dfting and design of bridges, on road constrn. in Scotland; 1928-29, with E. G. M. Cape & Co., Montreal, on quantity survey and later engr. i/c of constrn. of mill bldgs. at Steel Co. of Canada plant, Lachine; 1929, dftsman. and designer, Stuart Cameron & Co., and E. I. C. Cassedy, Vancouver; 1929-31, structl. designer, Powell River Co. Ltd., Powell River, B.C.; 1932, asst. on hydraulic development for mine power plant for W. R. Bonnycastle, M.E.I.C., consltg. engr.; 1933-34, dftsman. and designer, John S. Metcalf Co.; 1934-35, engr. on design and constrn., Bloedel, Stewart & Welch; 1935, drftsman. and structl. designer, Cons. Mining & Smelting Co., Trail, B.C.; 1936 to date, consltg. engr., Vancouver, B.C.

References—D. O. Lewis, J. R. Grant, A. D. Creer, P. B. Stroyan, J. B. Barclay, G. H. Bancroft.

PECK—ESMOND HASTINGS, of 455 Elm Ave., Westmount, Que. Born at Montreal, March 24th, 1910; Educ.: B.Eng. (Civil), McGill Univ., 1936; with the Shawinigan Water & Power Company as follows: 1936-40, dftsman. in distribution office, Three Rivers, 1940-42, asst. to district distribution engrs., field surveys, design and estimates, etc., 1942 to date, junior engr., water resources and statistical dept., asst. to hydraulic engr., Montreal.

References—A. C. Abbott, M. Balls, H. Massue, H. M. Finlayson.

PERRY—FREDERICK LLOYD, of Imperoyal, N.S. Born at Winnipeg, Man., Aug. 31st, 1917; Educ.: B.Sc. (Chem. Engrg.), Queen's Univ., 1942; 1937-39 (summers), San Antonio Gold Mine, Central Man., and International Nickel Company; 1940 (summer), lab. asst., control lab., International Nickel Co. Refinery at Port Colborne; 1940-41, asst. metallurgist, munitions dept., Pedlar People Ltd., of Oshawa; May, 1942, to date, asst. engr. of process control, Imperial Oil Co. Ltd., Dartmouth, N.S.

References—C. Scrymgeour, L. E. Mitchell, R. L. Dunsmore, A. E. Myra.

SAFRAN—NATHAN, of Calgary, Alta. Born at Calgary, April 12th, 1914; Educ.: B.Sc., 1934, M.Sc., 1935, Univ. of Alta.; 1936-40, instructor in science, and 1940 to date, head of science dept., Provincial Institute of Technology. Also 1938 to date, considerable analytical work (oil tests, organic, inorganic analyses and consultant work).

References—S. G. Coultis, F. N. Rhodes, J. B. deHart, A. Higgins, J. W. Young.

SALISBURY—ERNEST ALEXANDER, of 61 Kingsmount Park Road, Toronto, Ont. Born at Toronto, Sept. 20th, 1898; Educ.: B.A.Sc., Univ. of Toronto, 1920; R.P.E. of Ont.; 1920, detailer, Dominion Bridge Co. Ltd.; 1921-23, asst. engr., Toronto Power Co.; 1923-29, asst. engr. and dftsman., Toronto Hydro-Electric System; 1929 (May-July), asst. engr., Horwood & White, Toronto; 1929-31, asst. engr., Truscon Steel Co., Toronto; 1934-36, asst. engr., Public Works of Canada, Toronto; 1936 to date, asst. engr. and dftsman., G. L. Wallace, M.E.I.C., Consltg. Engr., Toronto, Ont.

References—G. L. Wallace, C. D. Carruthers, C. C. Jeffrey, W. S. Wilson, S. H. deJong, C. G. R. Armstrong.

SMITH—ERNEST ALBERT, of Toronto, Ont. Born at Gormley, Ont., Dec. 2nd, 1887; Educ.: B.A., M.A. (Honours Chemistry, Minerology, Geology), McMaster Univ., 1916; 1916-17, chemist and plant work, Canadian Explosives Ltd.; 1917-19, i/c soil survey work, western Canada for Dom. Govt.; 1920-22, research chemist, 1922-24, chief chemist, Standard Chemical Company, Montreal; 1924 to date, Dept. of Chemical Engrg., Faculty of Applied Science and Engineering, University of Toronto, as follows: 1924-29, lecturer, 1929-39, asst. professor, 1939-42, associate professor in chemical engrg., and Jan., 1943, to date, professor of industrial chemistry.

References—C. R. Young, W. S. Wilson, J. R. Cockburn, W. B. Dunbar, G. R. Lord, J. J. Spence, W. M. Treadgold.

STEVENSON—WALTER REGINALD, of 98-4th Ave., Ottawa, Ont. Born at Westmount, Que., May 18th, 1908; Educ.: mech. drawing, Montreal Technical Institute; 1935-36, test dept., trouble shooting and alignment of radio equipment, Canadian Marconi Co., Montreal; 1937, conversion of automatic telephone equipment, Northern Electric Co. Ltd., Montreal; 1937, trouble shooting, radio equipment, R.C.A. Victor Co., Montreal; 1937-39, radio service for factory branch, Canadian Radio Corporation, Montreal; 1939, transmitter valve test lab., Canadian Marconi Co., Montreal; 1939-42, dftsman., gen. engrg. dept., Aluminum Co. of Canada, Montreal; 1942 to date, mech. drawing and design, dept. of physics and elec. engrg., National Research Council, Ottawa, Ont.

References—R. W. Boyle, A. D. Turnbull, C. P. Edwards, S. R. Banks, J. W. Roland.

THOMASSON—HARRY, of Hamilton, Ont. Born at Bolton, England, Sept. 7th, 1900; I.C.S. course in mech. engrg. Course in welding engrg., Westinghouse Elec. & Mfg. Co., East Pittsburgh, R.P.E. of Ont.; 1916-20, tool makers ap'tice., National Steel Car Corpn., Hamilton; 1920-23, foreman, cold header dept., Stanley Works of Canada, Hamilton; with Canadian Westinghouse Co. Ltd. as follows: 1923-28, gen. work as welder and layout man in fabricating divn., 1928-30, time and motion study work, 1930 to date—took welding engrg. course at East Pittsburgh, becoming welding engr. at Hamilton, with control of all technical phases of metal joining. In 1936, technical control of all heat treating added to above as a result of a special study of these processes. Late in 1941 assumed control of new metallographic laboratory.

References—H. A. Cooch, N. Eager, N. Metcalf, A. Love, O. W. Ellis, T. S. Glover.

VEALE—FREDERIC JAMES, of Hamilton, Ont. Born at Kingston, Ont. Nov. 11th, 1899; Educ.: B.Sc. (Civil), Queen's Univ., 1923; 1922, instr'man., Dept. of Highways of Ontario; 1923-27, res. engr., sewer dept., 1927-28, designing office, sewer dept., and 1929 to date, supt. of waterworks, City of Hamilton.

References—W. L. McFaul, A. R. Hannaford, H. S. Philips, E. M. Whitby, W. G. Hollingworth.

WEBSTER—GORDON BURVILLE, of 6 Algoma Ave., Sault Ste. Marie, Ont. Born at Newmarket, Ont., Aug. 30th, 1895; Educ.: B.Sc., Queen's Univ., 1923; 1923, concrete inspr. and instr'man., Ont. Dept. of Highways; 1923-24, instr'man., Holland Marsh Drainage Syndicate; 1924, field engr., Wayagamack Pulp & Paper Co., Flamand, Que.; 1924-26, structl. steel detailing, American Bridge Co.; 1926, steel detailing, Hamilton Bridge Co.; 1927, checking drawings, etc., Morava Constrn. Co., Chicago; 1927 (Apr.-July), chief designer, Dominion Bridge Co., Winnipeg; 1927-32, res. engr., Manitoba Good Roads Board, at Brandon; 1932-34, private practice, estimating, etc.; 1934-42, res. engr., Ont. Dept. of Highways; at present on leave of absence, with A. G. McKee Co., Cleveland, Ohio, as chief field engr., at Sault Ste. Marie, on large project for Algoma Steel Corporation.

References—L. R. Brown, W. D. Adams, A. H. Russell, R. M. Smith, W. B. Redfern.

WONG—WALTER JAMES, of 1445 St. Urbain St., Montreal, Que. Born at Victoria, B.C., August 31st, 1913; Educ.: B.Eng. (Civil), McGill Univ., 1940; 1938-39 (summers), topographic survey, and brake testing and calculations, Montreal Tramways; 1939-40, concrete detailing, 1940 to date, reinforced concrete design, gen. engrg. dept., Aluminum Company of Canada, Montreal.

References—M. E. Hornback, D. G. Elliot, S. R. Banks, J. W. Roland, R. E. Jamieson, R. DeL. French.

WYATT—DIGBY, of 174 Spadina Ave., Toronto, Ont. Born at Toronto, Feb. 20th, 1904; Educ.: B.A.Sc., Univ. of Toronto, 1925; 1922-24 (summers), gen. dfting., etc., roadways section, Dept. of Public Works, City of Toronto; 1932-35, sales engr. in Ontario for G. H. Wood & Co. Ltd.; 1935-37, sales mgr., rock wool divn., i/c of production, Alfred Rogers Ltd.; 1937-42, industrial combustion engr., The Elias Rogers Co. Ltd.; March, 1942, to date, on leave of absence to Wartime Bureau of Technical Personnel, and from December, 1942, regional representative of the Bureau at Toronto.

References—L. A. Wright, C. R. Young, S. R. Frost, E. A. Allcut, W. L. Cassels, T. S. Glover, W. H. M. Laughlin, H. W. Lea, I. S. Patterson, F. E. Wellwood, H. E. T. Haultain, K. H. Tremaine, A. M. Toye.

**FOR TRANSFER FROM JUNIOR**

CRAIG—CARLETON, of 35 Broad St., Aylmer, Que. Born at Ottawa, Apr. 25, 1909; Educ.: B. Eng. 1933, M. Eng. 1934, McGill Univ., graduate summer school in Aerodynamics, Elasticity and Vibrations, Univ. of Michigan, 1935; 1927-33 (summers), chainman, instr'mn., inspr., clerk, C.N.R.; 1934-40, lecturer Dept. of Civil Engrg. and Applied Mechanics, McGill Univ.; 1938-39 (summers), project engr., Canadian Car & Foundry Co.; 1940-41, chief ground instr., Windsor Mills Flying Training School; 1941 to date, techl. asst. to Director-General Army Engrg. Design Branch, Dept. of Munitions & Supply. (St. 1931, Jr. 1937).

References—R. E. Jamieson, E. Brown, F. M. Wood, P. E. Savage, C. A. Peachey, L. H. Burpee.

DAVIDSON—ARTHUR CAMPBELL, of 80 St. Clair Ave. West, Toronto. Born at Calgary, Alta., July 21, 1914; Educ.: B.Sc., 1935, E. E., 1936, Univ. of Manitoba. 1931-35 (summers), instr'mn., dftsmn., Columbia Valley Irrigated Fruit Lands, Invermere, B.C.; 1936 (summer), laborer, Bridge and Bldg. Dept., C.P.R., Portage Division; 1937-38, junior engr., Dominion Bridge Co. and Aluminum Co. of Canada jointly, Shawinigan Falls, Que.; 1938-40, demonstrator, Dept. of Engrg. drawing, University of Toronto; 1940-41, inspr., Canadian Inspection & Testing Co., Toronto, testing materials; soil engr. Camp Borden airport; asst. inspr. Universal Carrier body and accessories built at Windsor, Ont., by Canadian Bridge Co.; June, 1941, to date, Captain, R.C.E., Canadian Army Active, covering off Staff Captain appointment. E2 (b) in Directorate of Engineer Development, National Defence Headquarters, Ottawa. (St. 1935, Jr. 1937).

References—E. C. Thorne, J. J. Spence, A. E. Macdonald, R. C. Manning, S. H. deJong.

GALE—FREDERIC TYNER, of Calgary, Alta. Born at Macleod, Alta., Feb. 6, 1908; Educ.: B.Sc. (Elec.), Univ. of Alta., 1935; 1935 (6 mos.) sales engr., electrical equipment, Wilkinson & McLean, Calgary; 1935-36, serviceman, Canadian Utilities Ltd.; 1936-40, apprentice and junior engr., and at present engr., Calgary Power Co. Ltd., Calgary, Alta. (Jr. 1940).

References—H. B. Sherman, H. B. Lebourveau, J. McMillan, H. Randle, F. A. Brownie.

LAWSON—GEORGE WHYTALL, of Lachute, Que. Born at Bradford, Ont., July 28, 1910; Educ.: B.A.Sc., Univ. of Toronto, 1933; 1937 (4 mos.), surveyor, highway constrn., 1938 (4 mos.), mechl. and structl. dfting. and 1938-40, costing and estimating, Dufferin Paving Co., Toronto; Aug., 1940, to date, plant mtce., mtce. engr., Defence Industries Ltd., Brownsburg, Que. (St. 1935, Jr. 1938).

References—C. Johnston, J. F. Lynch, F. X. Granville, H. C. Karn, J. W. Houlden.

NESBITT—WILLIAM PAUL, of Cornwall, Ont. Born at Merritton, Ont., Nov. 10th, 1911; Educ.: B.Sc. (Mech.), Queen's Univ., 1935; 1930-35 (summers), 1929, and 1936, Alliance Paper Mills, Merritton; 1936-38, engrg. dept. Fraser Companies Ltd., Edmundston, N.B., design and constrn. work; 1938-39, engrg. and design work for sulphite and rayon pulp mills, Canadian International Paper Co., Engrg. Dept.; 1939-41, asst. master mechanic and master mechanic, Consolidated Paper Corp., Grand'Mère, Que.; 1941 to date, mechl. supt., i/c all mechl. mtce., Howard Smith Paper Mills, Cornwall, Ont. (Jr. 1937).

References—R. E. Smythies, F. O. White, D. S. Ellis.

RETTIE—JAMES ROBERT, of LaTuque, Que. Born at Winnipeg, July 3, 1913; Educ.: B.Sc. (Civil) Univ. of Man., 1935; 1935-37, timekeeper, C.P.R., Nelson, B.C.; 1937-38, engr., iron foundry operations, Anthes Foundry Ltd., Winnipeg; 1938-40, techl. dftsmn. and instr'mn., Surveys Branch, 1940-41, engr. on hydrometric work, 1941-42, engr. i/c water development, Nor. Man., Water Resources Branch, Man. Dept. of Mines and Natural Resources; 1942 to date on loan to Fraser Brace, Ltd., LaTuque, Que., engr. on constrn. of aluminum plant. (Jr. 1938).

References—C. H. Attwood, E. Gauer, F. S. Small, D. M. Stephens.

**FOR TRANSFER FROM STUDENT**

BATEMAN—LEONARD ARTHUR, of 508 Carlaw Ave., Winnipeg. Born at Winnipeg, Jan. 14, 1919; Educ.: B.Sc. (Elec.), Univ. of Man., 1942; 1940, (summer), machine man underground, surface survey work, Madsen Red Lake Mine; 1941 (summer), electrician helper, and 1942 to date, junior engr., City of Winnipeg Hydro Electric System. (St. 1941)

References—E. P. Fetherstonhaugh, N. M. Hall, A. E. Macdonald, G. H. Herriot, J. W. Sanger.

DAVIS—SAMUEL, of 4955 Circle Road, Montreal. Born at Saint John, N.B., Sept. 10, 1914; Educ.: B.Sc. 1938, Univ. of N.B., M.Sc. 1939, Mass. Inst. of Tech.; 1936 (summer), concrete and piling inspr., Foundation Co. of Canada; 1937-38 (summers), asphalt plant and road inspr., Milton Hersey Co.; with Noorduyn Aviation Ltd. as follows: 1939-41, supervisor of outside production; 1941 to date, stress analyst, design and analysis of new components and assemblies, completed analysis of company-designed aircraft for U.S. Army Air Force and R.C.A.F. (St.1938.)

References—J. Stephens, E. O. Turner, A. F. Baird, H. Scheunert, I. S. Backler.

HARDING—HERMAN, of Shipshaw, Que. Born at Vancouver, June 30, 1918; Educ.: B.Sc. (Civil), Univ. of Sask., 1939; 1935-39 (summers), surveying with S. Harding, S.L.S.; 1939-40, water conversation, P.F.R.A., Regina; 1940-42 airport, constrn., Dept. of Transport, Regina; 1942 to date, engr. on powerhouse constrn., Foundation Co. of Canada, Shipshaw, Que. (St. 1939).

References—S. Harding, C. J. Mackenzie, R. A. Spencer, G. T. Chillcott, G. R. Adams.

LANCEFIELD—HAROLD ALLAN, of 521 Prince Arthur Ave., Montreal. Born at Calgary, Alta., Jan. 21, 1916; Educ.: B.Sc. (Mech.), Univ. of Sask., 1939; 1940-42, mtce. engr., Alliance Paper Mills Ltd., Merritton, Ont.; 1942 (Jan.-Aug.), project engr., Canadian Industries, Ltd., Windsor, Ont.; at present, Pilot Officer, R.C.A.F., Aeronautical Engineering Branch, Montreal. (St. 1939).

References—H. L. Johnston, C. J. Mackenzie, I. M. Fraser, W. E. Lovell, N. B. Hutcheon.

LEE—JOHN DOUGLAS, of Kingston, Ont. Born at Brantford, Ont., Apr. 15, 1917; Educ.: B.Sc., Queen's Univ., 1940; 1935-38 (summers), chainman, rodman, instr'mn., Highways Dept., Toronto; 1939 (summer), County of Waterloo, inspr. and dftsmn.; 1940-42 (summers), hydraulic dept., H.E.P.C. of Ontario; 1941-43, lecturer, Dept. of Civil Engrg., Queen's Univ., Kingston, Ont. (St. 1940)

References—D. S. Ellis, S. D. Lash, J. R. Montague, D. J. Emrey.

MOORE—JOHN BEVERLY, of Cleveland, Ohio. Born at Chatham, Ont., Sept. 1st, 1918; Educ.: B.A.Sc. (Civil), Univ. of Toronto, 1940; 1937 (summers), dftsmn. and field material checker, S. C. Hadley Constrn. Co., Detroit; 1938-39 (summers,) dftsmn. and checker, with Isaac Moore, Chatham, Ont.; 1940 (summer) detailer on struct'l. steel, Canadian Bridge Co., Walkerville, Ont.; with Arthur G. McKee & Co., Cleveland, Ohio, as follows: 1940-41, in Trinidad, B.W.I., as asst. civil engr. on the constrn. of a modern and new process refinery for the manufacture of 100 octane gasolene, later asst. to the general foreman supervising underground piping for oil and water drainage, also i/c misc. steel and rigging work, etc.; Oct., 1941, transferred to East Chicago, Indiana, as chief field engr. on constrn. of blast furnace for Inland Steel Co.; May, 1942, to date, designer and checker, engrg. dept., Cleveland, Ohio. (St. 1940).

References: D. T. Alexander, C. R. Young, R. F. Legget, C. F. Morrison.

---

# LIBRARY NOTES

(*Continued from page 176*)

**Canada—Department of Mines and Resources—Mines and Geology Branch —Bureau of Mines:**

*Coal mines of Canada, January, 1943.*

**U.S. Bureau of Standards—Miscellaneous Publication M172:**

*Index to the reports of the national conference on weights and measures from the first (1905) to the thirty-first (1941) inclusive.*

**U.S. Bureau of Standards—Handbook H29:**

*Specifications, tolerances and regulations for commercial weights and measures and weighing and measuring devices. Supersedes handbook H22. Issued September 26, 1942.*

**U.S. Bureau of Standards—Building Materials and Structures:**

*Report BMS94—Water permeability and weathering resistance of stucco - faced, gunite-faced and "knap concrete unit" walls.*

**University of Illinois Engineering Experiment Station:**

*Bulletin series No. 337—Tests of riveted and welded joints in low-alloy structural steels. A report of an investigation conducted by the Engineering Experiment Station of the University of Illinois and the American Bridge Company. No. 338—Influence charts for computation of stresses in elastic foundations. No. 339—Properties and applications of phase-shifted rectified sine waves. Circular series No. 45—Simplified procedure for selecting capacities of duct systems for gravity warm-air heating plants. No. 47—Save fuel for victory.*

**Purdue University — Engineering Bulletin:**

*Research series No. 86—A study of chert as a deleterious constituent in aggregates.*

## BOOK NOTES

### ALTERNATING-CURRENT CIRCUITS (Rochester Technical Series)

*By E. M. Morecock. Harper & Brothers, New York and London, 1942. 175 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $2.75.*

This text is intended for use in technical institutes, junior colleges and industrial schools, and is based on a functional study of the essentials of a course in the subject. Problems and laboratory experiments are included. No knowledge of calculus is necessary.

### AMERICA FLEDGES WINGS, the History of the Daniel Guggenheim Fund for the Promotion of Aeronautics

*By R. M. Cleveland, with a foreword by R. A. Millikan. Pitman Publishing Corporation, New York and Chicago, 1942. 224 pp., illus., diagrs., charts, maps, tables, 9½ x 6 in., cloth, $2.50.*

The story of this fund and the great part it played in fostering the development of aeronautical achievement in America is told in detail in this interesting volume.

### CHEMICAL-TECHNICAL DICTIONARY (German-English-French-Russian)

*By A. W. Mayer, translated under the direction of B. N. Menshutkin and M. A. Bloch. 1st American ed. Chemical Publishing Co., Brooklyn, N.Y., 1942. 870 pp., 9 x 5½ in., cloth, $8.00.*

This is the first American edition of a well-known German dictionary. A comprehensive German vocabulary is given, with equivalents in English, French and Russian. Readers of German chemical literature will find the work very useful.

### HEAT

*By J. M. Cork. 2 ed. John Wiley & Sons, New York, 1942. 294 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

This well-known text covers temperature and its measurement, specific heats, thermal expansion, the transfer of heat, radiation, the first law of thermodynamics, the state of matter, elementary thermodynamics and the production of high and low temperatures. This edition has been revised to include references to recent advances in the subject of heat and has also been adapted to students with less preparation by increasing the amount of descriptive matter.

### PRINCIPLES OF AERONAUTICAL RADIO ENGINEERING

*By P. C. Sandretto. McGraw-Hill Book Co. New York and London, 1942. 414 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

An engineering treatment is given of the peculiar problems that are involved in the use of radio in air transportation and of the means taken to solve them. The nine radio facilities used in modern air transport practice are considered in detail. The book is written chiefly from the point of view of commercial airline operation and assumes some preliminary knowledge of radio.

### PRINCIPLES OF ELECTRONICS

*By R. G. Kloeffler. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 175 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

A short introductory book on electronics, intended for sophomore or junior students of electrical engineering, and to be followed by a mathematical treatment of the subject.

### WELLS' MANUAL OF AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES

*By T. A. Wells. Harper & Brothers, New York and London, 1942. 212 pp., illus., diagrs., tables, 10½ x 7½ in., cloth, $3.50.*

The various materials and manufacturing processes used in airplane construction, and the characteristics, advantages and disadvantages of each are clearly and concisely set forth in this book.

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

MECHANICAL ENGINEER. Either capable of making mechanical repairs to power shovels, tractors, etc., or willing to learn. Apply to Box No. 2619-V.

EXPERIENCED TRANSITMAN for railway engineering work. Apply to Box No. 2629-V.

CIVIL ENGINEER, must be capable of supervising plant and small town house construction. Apply to Box No. 2630-V.

### SITUATIONS WANTED

CIVIL ENGINEER, 38, experienced in all types of building construction and in industrial layout work. Wants permanent or temporary position in charge of design or construction. Present location, Montreal. Apply to Box No. 576-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., 17 years experience as production manager and factory organizer in metal and various other industries, military exempt, available on short notice. Apply to Box No. 1730-W.

### SURVEYING INSTRUMENTS FOR SALE

SIMPLE THEODOLITE, Stackpole and Bros.
Telescope, 10" long, 1¼" dia. O.S.
Compass, 5¼" dia.
Table, 7¼" dia.
Scale, 6¼" dia.
Height of C.C. of telescope above levelling table, 10½".
Spirit levels, 3¼" long x ½" dia.
Levelling screws, 4.
Condition of instrument and lenses—excellent.
Complete with tripod and plumbob in wooden case.

TRANSIT, Watts.
Telescope, 7½" long, 1" dia. O.S.
Horizontal scale, 3" dia.
Vertical scale, 3½" dia. O.S.
Compass, 2¼" dia.
Height of C.C. of telescope above levelling table, 7½".
Levelling screws, 4.
Prism eyepiece and sun glass—1.
Extra eyepiece—1.
Scale reading lenses—2.
Spare frame in aluminum case.
Plumbob—1.
Complete in wooden case with tripod.
Condition of instrument and lenses—excellent.

TRANSIT, F. Barker & Sons, London.
Telescope, 9" long, 1⅛" dia. O.S.
Horizontal scale, 4½" dia.
Vertical scale, 4½" dia.
Compass, 2½" dia.
Height of C.C. of telescope above levelling table, 9¼".
Levelling screws, 4.
Levelling table part of the tripod.
Scale reading glasses—2.
Prism eyepiece and sun glass—1.
Plumbob—1.
Complete in leather-covered wooden box, with tripod.
Condition of instrument and lenses—excellent.

Y LEVEL, Watts (bright brass).
Telescope, 10½" long, 1¼" dia. O.S.
Height of C.C. of telescope above levelling table, 5½".
Levelling screws—4.
Base plate, 3½" dia.
Complete in wooden case, with tripod.
Condition of instrument and lenses, good; one indexed lense appears to require cleaning.

SEXTANT, pocket type, brass case, complete in leather carrying case.
Screw-in type of telescope.
Condition of instrument, good.

SEXTANT, pocket-type, brass case, no telescope, no carrying case. Clamp-on type of telescope.
Condition good, except for missing telescope.

SURVEYOR ARROWS, one set (11), 3/16" sq. x 14" long. Condition, new.

STADIA ROD, 12 ft. (7 ft. closed). Condition, new.

LEVELLING ROD, 16 ft. (6 ft. closed). Condition, excellent.

PICKETS, iron-shod, 2-5 ft. Condition, good.

STEEL TAPE, 66 ft., ½", Chesterman, on reel. Condition, good.

STEEL TAPE, 66 ft., 5/16", on fibre reel. Condition, good.

STEEL TAPE, 100 ft., ¼" on reel. Condition, good.

STEEL TAPE, 200 ft., ¼" on reel. Condition very good.

STEEL TAPE, 100 ft., ⅜" (ft. and 10ths.). Leather case. Condition, very good.

MINER'S DIP COMPASS, W. S. Darley, in case. Like new.

SET OF 65 RAILROAD CURVES, in wooden case. Like new.

C.C. Moler-Line loss and voltage drop slide rule. Like new.

Full leather map-case, 5½" dia. x 40" long. Condition, good.

Matthews Teleaheight Level, in leather case. Condition, good.

*Offers will be considered.* Apply to Box No. 48-S.

## REQUIRED IMMEDIATELY

Chemical, Civil, Mechanical
and
Metallurgical Engineers

**DOMESTIC AND FOREIGN ASSIGNMENTS**
**ESSENTIAL WAR WORK**

Apply to Box No. 2622-V
The Employment Service Bureau
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

**TRANSITS, LEVELS** and accessories for rent. Apply to Ralph Kendall, M.E.I.C., 49 Granville Street, Halifax, N.S.

### FOR SALE

Complete file of *Engineering News Record*, 1916 to date. All volumes 1916 to 1929, inclusive are bound in half-leather. Must be cleared before April 20th, at your own price. Apply to Box No. 46-S.

### FOR SALE

PORTABLE TYPEWRITER, bought in 1938 and little used. Fitted with keyboard carrying mathematical symbols. In perfect condition. Original cost, $65.00. Make your offer. Apply to Box 47-S.

## ELECTRICAL OFFICERS FOR R.C.N.V.R.

**A limited number of vacancies exist in the Royal Canadian Naval Volunteer Reserve for young graduates in electrical engineering possessing suitable personal qualities and engineering experience.**

**Applicants should complete an "Offer of Service" form, which may be obtained from the nearest R.C.N.V.R. Barracks, and should attach to it a detailed account of educational qualifications and engineering experience, together with copies of properly attested testimonials.**

**Successful applicants will be entered as Probationary Electrical Sub-Lieutenants or, in the case of exceptional qualifications, as Electrical Sub-Lieutenants. Their duties after a period of training will consist of electrical engineering work in connection with any of the following: Design and Manufacture; Ship Installations; Testing and Trials; and Base Maintenance. Applicants must be prepared to go to sea. Completed forms should be returned to the Deputy Secretary, Naval Board, Department of National Defence, Ottawa, Ont.**

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### ARC WELDING ACCESSORIES

Canadian General Electric Company, Ltd., Toronto, Ont., have recently issued Catalogue CGEA-2704B, 28 pages and cover. Using the well-known "Joe McGee" character in the cover design, this catalogue lists over 100 arc-welding accessory items to meet the requirements of all ordinary welding work as well as many special applications. Head protectors, welding lenses and cover glasses, protective clothing, metal and carbon electrode holders, cable connectors, clamps and chippers, brushes and electrode carriers, "Glyptal" to prevent adhesion of weld spatter, are among the items featured.

### CENTRIFUGAL PUMPS

Darling Brothers Ltd., Montreal, Que., have for distribution a 15-page bulletin, 46-C, describing the "Darling" ClassD end suction centrifugal pumps for general industrial use. The centre spread gives typical sectional drawings of standard designs of this class of pump, indicating the particular application of each type. A general description of the principal parts is included, together with photographs of a number of installations representing a variety of applications. Rating tables, dimensional drawings and tables of dimensions and other hydraulic data are also included.

### TRANSMITTING AND CONVEYING IDEAS

The February, 1943, issue of Transmitting and Conveying Ideas, published by Link-Belt Limited, Toronto, Ont., presents much of interest on the application of conveying and power transmission machinery with a view to solving the problems of modern industry. This issue describes the production of plywood and its many applications under present conditions. A number of plant photographs show the ingenious machines employed.Uniform paper machine speed through the use of P.I.V. gear, applied to the engine governor, is the subject of another article featuring the installation at the Abitibi Power & Paper Company's plant at Sault Ste. Marie.

### PRESIDENT, ELECTRIC SERVICE LEAGUE

Mr. Norman Franks of Canadian General Electric Co. Ltd. has been elected president of the Electric Service League of Toronto. Mr. Franks is manager of the Toronto district office of C.G.E.

Mr. Norman Franks.

Late Mr. F. W. Blyth.

### MR. F. W. BLYTH, DECEASED

Mr. F. W. Blyth, former district sales manager for Amalgamated Electric Corporation Ltd. at Montreal, died recently in Montreal. Born in Montreal and educated in Toronto, Mr. Blyth spent a number of years in Winnipeg and Toronto with Canadian Allis-Chalmers Limited until 1920, and later with Rose & O'Hearn, Toronto, and Northern Electric in Toronto and Renfrew Electric Products. He joined Amalgamated in 1929 and in 1932 became district sales manager for that company at Montreal, which position he occupied at the time of his death.

### MR. G. L. KIRKPATRICK, DECEASED

Word has been received of the death of Mr. G. L. Kirkpatrick, for many years managing director of Bruce Peebles & Co. Ltd., Edinburgh. Mr. Kirkpatrick was a leading figure in the heavy electrical industry field in Britain and was largely responsible for the international reputation enjoyed by his company. Manufacturers of transformers and other electrical equipment since 1866, Bruce Peebles is a constituent company of Bepco Canada Ltd., an amalgamation of four British companies with Canadian head offices in Montreal.

### CONTACTOR RELAYS

Cansfield Electrical Works Ltd., Toronto, Ont., have issued bulletin No. B-2, describing their type J11 double pole, double throw contactors. This contains full information and specifications covering the contactor element only without mounting or enclosures and with the elements mounted in an enclosure for either indoor service, panel mounting or outdoor service. The double pole, double throw contacts are supplied as standard while single pole, normally open or normally closed circuits can be obtained by using appropriate terminals.

### GRINDING WHEELS

Entitled "Boost Production on Your O.D. Grinding Jobs—Centerless and Cylindrical", Norton Co. of Canada Ltd., Hamilton, Ont., have issued a leaflet telling why the Norton "B-E" bond grinding wheel is stronger for faster production of traverse or plunge-cut jobs on steel and steel alloys. A list of "Norton" cylindrical and centerless grinding wheels for O.D. grinding, giving material and wheel marking, is included and the company states that a complete line of "Norton" wheels of hard, sharp Crystolon abrasive for the O.D. grinding of cast iron, brass, aluminum and non-metallic materials is available.

### ELECTED PRESIDENT

Mr. A. L. Ainsworth, vice-president and general manager of John Inglis Company, Ltd., of Toronto, has been elected president of the Canadian Employee Chest, the organization which has consolidated the charity contributions of employees of many large companies.

### INDUSTRIAL SWEEPING MACHINES

Moto-Mower Company, Detroit, Mich., have for distribution a bulletin featuring their "Moto-Sweeper", a new manually operated sweeper which collects all varieties of dirt, paper and trash in factories, warehouses, schools, parks, air fields, tennis courts, skating rinks, railroads, etc. This sweeper, which is pushed like a lawn mower, is thoroughly described and illustrated and specifications and advantages in efficiency, operation, economy and construction are given. This bulletin also illustrates two motorized units—the "Commander" Moto Sweeper which turns right or left under its own power by use of a clutch on each wheel of the tractor, controlled at the handle bar; and the "Fleetway" Moto-Sweeper equipped with a sprinkling system and brush, used for removing dirt or snow.

### TABLES, CHARTS AND ENGINEERING DATA

Canadian SKF Company, Ltd., Toronto, Ont., have issued sheet No. 22 of a series of punched filing sheets of tables, charts and engineering data prepared by this company during the past two years. It contains a table of "U.S. Standard Thread Bolts and Nuts" and diagrams and data dealing with "Bearing Types and Their Application" which is continued from similar information on sheet No. 21. Any or all of these twenty-two sheets are available.

### RECENT APPOINTMENT

Mr. M. F. Anderson has been appointed general manager of Naugatuck Chemicals Ltd., Elmira, Ont., and the Rubber Regenerating Division, Montreal, now known as the Chemical and Regenerating Division, Dominion Rubber Company, Ltd. Mr. Anderson continues as director of development with headquarters in Montreal. Mr. R. Bruce Marr remains as manager of the Naugatuck plant.

Mr. M. F. Anderson.

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### APPOINTED EXCLUSIVE DISTRIBUTORS

Tweco Products Company of Wichita, Kansas, has just announced the appointment of G. D. Peters & Company of Canada Limited as exclusive Canadian distributor for their extensive line of electrode holders, ground clamps, cable lugs, and cable connectors. Included in the range is the widely used "Red Head" ground clamp which is supplied in two sizes having capacities of 300 and 500 amperes, "Sol-Con" detachable type connectors, Tweco mechanical cable lugs of both open and hole type, and the new line of "Hol-Grip" fully insulated electrode holders. These are supplied in two sizes, the "Hol-Grip Jr." which weighs only eight ounces and has been especially developed for aircraft and sheet metal work, and the "Hol-Grip Sr." which has a capacity of 300 amperes. Also available is the "Type H Hol-Grip Sr." which features a quickly detachable cable connector and is of particular interest to shipyards and other large users.

### DUST COLLECTOR

A 4-page leaflet, 34-C, prepared by Frontier Engineering & Manufacturing Ltd., Niagara Falls, Ont., outlines advantages of the type "V" unit dust collector—a high efficiency cyclone-type unit designed for use in single or multiple arrangement. A test unit equipped with fan and motor drive is illustrated and a performance table shows the wide range of collection efficiencies of various particle sizes.

### JENKINS APPOINTMENT

On January 1st, 1943, Mr. Delmar K. Brundage became district sales executive for the province of Ontario excepting the Ottawa Valley and the territory west of Sault Ste. Marie, and will be in charge of the office of Jenkins Bros. Limited, at 204 Terminal Bldg., Toronto.

### SAFETY VALVES

The James Morrison Brass Mfg. Company, Ltd., Toronto, Ont., have prepared a 24-page catalogue, No. 80-5, illustrating and describing the "Morrison" line of safety and relief valves of bronze, iron and steel, for steam, air, water, gas, oil, etc. Each is illustrated and described and accompanied by specifications. Four pages contain abstracted rules for safety valves from the A.S.M.E. Code for Power Boilers—1927.

### REFRACTORIES

A 50-page catalogue just published by National Refractories Limited, Montreal, Que., illustrates, in colour, standard and special shapes in fireclay materials. In addition to much information of value regarding proper refractory practice, the catalogue gives many hints on the care and use of fire brick in its many industrial applications. Several pages of useful tabulated data are included.

### THAWERS AND HEATERS

Bulletin No. 1038, 16 pages, by Hauck Manufacturing Company, Brooklyn, N.Y., covers the company's line of thawers and heaters designed for use wherever snow, ice or freeze-up are causing trouble or interferring with production. The wide variety of these units and their many applications are fully described.

### ION EXCHANGERS

Bulletin No. 2508, four pages, by Permutit Company of Canada, Ltd., Montreal, Que. Stating that "Recent development of acid-regenerated cation exchangers and of suitable union exchangers has widened the fields in which ion exchange materials may be used . .", this Company presents a brief historical summary of this development, describing cation exchangers, Permutit's union exchanger, and demineralizing, and lists applications in industrial process work.

**Mr. H. M. Rowlette.**

### COMPANY HEADQUARTERS MOVED

It has been announced by Whiting Corporation, of Harvey, Ill., that the headquarters of its Canadian subsidiary, Whiting Corporation (Canada) Ltd., has been moved to 45 Richmond St., West Toronto, where its newly-elected vice-president and general manager, Mr. H. M. Rowlette, will be in active charge of the Canadian business. Serving with him as assistant general manager is Mr. Alex. Ritchie. Mr. H. T. Doran, New Birks Building, Montreal, and Mr. W. Bruce Campbell, Royal Bank Building, Winnipeg, will continue as sales representatives of the Canadian Company.

### MOTION PICTURES

"Lights—Camera—Action" is the title of a 16-page booklet recently issued by Associated Screen News Ltd., Montreal, Que. This extremely interesting publication illustrates and describes the production of a motion picture from the planning stage onward and tells why motion pictures are important tools in the war effort. Their importance in public relations programmes, sales promotion, public relations, production and safety teaching in industry, etc., is dealt with, and under the heading "What Does a Motion Picture Cost?" the great number of variables which comprise the product of creative imagination are listed to show the many factors which will determine the cost varying from a few hundred dollars to thousands.

### PLASTIC MATERIAL

Canadian Industries Limited, Plastics Division, Montreal, Que., have prepared a pocket size booklet containing complete information regarding the new "Dupont" plastic material designated as "Lucite" which is available in sheets, rods and tubes, and as a thermoplastic molding powder. The booklet gives physical, thermal, optical, electrical, chemical and working properties, together with information regarding compression molding.

### VICKERS' FIRST CATALINA

Aircraft workers, R.C.A.F. officers and many distinguished guests were present recently at the christening of the first Consolidated PBY Flying Boat "Princess Alice" to be produced in Canada. The ceremony was performed by Lady Bowhill, wife of Air Chief Marshall Sir Frederick Bowhill, head of the R.A.F. Ferry Command. Ralph P. Bell, Director-General of Aircraft production for the Department of Munitions and Supply, speaking before the christening, traced the growth of aircraft production in Canada and praised the work of the Catalina Flying Boats as the "Watchdogs of the High Seas".

### RECENT APPOINTMENT

It has just been announced that Mr. C. Jones has been appointed to the position of Montreal District sales manager for Amalgamated Electric Corporation Ltd. He joined the Toronto sales staff of the company in 1929 and moved to the Montreal District Office in 1932, and has served that territory to the present time, contacting electrical trade in Quebec and Eastern Ontario.

### LATHE CHUCKS

A 20-page catalogue, No. 42, prepared by Williams Tool Corporation of Canada Ltd., Brantford, Ont., describes and illustrates this manufacturer's new line of 3-jaw self-centering, and 4-jaw independent, lathe chucks. Complete range of sizes and specifications are provided in the various tables. In addition to the lathe chucks there is information and illustrations regarding adapter plates, spindle noses, face plate jaws, boring mill jaws and a chart showing standard limits of accuracy adapted by the lathe chuck manufacturers.

### THE WELD-IT

Volume No. 18 of The Weld-It by Commonwealth Electric Corporation Ltd., Welland, Ont., is devoted to the description of Taylor-Winfield standard type resistance welders. Details of various types of spot, projection, seam and butt-flash welders are given and accompanied by illustrations.

### SHIPS' BADGES

A 16-page booklet being distributed by Gutta Percha & Rubber Ltd., Toronto, Ont., illustrates with colour plates 121 badges of fighting ships of H.M.R.N. Also shown are sleeve markings and shoulder straps indicating rank of Naval Officers and silhouettes of British Naval Vessels of the different classes.

### NEW COMPANY FORMED

Mechanical Leather Products, Limited, Hamilton, Ont., a wholly Canadian owned and controlled company, has been incorporated to succeed Canadian Graton & Knight, Limited, in the manufacture of leather belting and allied industrial products, with Mr. W. H. Martin as manager. The Canadian Fairbanks-Morse Co. Ltd. will continue as national distributors for these products.

### SCIENTIFIC METAL CLEANING

Canadian Hanson & Van Winkle Company, Ltd., Toronto, Ont., have published a 12-page bulletin describing the "Royalene" process of solvent degreasing and alkali cleaning. Full details of the process are included and the various machines are illustrated and described. A number of Canadian installations are also shown.

### APPOINTED CANADIAN DISTRIBUTOR

Mr. O. Biedermann, well known in the electrical industry as manager of Oerlikon-Canada Limited, Montreal, has been appointed Canadian distributor for "Insl-X", the synthetic base coatings and electrical insulation compounds sold by the Insl-X Company, Inc., Brooklyn, N.Y.

It is claimed for "Insl-X" that, combining uniquely formulated synthetic materials, it gives the utmost in high di-electric strength, toughness and durability, resistance to moisture, oil, chemicals and light. It resembles paint and while it can be brushed, sprayed or dipped in application, it is much more chemically resistant. It finishes like a varnish but, being chemically inert, it is more resistant to decomposition. It dries quickly like lacquer, but it is tougher and more resistant to chemically active rays. "Insl-X" products are being employed in a wide variety of uses such as the insulation of tools, bus bars, coil sealing, flexible sealing and cable covering, radio and aircraft parts insulation.

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 — MONTREAL, APRIL 1943 — NUMBER 4

"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."

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.



★ ★ ★

## CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**

†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**

*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont.
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**

†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que.

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que.

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**PAPERS**
L. F. GRANT, *Chairman*

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PUBLICATION**
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
A. C. D. BLANCHARD
T. H. JENKINS
V. A. McKILLOP

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
J. B. deHART
A. O. DUFRESNE
A. E. MacRAE
E. STANSFIELD

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**PROFESSIONAL INTERESTS**
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairma*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

**STUDENTS' AND JUNIORS' PRIZES**

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. McL. PITTS
P. M. SAUDER
D. C. TENNANT

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK
A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR
H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY,
1614 Ontario Street,
Walkerville, Ont.

**CALGARY**
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE
H. R. HAYES
A. HIGGINS
W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS
G. P. F. BOESE
H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL,
803-17th Ave. N.W.,
Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN,
60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* D. HUTCHISON
*Vice-Chair.,* C. W. CARRY
*Executive,* B. W. PITFIELD
E. R. T. SKARIN
J. A. ALLAN
E. ROBERTSON
J. W. JUDGE
*(Ex-Officio),* E. NELSON
R. M. HARDY
*Sec.-Treas.,* F. R. BURFIELD,
Water Resources Office,
Provincial Government,
Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF
G. J. CURRIE, L. E. MITCHELL
J. D. FRASER, P. A. LOVETT
J. W. MacDONALD
G. T. MEDFORTH
J. E. CLARKE
R. B. STEWART
K. L. DAWSON
*(Ex-Officio),* J. R. KAYE, S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY,
Wartime Bureau of Technical
Personnel, 84 Hollis Street,
Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON
R. J. G. SCHOFIELD
NORMAN EAGER
A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID
STANLEY SHUPE
A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN,
427 Concession Street,
Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN
J. R. CARTER
J. D. LEE
*(Ex-Officio),* T. A. McGINNIS
L. F. GRANT, A. JACKSON
*Sec. Treas.,* R. A. LOW,
Dept. of Civil Engineering,
Queen's University,
Kingston, Ont.

**LAKEHEAD**
*Chairman,* MISS E. M. G. MacGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL
R. B. CHANDLER
S. E. FLOOK
O. J. KOREEN
S. T. McCAVOUR
W. H. SMALL
E. A. KELLY
J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER
H. G. O'LEARY
*Sec. Treas.,* W. C. BYERS,
c/o C. D. Howe Co. Ltd.,
Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN
N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE,
McKenzie Electric Ltd.,
706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT
W. C. MILLER
F. T. TAYLOR
F. C. BALL
V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN
J. A. VANCE
*Sec. Treas.,* H. G. STEAD,
60 Alexandra Street,
London, Ont.

**MONCTON**
*Chairman,* H. J. CRUDGE
*Vice-Chair.,* J. A. GODFREY
*Executive,* A. S. DONALD
E. R. EVANS, E. B. MARTIN
H. W. HOLE, G. C. TORRENS
*(Ex-Officio),* F. O. CONDON
G. L. DICKSON
*Sec. Treas.,* V. C. BLACKETT
Engrg. Dept., C.N.R.,
Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE
R. C. FLITTON
G. D. HULME
G. E. GELINAS
K. G. CAMERON
G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD
J. E. ARMSTRONG
R. E. HEARTZ
W. G. HUNT
J. A. LALONDE
G. MacL. PITTS
E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL,
40 Kelvin Avenue,
Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* C. G. CLINE
*Vice-Chair.,* G. E. GRIFFITHS
*Executive,* A. G. HERR
R. T. SAWLE
G. F. VOLLMER
W. D. BRACKEN
J. W. BROOKS
J. H. TUCK
D. S. SCRYMGEOUR
*(Ex-Officio),* A. L. McPHAIL
A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS
1870 Ferry Street,
Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY
G. A. LINDSAY
R. YUILL
W. H. B. BEVAN
J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY
K. M. CAMERON
N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON
Dept. of Mines & Resources,
Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* D. J. EMERY
*Executive,* C. R. WHITTEMORE, F. R. POPE
I. F. McRAE, R. L. DOBBIN
A. J. GIRDWOOD
*(Ex-Officio),* J. CAMERON
H. R. SILLS
*Sec.-Treas.,* A. R. JONES,
5, Anne Street,
Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES
L. GAGNON, A. E. PARÉ
G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON
R. B. McDUNNOUGH
P. MÉTHÉ
L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT,
Colonization Department,
Room 333-A, Parliament Bldgs.,
Quebec, Que.

**SAGUENAY**
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER
J. FRISCH
B. BAUMAN
G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS
N. F. McCAGHEY
J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS,
P.O. Box 33,
Arvida, Que.

**SAINT JOHN**
*Chairman,* D. R. SMITH
*Vice-Chair.,* A. O. WOLFF
*Executive,* H. P. LINGLEY
C. D. McALLISTER
C. C. KIRBY
*(Ex-Officio),* F. A. PATRIQUEN
V. S. CHESNUT
J. P. MOONEY
G. G. MURDOCH
*Sec.-Treas.,* G. W. GRIFFIN
P.O. Box 220,
Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vive-Chair.,* R. DORION
*Executive,* G. B. BAXTER
E. BUTLER
A. G. JACQUES
R. D. PACKARD, M. EATON
E. T. BUCHANAN, J. JOYAL
W. E. A. McLEISH, H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN
H. J. WARD
*Acting Sec. Treas.,* VIGGO JEPSEN,
Consolidated Paper Corporation
Grand'Mère, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN
E. K. PHILLIPS
J. I. STRONG
F. C. DEMPSEY
N. B. HUTCHEON
J. G. SCHAEFFER
R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG,
P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK
C. R. MURDOCK
G. W. MacLEOD
K. G. ROSS
H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG
A. E. PICKERING
L. R. BROWN
*Sec. Treas.,* O. A. EVANS,
159 Upton Road,
Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR, R. F. LEGGET
E. G. HEWSON, A. H. HULL
C. F. MORRISON, E. A. CROSS
*(Ex-Officio),* E. H. BRANDON, W. S. WILSON
T. H. HOGG, C. R. YOUNG
N. MacNICOL
*Sec.-Treas.,* S. H. deJONG,
Dept. of Civil Engineering,
University of Toronto,
Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD
R. E. POTTER, I. C. BARLTROP
E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT
C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN,
2099 Beach Avenue,
Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD
A. N. ANDERSON
F. C. GREEN
J. H. BLAKE
*(Ex-Officio),* E. W. IZARD
A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING,
41 Gorge Road West,
Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING
N. M. HALL
B. B. HOGARTH
R. H. ROBINSON
R. A. SARA
*(Ex-Officio),* W. P. BRERETON
J. W. SANGER
D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY,
55 Princess Street,
Winnipeg, Man.

# POST-WAR RECONSTRUCTION

**Proceedings of the session held during the Fifty-Seventh Annual General Professional Meeting of The Engineering Institute of Canada, at Toronto, Ont., on February 12th, 1943, under the auspices of the Institute Committee on Post-War Problems. Mr. Warren C. Miller, M.E.I.C., chairman of the Committee, presided.**

## INTRODUCTION

Chairman Warren C. Miller, M.E.I.C.[1]

The late Lord Tweedsmuir used to tell the story of a party of tourists visiting a small village in his native land. They desired to pay their respects to the Laird. When they called at his home an elderly servant advised them that the great man was indisposed and regretted very much his inability to receive them. The visitors expressed sympathy and inquired the nature of his illness. "Ah", said the old man, "The Maister is a pairfect martyr tae the delirium tremens."

As we examine the various problems involved in post-war reconstruction, the matters that have to be rectified and the features that must be retained, we get the impression, finding so many things that are bad mixed with many that are good, that this old world, too, has for a decade or so, been suffering from economic and political delirium tremens. While many people think of reconstruction as an outcome of the war there is also justification for the assumption that the war is simply an incident in reconstruction. True, some of the problems to be faced would not have been met so soon if it had not been for the war, but they would have been before us inevitably. The war has simply hastened the occasion.

There are very few, I think, who look for a restoration of the world of 1939, or of 1929 or of 1914. We face a world after this war that will be as different from the world of 1939 or 1914 as they were from the world of 1900. He would indeed be blind who can still think that, after the cataclysmic happenings of the past few years, conditions on this planet, political, economic or spiritual can ever be the same again.

The building of this new world is our greatest problem after the winning of the war. I think that we all hope, as far as we may, consistent with our enlarging aims, that we shall be able to use the pattern of the old. This is something with which we are all concerned but in which we may tend to visualize what needs to be done in terms of our own experience. The exporter thinks of restored foreign trade. The business man looks for the removal of economic controls. The farmer wants increased prices for farm products with no increase in the prices of what he has to buy. The engineer visualizes the reconstruction of physical structures. The worker looks for the removal of rationing and wage ceilings. The bishop prays and works for an enlarged world vision of spiritual realities. These are all truly problems of the post-war world but they are all parts of the one problem, not separate questions.

The pattern of the programme devoted to post-war problems was this enlarged vision. It is an attempt to impress the idea that in addition to being engineers we are citizens of Canada, of the British Commonwealth, of the world. Engineers have a place in the pattern of reconstruction. We have a specialized knowledge of some phases. But we can bring to bear on other factors our established experience as solvers of difficult problems. This is the approach that we hope that the afternoon's programme will develop.

In regard to reconstruction in its wider aspects, the main Advisory Committee, under the chairmanship of Dr. F. Cyril James, has done admirable work in its appreciation of the situation that we face.

We regret very much that Dr. James or Mr. J. S. McLean, the vice-chairman of the committee, is not here to give us that picture. But we are fortunate, however, in having with us our own president, Mr. Cameron, who is chairman of the Sub-committee on Construction Projects of that Committee on Reconstruction.

[1]City Engineer, St. Thomas, Ont.

K. M. Cameron, M.E.I.C.[2]

After the last war the country had no definite plans for the future. The consequence, most of us know. As a result of the experience found in the last war, the Government, immediately on the outbreak of this war, set up its first planning committee, which was an inter-departmental Committee on Demobilization and Rehabilitation of members of the Armed Forces, including both men and women in the services. That committee is under the chairmanship of Brigadier-General H. F. McDonald, chairman of the Canadian Pensions Commission. It is advisedly inter-departmental because it has to do with the members of the various branches of the Armed Forces, and has done a masterly piece of work.

In December, 1940, a committee of the Cabinet was appointed to deal with matters relating to rehabilitation. In February, 1941, its functions were enlarged to include the general question of post-war reconstruction and to recommend the course of action which the government should take in respect to this subject.

Shortly after this, in order to advise that Cabinet Committee, there was established an Advisory Committee on Reconstruction of which Dr. James is chairman and which is a sister committee to that on Demobilization and Rehabilitation. That committee also is to advise the cabinet but reports on the matters particularly relating to the returned soldier. In other words, when a man is discharged while he is physically in a position to go to work, there must be a plan to give him something to do.

The Advisory Committee on Reconstruction, on the other hand, is to advise the Government on how people can be re-established who have been taken from their ordinary occupations to perform war duties.

More recently, there has been formed an Advisory Committee on Economic Policy, under the chairmanship of Dr. W. C. Clark, the Deputy Minister of Finance. That is also an inter-departmental committee, in that the members of that committee are the continuing heads in the Civil Service of those departments mostly concerned with the future and reconstruction.

As regards Dr. James' Committee, it is composed of men entirely separate from the government. Its members were chosen for their standing in the community, and they constitute a group who are bringing the very best they have in them to this problem.

That committee has a number of sub-committees including one on agricultural problems, and one on post-war employment, which relates largely to employment of labour. A third is on the development and utilization of the natural resources of the country, and the fourth one, on post-war construction projects, did me the honour to ask me to accept its chairmanship. A fifth, more recently formed subcommittee, allied very largely to and in fact initiated under my sub-committee, deals with housing and planning.

There is interrelation between a number of these subcommittees that is of interest to engineers. In the work of the sub-committee on development and utilization of natural resources, projects will have to be considered which involve construction. We have liaisons between our subcommittee and other sub-committees. Even in regard to the development of agriculture, there is opportunity of bringing forward construction projects which will assist in the development of our agricultural resources.

[2]Chief Engineer, Department of Public Works of Canada, Ottawa, Ont. President of The Engineering Institute of Canada, 1943.

# POST-WAR PATTERN

H. G. COCHRANE, M.E.I.C.
*Department of Munitions and Supply, Toronto, Ont.*

**SUMMARY—Three years after victory, assuming it comes in 1944, and with gross national production maintained at or near $7 billions, 1,350,000 Canadian workers will probably be needed for capital goods production. Of this number, 900,000 should be engaged in constructing, supplying and equipping public works, buildings, housing, roads and like projects. For every dollar provided from public funds, private enterprise should be spending $3.50. Between victory and this period of stabilization referred to, however, jobs will have to be found for around 1,000,000 displaced war workers and demobilized armed forces. Public works could be provided at Government expense sufficient to provide jobs for 550,000 or nearly 55 per cent of those to be cared for, for almost three years, either during the interim "tooling-up" period for peace, or later when the pent up demand for goods and services slackens. There is no time to lose in preparing a shelf of public works totalling to a value of $3 billions, if we are not to be caught unprepared for peace as we were for war.**

With the turn of the tide in the war in Europe, the publication of the Beveridge Report in Britain, and the Canada-U.S. post-war tariff agreements, interest in post-war affairs has greatly increased. This is a good sign, for emphatic expression of public opinion is necessary before government planning to the extent necessary can be expected, and although committees have been studying post-war problems for more than a year, Canada is considerably behind both Britain and the United States in preparing for peace. Should Hitler crack up unexpectedly during 1943, we would be caught unprepared for peace just as we were caught unprepared for war in 1939.

The kind of a post-war world we are going to live in is in our own hands. And while there are many problems to solve and many difficulties to surmount, there are also many things in our favour. To better fight our war, we have appraised all our resources, both human and material; we are learning the habits of saving instead of wasting; we have developed substitutes for scores of scarce materials; we have trained thousands of our man- and woman-power in technical and managerial skills; we have built up research organizations whose ability and imagination and accomplishments are equal to those of any nation.

We have also learned, through war, that various economic devices and controls may be made to serve us, to save us from sharp fluctuations in the business cycle. We need never fear for the future the runaway booms and the wretched depressions to the extent they reached in the past. We know now we can control them. Best of all, we are determined that never again will we go through another decade of unemployment and relief and indecision. If a wartime economy can guarantee every man a job who wants one, a peacetime economy can and will be framed to do likewise.

The keystone of the entire post-war structure is assurance backed by public opinion, by both the Government in power, and the Loyal Opposition, that national income and employment must and will be maintained at or near present wartime levels. With such assurance, private enterprise, confident of its markets, can boldly make their plans for production. Without it, indecision and chaos will result.

Post-war planning naturally divides into two parts; the first is the "short-term" planning, that which relates to domestic considerations over which we have full control, such as the conversion of war plants to peacetime uses, rehabilitation of our armed forces, education and training, preparation of a reserve shelf of public works to cushion the blow of a possible post-war depression, conservation of natural resources, necessity of the retention or gradual relaxation of wartime controls, etc., and secondly, the "longer term" planning, for export markets and tariffs, rehabilitation of foreign countries, a post-war world police force, and the like, which must be considered jointly with other nations.

While full consideration of most of the latter may have to await some later date nearer victory, preliminary sketches for most of the items appearing in the first group should already be nearing the blueprint stage.

The making of a pattern for post-war production involves a study of available human resources, broken down by skills and location, of material resources and potential rate, of extraction, of plant capacities and suitable peacetime uses to which they may be put, of transportation, taxation, rate of demobilization, of built up backlogs of unfilled wants in durable goods, plant improvement, retooling and expansion as well as residential and commercial construction, and many other related items. A shelf of public works must be prepared and readied to be built at public expense as and when a drop in employment and national production threatens, as it may either during the tooling up period for peace, or when the pent up demand for goods and services slackens.

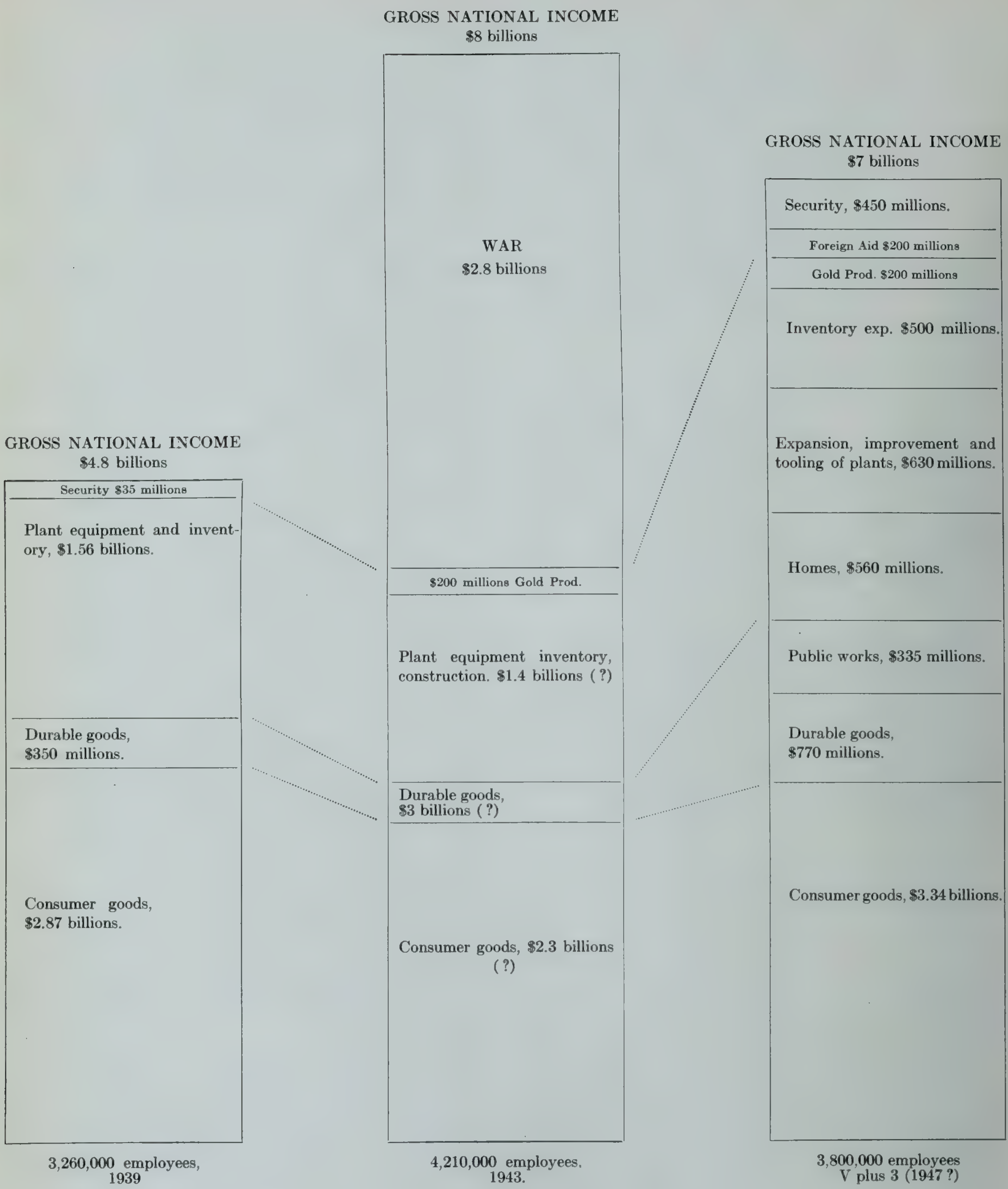
The various pieces of this pattern must be sketched and cut and tried and finally fitted together, so that in making the garment, material and time may not be wasted. Here it is only possible to draw some freehand sketches of how the garment will look on the model. Nevertheless, however rough, these should help us to visualize what our post-war years are going to be like.

In the 1942 summer number of the *Harvard Business Review*, there was published an article by Messrs. Gustin and Holme, of the General Electric Company, entitled "An Approach to Post-War Planning." This article goes into considerable detail as to the methods used for determining post-war markets for the General Electric Company output. The first part, however, is devoted to an attempt to determine a pattern for post-war production for the entire United States.

The authors believe that the first step in planning post-war production should be to direct our efforts towards a post-war stabilized period, to determine what the ultimate objective should be. Thus, we are better equipped to face the immediate problem of conversion during the interim period between victory and the stabilized period two to three years later, from "all out," to the desired level of peacetime production.

The authors determine that (1) in 1940 (a pre-war year), it required $22 worth of capital goods production to generate buying power to support $78 production of consumer's goods and services, (2) for 1943 (the peak war year), they estimate around $45 capital goods production to support $55 worth of consumer's goods, and (3) for a post-war year two years after victory, $30 of capital goods production to support $70 worth of consumer's goods.

The actual ratio for Canada for (1) a pre-war year, can only be estimated very roughly from statistics available, but it would appear to be nearer $35 capital goods production supporting $65 of consumer's goods production. The estimated Canadian ratio for (2) will not differ widely from that for the U.S.A. in the peak war year, probably because through war and "Lend-lease," the U.S. during




**PATTERNS OF GROSS NATIONAL PRODUCTION FOR A PRE-WAR, PEAK-WAR, AND POST-WAR YEAR**

the war becomes less self-sufficient and becomes proportionately as heavy an export nation as Canada is.

But it is difficult to visualize a ratio for a post-war year for Canada, similar to that suggested for the U.S.A. by the authors as in (3) above, namely $30 capital goods to $70 consumer's goods. Assuming expenditures on security and for help for undeveloped countries to the same proportion of total production as for the U.S., and a continuation of gold production on a pre-war scale, with a gross national output of $7 billions and a maintenance of the $35 capital goods to $65 consumer's goods ratio which appears to be about standard for peace and war conditions so far, would call for expenditures per year, say three years after victory in Canada somewhat as follows:

TABLE I

| | Millions of Dollars |
|---|---|
| Security, say | 450 |
| Help for other nations | 200 |
| Precious metals production | 200 |
| * Inventory expansion | 500 |
| * Replacement, expansion and tooling of plant | 630 |
| * Homes | 560 |
| * Public works | 335 |
| Durable goods | 770 |
| Consumer goods | 3340 |
| | $7000 |

*Using same proportions as assumed for U.S.A.

In June, 1941, there were 2,865,000 Canadian wage-earners. There was a 20 per cent increase from October, 1941 to date, making a present total of roughly 3,460,000. Adding the employment in the armed forces of say 750,000, gives 4,210,000 total.

Assuming a reduction of 10 per cent in this total for a post-war year two or three years after victory, as suggested by the authors for the United States, there would then be some 3,800,000 in employment or remaining in uniform by 1946-47, and producing $7 billions worth of gross national production.

Capital goods production as listed above amounts to $2.25 billions, the components thereof, assuming proportions similar to those used for the U.S.A., being $335 millions for public works, $560 millions for private construction of homes, perhaps $105 millions of plant construction and expansion, $525 millions of equipment machinery and tools, and the balance on inventory expansion and precious metals production. Dollar volume of construction contracts would then be around $900 millions to one billion, machinery and equipment another $700 million.

Resulting employment would be around 1,350,000 for capital goods production, while for construction and equipment only, an employment of 900,000 in the proportion of perhaps 320,000 on-site and 580,000 off-site. Mining and manufacturing account for another 500,000.

Thus roughly, one third of the potential output of the entire labour force would be devoted to the construction and equipment of permanent structures, factories, housing, roads, and the like.

It will also be observed that there are to be $335 millions annually provided from the federal purse for public works, while $1.2 billions, slightly over three times as much, would be financed and built by private enterprise.

Here then, in broad outline, is a pattern of post-war production and employment for Canada, say three years after victory, with national income maintained near war levels, and inflation averted through the retention of whatever wartime controls may be necessary.

During the intervening tooling up period between victory and stability, however, it will probably be necessary to devote a greater expenditure to public works. How many displaced war workers and returned soldiers will have to be provided for? Here we must make some more broad assumptions.

First, let us assume victory by mid-1944, and another year to settle accounts with Japan, in which Canada's share is mostly naval and air support. Assume 950,000 war-workers in Canada, 200,000 of whom are women, assume 750,000 men in uniform, or a total of 1,700,000 whose efforts are to be ultimately directed from war to peace.

Assume 200,000, mostly navy and air force, are kept in uniform as Canada's contribution to world security, that 175,000 war workers are retired, and another 125,000 remain on war production. This leaves 1,200,000 for whom peacetime jobs must be found. Perhaps as many as 200,000 of these will be needed to supply sufficient additional consumer's goods and services so that our standard of living may be brought back to pre-war standard. This group would include farm help, doctors, nurses, taxi drivers, dietitians, tailors, manicurists, etc., leaving 1,000,000 to be immediately absorbed into peacetime employment on capital goods production.

How fast private enterprise will absorb them can only be guessed, but it is certainly going to be necessary to provide public funds for employing somewhere between this number of 1,000,000 and the 200,000 or so on-site and off-site workers to be ultimately engaged in producing $335 millions worth of public works, for a year or so.

All of the above figures are approximations. They are based on assumptions which may turn out to be wrong. They are presented with a view to scaling the magnitude of our post-war employment problem, and to provoking discussion. It would seem idle to introduce refinements at this stage, which may later be upset by wrong assumptions or unforeseen developments.

Prior to this war, both volume of expenditure on producer's goods needed to achieve full employment, *and plant capacity* for full employment, were lacking. Canada has gone a long way towards correcting the latter, but it cannot be made effective until it is re-tooled for peace.

The enormous activity of wartime cannot be maintained through any automatic rise in living standards. There is needed a powerful economic and moral substitute for war, when it is over, to provide the impetus to keep the economic machine going. Stimulation may have to be artificial, but it must be expansion and must be expressed to a great extent in construction activity at first.

This indicates the need for having a planned programme of public works ready to take up the slack until private industry gets tooled up and ready to use them.

Since it is apparent that a stimulus will have to be given through the spending of public funds, for a time at least, it seems appropriate here to examine into what maximum amounts the Dominion could afford to spend, having in mind that some war expenditure will continue for security purposes and that there will be insistent demand for a Canadian equivalent of the Beveridge plan.

If we accept the authority of Mr. Alvin Hansen, eminent authority on economics, that national debt may be allowed to attain a figure equal to twice national income, without disastrous results, and if we assume national income to be maintained at or near $7 billions a year, Canada's budgets for years 1942 to 1949, expressed in billions of dollars, might appear somewhat as shown in Table II.

This indicates that $750 millions yearly (or about 35 per cent of expected yearly expenditure on construction and equipment, two or three years after victory) for a period of about 2½ years is about the maximum contribution from public funds that could be allotted for providing employment during the difficult interim period. It would make jobs for some 550,000. It emphasizes the urgent necessity of starting at once to prepare a shelf of public works to be resorted to,

Table II

| Item | '42 | '43 | '44 | '45 | '46 | '47 | '48 | '49 |
|---|---|---|---|---|---|---|---|---|
| Ordinary expense | .34 | .34 | .34 | .34 | .34 | .34 | .34 | .34 |
| Debt service | .15 | .21 | .27 | .33 | .39 | .41 | .41 | .41 |
| War | 3.40 | 3.80 | 3.30 | 2.00 | .70 | .45 | .45 | .45 |
| Aid to other nations | .... | .... | .... | .20 | .20 | .20 | .20 | .20 |
| Public works | .... | .05 | .05 | .75 | .75 | .60 | .50 | .40 |
| Social measures and other reconstruction | .... | .... | .... | .25 | .25 | .40 | .40 | .40 |
| Total | 3.89 | 4.40 | 3.96 | 3.87 | 2.63 | 2.40 | 2.30 | 2.20 |
| Taxes | 2.10 | 2.45 | 2.31 | 2.27 | 2.03 | 2.00 | 2.05 | 2.20 |
| Borrow | 1.79 | 1.95 | 1.65 | 1.60 | .60 | .40 | .25 | .... |
| Total national debt | 7.55 | 9.50 | 11.15 | 12.75 | 13.35 | 13.75 | 14.00 | 14.00 |

All figures in billions of dollars.

as required, to provide employment. They should total to a value of at least $3 billions, so there will be plenty to choose from.

A sub-committee of the Committee on Post-War Reconstruction, has already drafted a standard project questionnaire, based on ideas gleaned from contractors and engineers from all parts of Canada, ready for use the moment a central organization is set up to receive returns. As these replies come in, they will presumably be analyzed and reduced to common terms, inspected, and passed on or rejected, evaluated in terms of quantities of principal materials and man-hours of various skills, needs for equipment, power, fuel and transportation assessed, and scheduled for time. Summaries of these items can then be equated to known output and inventories, and a balance sheet of shortages and surpluses made.

From here on, the committees on conservation and conversion of war plants could take a hand. And here is where there is scope for vision and realism in seeing the need for, and the possibilities of providing substitute materials where scarcities exist or where savings can be made. Here our National Research Council should be invited to sit in.

New trends must be watched, such as the 60 per cent increase in aluminum production and its reduction in price to half the pre-war figure, the thousandfold increase in magnesium output, the new synthetic rubber, dozens of new plastics, powdered metallurgy, flexible and heat-toughened glass, high-octane gas, faster freight, gliders, transport planes and autogiros, and their influence on decentralization, "walkie-talkies," influence of the war on design, creosoted timber roof trusses, lower factors of safety, the possibilities of prefabrication when and as financing, building codes and union regulations are revamped to give it the scope it deserves.

Another tendency that must be taken into account is that neither this war's crop of ex-servicemen nor to-day's highly trained displaced war workers will take kindly to a pick and shovel. This will make for a greater measure of mechanization in all types of construction than heretofore.

The longer term prospects for employment following victory, however, after the first two or three years of readjustment are over, are tremendous. For one need only observe the current crowding in public places such as depots, movie theatres, restaurants, hotels, houses, apartments, railway trains, street-cars and buses, to realize the need for more of all of them if national income and employment is kept at or near current levels. Add to this the necessary resulting increase in services,—water, light, sewers, heating, telephones, pavements. Superimpose on these the further needs for 700,000 returned soldiers plus their families, let alone the immigration that must result from an influx of freedom-seeking war victims.

Power output has more than doubled in ten years, and this with only 30 per cent more installed capacity. There are shortages in Ontario alone of 300,000 h.p., and the paper industry has been temporarily deprived of the capacity of 350,000 h.p. formerly used for steam generation, to serve war industries.

Rail freight has more than doubled since 1938, while rail passenger traffic is almost three times the pre-war figure, and this with actually less than pre-war equipment.

Urban transit has risen 70 per cent since 1939, with only a 7 per cent increase in seats.

Fuel consumption is up 50 per cent over 1939. More than half of our fuel needs are imported.

Enormous backlogs of unfilled wants have been building up. By the end of 1944, the very earliest that normal production is likely to be resumed, there should be backlogs of 500,000 autos and trucks, half a million radios, $200 million worth of construction equipment and farm machinery, half a billion dollars worth of electrical and mining equipment, including the equipment needed for a million electrical horsepower. Add 1,000 locomotives, 2,000 passenger coaches, 20,000 freight cars, 3,000 buses for urban and interurban traffic. At present prices these total to a value of close to $3 billions. But there are further tremendous pent up demands for residential and commercial buildings and the services that go with them. There is reportedly a deficit in the United States of 13 million homes. Prorated this means 1.2 millions for Canada. Yet 700,000 is probably nearer the truth, whose cost would be $2.8 billions. And rounding the picture out with a sheer guess of another $2.5 billions for services and commercial building, would give a backlog of unfilled wants of $10½ billions.

Our post-war pattern of production here given calls for an increase in production of capital goods and consumer's durable goods, over "pre-war," of $1.1 billion dollars annually. Thus with depreciation continuing about as before, it would take eight years to catch up with this $8½ billions of unfilled wants. And thus far we are only thinking in terms of a population of 12 millions!

The cutting of this post-war pattern is not exclusively an Ottawa job. Canadian industry might well follow the example of our southern neighbour in forming a Canadian "Committee for Economic Development," chaired and directed by some of our top-flight industrialists and economists. Ottawa will have plenty on its hands after victory, with demobilization, peace treaties, social measures, immigration, untangling and improving Dominion-Provincial relations, and the like. Between Government and private enterprise there must be a compromise, or better, a partnership, steering a narrow course between bureaucracy and the "normalcy" of 1919.

Toronto—January 19th, 1943.

# THE CONSTRUCTION INDUSTRY IN POST-WAR ECONOMY

O. J. FIRESTONE, Ph.D.
*Advisory Committee on Reconstruction, Ottawa, Ont.*

### Introduction

You are concerned with many of the problems which have been examined and analyzed by the Advisory Committee on Reconstruction since early 1941. This Committee was set up, in the words of the Order-in-Council creating it, "to examine and discuss the general question of post-war reconstruction, and to make recommendation as to what Government facilities should be established to deal with this question."

I have been asked to inform you about important changes which have been made by the Government recently with regard to the study and the preparation of plans for dealing with post-war problems:

1. The Advisory Committee on Reconstruction which has been reporting hitherto to the Special Committee of the Cabinet on Demobilization and Rehabilitation, of which the Minister of Pensions and National Health was Chairman, now reports directly to the Prime Minister.
2. The Advisory Committee on Economic Policy, a committee of Government officials, hitherto concerned with war problems only, has been re-constituted and includes now post-war problems in its functions.
3. The Advisory Committee on Economic Policy and the Advisory Committee on Reconstruction are working in close co-operation in order to avoid duplication of effort and to insure that recommendations relating to post-war problems are put into the hands of the Government without delay.

After having offered you these explanations on the reorganization of Government Departments concerned with Post-War Planning, let us now turn to the topic of the day: "The Post-War Pattern of Canada." The views presented in the following are my own personal conclusions based on considerable research on the character of the construction industry in the Canadian economy.

### Full Employment

The paper delivered to-day by Mr. H. G. Cochrane on the "Post-War Pattern" has approached the problem of the role which construction industry might play in the Canadian post-war economy with courage and imagination.

The ablest economists in Great Britain, the United States and this country are very much concerned with the full employment concept. Full employment means the successful mobilization of all the productive resources (human and material) of a nation. In essence, the problem of full employment is a problem of the trade cycle. Not all forms of unemployment, it is true, are the products of cyclical depression. "Normal minimum" or the so-called "dynamic" unemployment is an inevitable concomitant of the mobility of labour; seasonal unemployment is as great in years of good trade as in years of bad; and the unemployment that arises from the decay of individual industries is another special case. But the two former could easily be cared for, and the third would be greatly alleviated if it were possible to avoid the much larger and more widespread unemployment that comes with trade depressions; and it is with these depressions that diagnosis and cure must chiefly concern themselves.* There is no doubt that it will take considerable forethought and planning in this country before a full employment scheme can reach the stage of realization in the post-war period. Mr. Cochrane has quite rightly stated that the construction industry could play an important role in the pattern of the Canadian post-war economy.

For over a year, the Committee on Reconstruction in Ottawa has given serious consideration to this problem. A study was undertaken for the purpose of determining, in the light of statistics and estimates available, the importance of the construction industry as a field of employment. This study deals with an analysis of the various definitions of the construction field, public and private construction and assesses the importance of construction in the the Canadian economy. The components of the construction industry, its organization and the nature of the construction labour force are discussed. The supply of building labour, skilled, semi-skilled and unskilled with special reference to post-war needs, is assessed. Finally, the importance which the construction industry might obtain in the post-war period is analyzed. It is not contemplated to give to-day a summary of all the research work done in this field by the Committee on Reconstruction. It is intended to give only a few facts and some essential statistics which might assist us to see the role of construction in Canada in the proper perspective.

### Desirability of Reliance on Canadian Statistics

It is important to consider the Canadian construction industry in the light of Canadian statistics and not to rely on estimates made in Great Britain or in the United States. The following two examples will illustrate how different conditions in the construction industry in Canada are from those in Great Britain and the United States.

(a) *Labour Supply*—The resources of skilled labour in this country and Great Britain differ markedly. Nearly all construction craftsmen in Great Britain are trained there. This

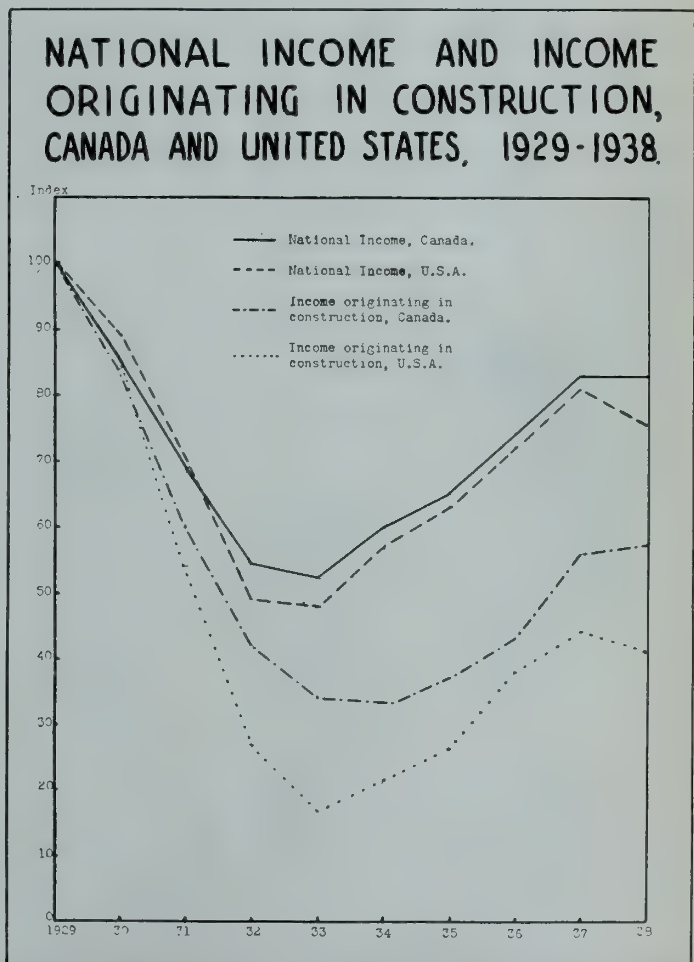



**Fig. 1—Chart showing on a comparative basis annual changes in total national income and income originating in construction in Canada and United States. Base of Index: 1929 = 100.**

*See article on Full Employment in the *London Economist*, October 10, 1942.

country has depended to a great extent on immigration of skilled construction workers. You will be interested to hear that during 13½ years of operation of the Ontario Apprenticeship Act only 2,595 young men registered as apprentices. During seven years operation of the British Columbia Apprenticeship Act only 571 apprentices were registered. If you remember that the total number of persons in construction occupations is over 200,000, you will realize how important it is to consider the problem of training of construction craftsmen in a light different from the problem faced in Great Britain. The average person in a construction occupation in Canada is considerably older than his colleague in Great Britain. In England and Wales there are 5.2 adult construction craftsmen for every youth under 21 years of age. In Scotland there are 3.3 while in Canada there are 10 adults to each youth under 21 in the construction trade.

(b) *National Income*—Quite often American figures indicating the importance of the construction industry or possible backlogs of construction are used by adjusting them to Canadian conditions on a per capita basis. Statistics indicating conditions in the United States do not provide us with a true picture of Canadian conditions. Figure 1 shows the trend of the national income in Canada and the United States for the period 1929-1938. This chart shows that on the whole, as far as unadjusted dollar values indicate, national income in the United States declined more rapidly in the depression in the thirties than the national income in Canada. Since 1934 the national income has been increasing in proportion at a greater pace in Canada than in the United States. This chart further shows that the trend of income originating in construction is similar to that of the total national income. It is of interest to note that income originating in construction reached a far lower point in the United States in 1933 (the index figure is 17) than in Canada in 1934 (the index figure is 33). This index gives only an approximate picture since it is based on preliminary estimates made by the Dominion Bureau of Statistics.

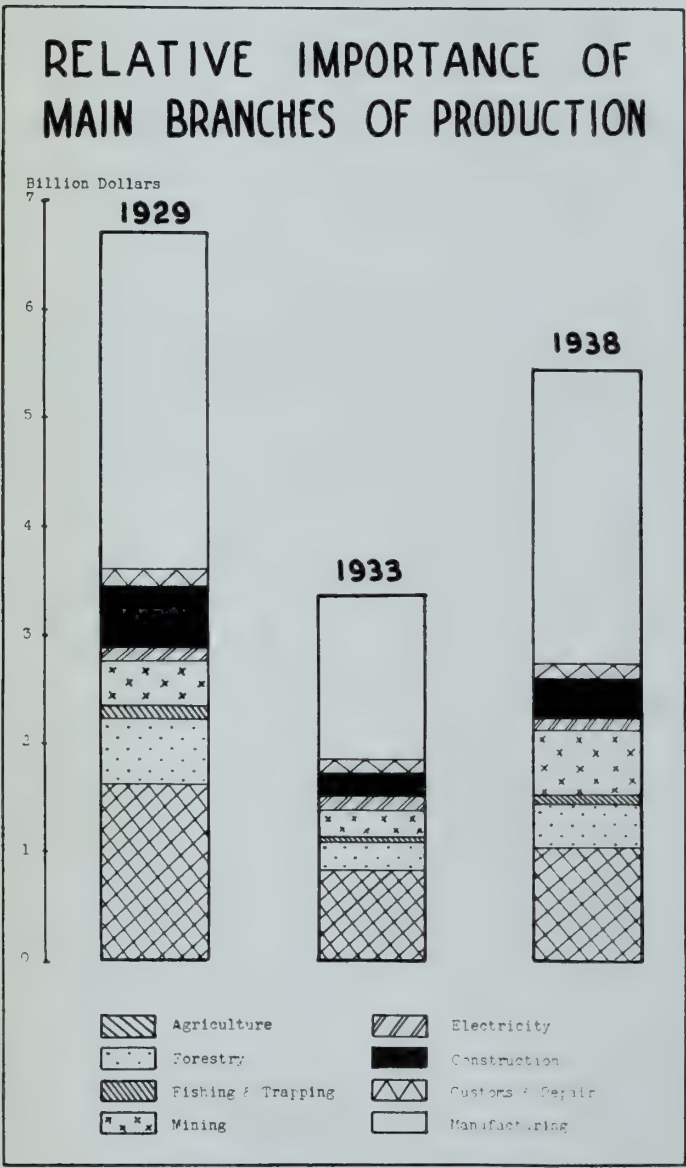



**Fig. 2—Chart showing the gross value of production for the years 1929, 1933 and 1938. According to the classification used by the Dominion Bureau of Statistics "production" includes the industries specified above. The "commodity handling" and "facilitating" division of economic activity are excluded.**

### Role of Construction Industry in the Canadian Economy

Bearing the above qualifications in mind, the importance of the Canadian construction industry should be appraised in the light of Canadian statistics only. The Dominion Bureau of Statistics estimated that the gross value of construction in Canada amounted to 590.9 million dollars in 1929. This figure declined to 176.8 million dollars in 1934, but increased from 1935 onwards. The construction cycle reached its highest point in 1941 when gross value of construction amounted to approximately 640 million dollars. These statistics indicate that the construction industry undergoes fluctuations to a greater extent than any other industry in Canada.

For the purpose of comparison let us assess the importance of the construction industry among the nine main branches of production. Figure 2 shows that construction amounted to 8.8 per cent of the total gross value of production in 1929. It amounted to 6.1 per cent in 1933 and 6.5 per cent in 1938. The other main branches of production as shown in the chart are agriculture, forestry, fishing and trapping, mining, electricity, custom and repair, and manufacturing. The "commodity handling division," including transportation, communication and trade and the "facilitating division" including banking and finance, government activities and service excluding custom and repair are not considered. (See Table I.)

Some indication of the field of employment provided in the construction industry might be obtained from the 1941 Census, preliminary figures for which have just been released. There were approximately 4.2 million persons gainfully occupied in Canada in June, 1941 (men in the armed forces excluded). Of this number, approximately 220,000 persons were gainfully occupied in the construction industry. It appears that about 5.2 per cent of the total gainfully occupied were directly employed in the construction field. If allowance is made for employment in the construction material supplying and transporting industries, the percentage will probably rise to about 12 per cent or about ⅛ of the total population gaining its livelihood in Canada. This is the field of employment provided by construction in a good year. In this no consideration has been given to the secondary effects of construction expenditure which represent additional stimulus to our economic system. In a depression, employment in the construction industry and related industries might decrease to one-third or one-fourth of the level of employment in a prosperous year. It is obvious that provisions have to be made not only to provide employment in the post-war period for all those who have been working in the construction field but also for those men in the armed forces who have been working in the construction field previous to enlistment. Furthermore, a number of construction craftsmen have found work in war industries and they will also be looking for work.

### Employment

It is possible to estimate broadly the volume of construction required in order to provide employment for those who are working in this field now *and* for those who will be released after the war from the armed forces and from war factories.

As far as can be ascertained, there were, in the armed forces on August 31, 1942, between 30,000 and 35,000 per-

TABLE I

Gross Value of Production in Nine Main Branches for the Years 1929, 1933 and 1938[1]

| Industry | 1929 | | 1933 | | 1938 | |
|---|---|---|---|---|---|---|
| | Million Dollars | Per Cent | Million Dollars | Per Cent | Million Dollars | Per Cent |
| Agriculture | 1,631 | 24.3 | 805 | 23.8 | 1,063 | 19.6 |
| Forestry | 611 | 9.1 | 257 | 7.6 | 425 | 7.8 |
| Fishing | 71 | 1.1 | 36 | 1.1 | 53 | 1.0 |
| Trapping | 16 | 0.2 | 7 | 0.2 | 7 | 0.1 |
| Mining | 361 | 5.4 | 269 | 7.9 | 654 | 12.0 |
| Electricity | 123 | 1.8 | 118 | 3.5 | 144 | 2.6 |
| Construction | 591 | 8.8 | 208 | 6.1 | 353 | 6.5 |
| Custom and Repair | 145 | 2.2 | 113 | 3.3 | 146 | 2.7 |
| Manufacturing | 3,166 | 47.1 | 1,575 | 46.5 | 2,595 | 47.7 |
| Total Gross Value of Production | 6,714 | 100.0 | 3,387 | 100.0 | 5,440 | 100.00 |

[1]Data taken from "Survey of Production in Canada, 1939," published by the Dominion Bureau of Statistics, pp. 16-17. "Production" includes, according to the classification used by the Dominion Bureau of Statistics, the industries specified above. Transportation, communications and trade described as the "commodity handling division" and banking and finance, government activities, and service excluding custom and repair described as "facilitating division" are not considered.

sons normally employed in construction work. It was further estimated that the ratio of skilled to unskilled workers employed in the construction industry was approximately 60 to 40 at that time. It means that employment for at least 50,000 to 58,000 men (including skilled) on the site would be required to provide employment for construction craftsmen released from the armed forces. An additional allowance will have to be made for those construction craftsmen working in war factories. This task of rehabilitation should be well within the capacity of the construction industry if this industry is given sufficient encouragement after the war.

One thing becomes obvious. We shall have to spend more than the 640 million dollars which were spent in 1941 on construction in order to provide employment for this additional group of men who will be looking for work in the construction field. It appears that an annual expenditure of one billion dollars would be the minimum required for this purpose. This is not to say that the whole expenditure needs to be Government expenditure. On the contrary, it can be expected that a great proportion of construction expenditure will come from private sources, provided adequate facilities for financing building after the war are made and encouragement to build given to the public as a whole. Another important part of construction expenditure might be inspired by the Dominion Government in assisting the provincial governments and the municipalities in large-scale building developments. Construction projects undertaken by the Dominion Government will only have to supplement the activity of private individuals and corporations and other public bodies in order to assure that sufficient employment will be provided in the construction industry.

Estimates of post-war demands for construction can only be very rough because technological changes, the duration of the war and a number of other factors, have an important bearing on the requirements of a sound economy in the post-war period. If you bear in mind that a construction expenditure of one billion dollars per year means work for at least 700,000 men on the site and off the site (estimate based on pre-war wage rates), you will be able to appraise the importance of such an expenditure for the Canadian post-war economy.

### Backlog of Construction

Based on American estimates, a backlog of construction has been suggested to exist in Canada exceeding five billion dollars. Let us analyze this estimate in the light of Canadian statistics. The Dominion Bureau of Statistics has prepared a preliminary estimate indicating that the average gross value of construction per year during the period 1921 to 1930 amounted to 461 million dollars. Figure 3 illustrates the backlog of construction which has developed during the period 1931-1941 due to the depression of the early thirties and due to the fact that, since the outbreak of the war, the major proportion of construction activity was either directly or indirectly connected with the war effort. This figure shows also estimates of construction for war and civilian purposes. According to these estimates the total backlog amounts, for the period 1931-1941, to 2,126 million dollars. This backlog continues to increase the longer the war lasts. Furthermore, these estimates have made no allowance for the increase of population which Canada experienced since 1931. If this is done and the war ends in 1945, the backlog of construction will be around three billion dollars.

These statistics and estimates, which should only be taken as indicative of post-war requirements, make one thing clear. Canada will have to have a construction programme of a greater size than it had in the pre-war period. Such a programme can neither be planned nor be carried out without the active co-operation of the construction industry itself. Therefore, I was very happy to learn from Mr. Warren C. Miller, the Chairman of the "Committee on Post-War Construction Problems" of your Institute, that the Advisory Committee on Reconstruction can be assured of your co-operation in solving the numerous problems which are connected with the smooth operation of any large-scale construction programme after the war.

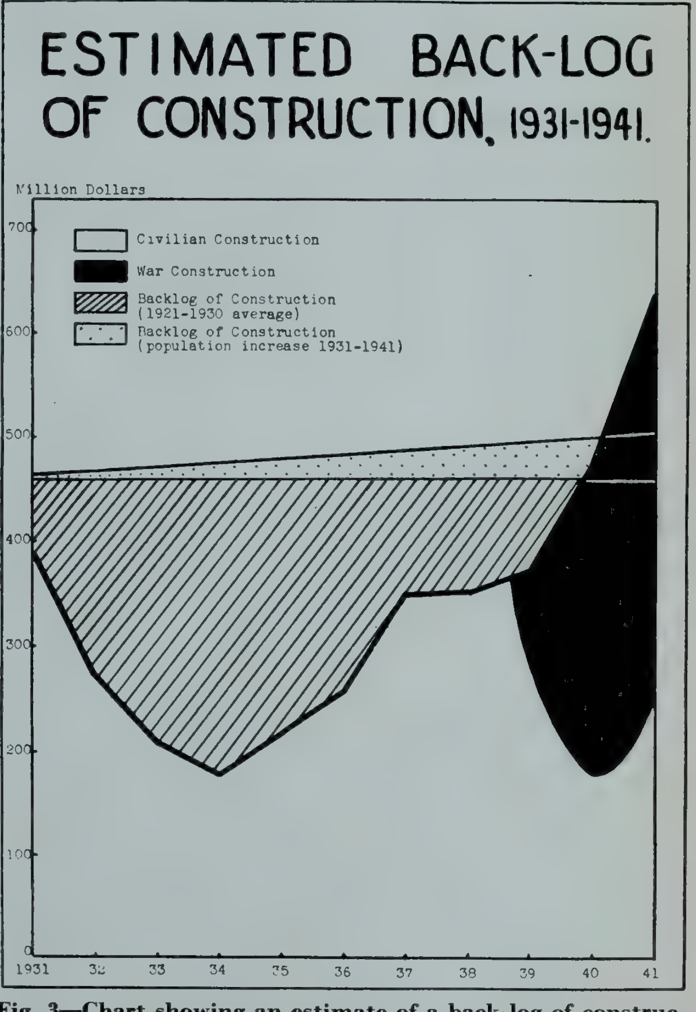



**Fig. 3—Chart showing an estimate of a back-log of construction in Canada for the period 1931-1941. This estimate is based on the annual average gross value of construction (461 million dollars) during the period 1921-1930 as computed by the Dominion Bureau of Statistics (preliminary estimate). The estimate of civilian and war construction for the period September, 1939, to December, 1941, is based on a survey undertaken by the Department of Munitions and Supply, in August, 1942.**

# SOIL AND WATER CONSERVATION

PROFESSOR A. F. COVENTRY, B.A.
*Department of Zoology, University of Toronto, Toronto, Ont.*

Perhaps, at first glance, the subject of land reconstruction has little to do with the problems of a meeting such as this, but on reflection it would seem evident that unless the physical structure, the physical health of the land on which we live and on which our civilization depends is good, all our plans for reconstruction will have an unsafe basis.

Therefore, I very much appreciate the privilege of being invited to put before you a few statements on this subject, even if they are necessarily somewhat dogmatic.

My remarks will deal with a limited aspect of the subject. That is to say, some problems which concern agricultural Ontario. Similar agricultural problems, differing in detail but fundamentally the same in principle, are to be found in all other areas of the Dominion of Canada.

There is ample evidence in support of the facts presented. The evidence, as far as southern Ontario is concerned, has been collected and published recently by the Guelph Conference in a report dealing with the natural resources of the southern part of Ontario, an area of some 35,000 or 40,000 square miles.

They point out that the natural resources of southern agricultural Ontario are now in a depreciated condition as compared with their original productivity and activity, and they cannot restore themselves; unless active and careful measures are taken, conditions will get progressively worse.

Southern Ontario was originally forest country whose water system and soil system had developed under practically a continuous cover of trees. That cover is almost gone now. Precisely how much is left we do not know. There are scattered woodlots but many of them are in an ineffective condition, owing to lack of management or poor management. Some of the original cover had to be removed in the interests of agricultural development, but the fact has been disastrous to the water system of the area. All will agree that no country can prosper without fertile soil, and an adequate water supply. Many countries in the past have experienced this; when their natural resources were destroyed their civilization disappeared.

The water situation in Ontario can be summed up thus: floods in spring, drought in summer, fading wells and springs in fall and winter.

Now, that may sound like an exaggerated statement, but I can assure you the figures justify it. Eighty per cent or more of all our once permanent streams now dry up for a considerable part of a normal summer, and within the last five years, numerous springs have ceased to flow for the first time in the history of this province. It is now a matter of ordinary, unhappy experience among our farmers to have to carry water, often for miles, throughout a great part of many seasons.

Much of our water, too, is severely polluted, as any angler is only too well aware. Many of our harbours are being filled with silt and they can no longer take even motor boats.

Now the silt that has blocked the harbours is the fertile soil from the fields that were opened up when the forests were cleared away.

As a result of our exploitation, there are now spring floods which carry away large quantities of the fertile top soil on which the whole of our life depends. There is only about six inches or so of that fertile soil—seven in some places, three in others. It is a thin layer, in any case, and on that thin layer depends our agriculture. In other words, our soil is rapidly losing its fertility, its productivity. Without going into details, it is fair to say this loss of fertility which has taken place in Southern Ontario, and likewise in other parts of Canada has already given rise to a major economic problem.

One instance has been given me by an expert agricultural friend of mine, of an area in Ontario right in the middle of agricultural country which was considered good, in which during the last few decades the soil has progressively become less and less fertile, and more and more lacking in essential elements through the washing away of the surface soil. That lack manifests itself now in inferior crops. The root crops show definite signs of imperfect nutrition. Correspondingly, stock fed on those crops show signs of malnutrition, and more recently, the children living in that area are showing the effects of the loss of the fertility of its soil.

The whole picture then is one of a degradation of our originally rich natural resources in terms of soil and water. In fact, in the 35,000 square miles that constitute southern agricultural Ontario, some 8,000 square miles are now fit for growing nothing but trees. It is not merely waste country but it is a danger to neighbouring land, because it does nothing to provide proper control of its streams as it did when covered by forest.

The cure for such conditions as these has been applied with great success in many places in the United States and that quite recently. The first steps include, of course, the obtaining of accurate information as to conditions, and that we have not got in southern Ontario and, indeed, in few parts of Canada. To get such information surveys must be made in the field, detailed surveys of areas of erosion, amount of stream flow, cutting of gulleys, what condition the woodlots are in, density of population, the social question whether a farmer trying to catch a living out of a piece of light, sandy soil with no fertility in it is a social asset or the reverse—all these problems and many others come immediately into the picture.

Then comes the matter of the natural resources of the area—wild animals, land and water game stock, forest, trees, soil, rivers, ponds; all these form an interlocking unit and cannot be dealt with piecemeal. The planning of the cure therefore must be of a comprehensive kind and on a large scale.

Such planning covers a wide range. It must consider soil chemistry, of course; the science of raising stock; the fertilization of the soil; the engineering control of water; reforestation. How much each comes into the problem as it affects any single area can only be decided when detailed and full information is available.

It is therefore evident that immediate action in collecting information and planning is essential if land reconstruction is to play any important part in the general post-war pattern. That it should play a part is clear, but we have as yet no figures which give us adequate information—just how many men, of the hundreds of thousands who will be wanting jobs, can be employed in this way.

The time element then is of first importance. Last summer a survey was conducted in the Ganeraska Valley, a joint survey by co-operation between the Dominion Government and the Government of the Province of Ontario. It collected information on the watershed of the River Ganeraska, which flows out at Port Hope from a basin of about one hundred square miles.

It has not yet been announced when the report with the results will be out. I understand at no very early date. We have an earlier report on King Township, about 120 square miles, which gives a good deal of information about the need of reconstruction in that area—a total of about 200 square miles. That is all the information that is available or partially available at the present moment, and at our present rate of survey it will take about 150 years to have the most important and critical parts of the province surveyed so that we can make plans. At our present rate of planting the areas that should be under trees, and which dominate a great deal of the water supply in Ontario as such, replanting would take about 800 years.

These are not pleasant statements, but I do not think they can be refuted. That is the situation.

My statements are based on the opinions of a score or more of men, all of whom have devoted much of their time in recent years to considering the problem of soil reconstruction. The figures have been approved by all of them. They can be found in the Guelph Conference report to which reference has been made.

In the United States, the principles of land conservation have been applied to the physical and social reconstruction of enormous tracts of land. The most famous of these is the Tennessee Valley Administration Scheme. Some people say that southern Ontario is too big a thing to plan for—the Tennessee Valley is about 40,000 square miles. Southern Ontario is about 35,000 square miles. It is true that they do not present the same problem. One is a big river basin, the other a lot of small river basins, but the area is about the same.

But here we have not even begun, and unless we get a much greater speed into our attack on this problem there is no chance whatever that land reconstruction will play any important part in the general post-war pattern.

# FORESTRY PROBLEMS IN RECONSTRUCTION

JOHN C. W. IRWIN, B.Sc.F.
*Clarke Irwin and Company, Educational Publishers, Toronto, Ont.*

It is not necessary before an audience such as this to record the contribution of the forest and forest products to the prosperity of Canada. To refresh memories, however, may I quote a few figures given before the Annual Meeting of the Canadian Society of Forest Engineers last month by J. D. B. Harrison, Chief, Division of Economics, Dominion Forest Service.

Forest Industry—1940

Capital invested—$1,110 million of which $643 million is invested in the pulp and paper industry.

| | |
|---|---|
| Gross value of products, pulp and paper industry | $298 million |
| Sawmill industry | $135 million |
| Net value of products of all wood-using industries | $458 million |

In gross value of products, pulp and paper was second and sawmilling sixth, among the manufacturing industries.

Employment

| | |
|---|---|
| Woods operations | 100,000 man years |
| Sawmilling | 40,000 " " |
| Pulp and paper | 35,000 " " |
| Miscellaneous wood-using | 36,000 " " |
| Paper-using (except printing trades) | 13,000 " " |
| Total | 224,000 " " |

This represents subsistence for nearly a million people.
Wages or salaries, 1940—$240 million.

Sawmilling gave most employment, pulp and paper next. These two provided nearly 10 per cent of total industrial employment. In salaries and wages paid, pulp and paper stood first and sawmilling second.

In external trade "wood, wood products and paper" yielded a favourable balance of $310 million in 1940, as compared with a deficit of $199 million from trade in all other commodities, giving a net favourable balance for all commodities of $111 million.

And finally one more set of figures also from Mr. Harrison's paper.

Of the total area of the nine provinces of 2 million square miles, 760,000 square miles or 37 per cent is rated as productive forest land.

One would naturally suppose that the citizens of a country endowed with such blessings from the hand of a bountiful Creator would try to see to it for selfish reasons and for the sake of their children that such a resource as the forest was given at least a half decent chance at self-renewal, or even that forestry knowledge be used to improve the quality and quantity of the natural forest.

Such has been far from the case—if I may speak with moderation, I would say that our treatment of the forests of Canada represents the ultimate in callous stupidity, and a flagrant abuse and breach of trust on the part of our elected representatives, for which we the people must accept our share of responsibility.

This applies to all the major forested provinces of the Dominion, and although there is a little light on the horizon from Quebec and a gleam from New Brunswick the pall of politics still enshrouds. For various apparent reasons the public has not insisted on reform and as yet, speaking for Ontario, no Adam Beck of forestry has arisen. It is my considered opinion that the public is ready and eager for any reform, and that political leaders are lagging behind, loath to part with such valuable, ready-made hand-outs for favours received or expected, that the undertaking of a serious forest policy would require.

As added background for what I have to say regarding forestry problems in reconstruction may I remind you that the forest is a living organism, subject to *improvement* by selection, betterment of soil and moisture conditions, and avoidance of overcrowding; subject to *deterioration* and destruction by the reverse and as are all living things, by disease and the depredation of natural enemies, particularly insects. The greatest enemy is the forest fire, however, some 90 per cent of which are man-caused and preventable. By leaving large amounts of slash in the woods, man is also responsible for the spread and intensity of many forest fires; his neglecting to remove the trees killed by insect infestations of epidemic proportions results in further dangerous fire hazards.

The handling of the forests so that they will continue to yield profitably forever is a highly technical and scientific business, requiring, I would suggest, for even average success, study and knowledge greater than that required for comparable success in agriculture. Just as different agricultural crops require different soil conditions, so in the growing of trees every variation of soil, slope and moisture content may present a different problem. Nature gives no guarantee that a second crop of trees as valuable or numerous as the present will grow in any particular area when the forest is cut, even if the area is not burned over, which it often is —again and again.

One other thing should be remembered, and it is often lost sight of by those who talk about unlimited supplies of wood—that is that wood is heavy and, therefore, transportation is a considerable factor in cost. Transportation requires roads in the woods, river improvements, railroad facilities, besides rolling stock of various kinds, all of which cost considerable money.

It follows, therefore, that the more wood that can be grown on an acre, the cheaper the unit price. That is why B.C. products can cross the continent to compete in Ontario markets. Our natural forests in Ontario produce from a quarter to one-half of what could be produced with any reasonable kind of forest management and silvicultural practice. The transportation problem explains also the numerous ghost lumber towns in Ontario—there was plenty of wood left in the province but it was too far from the mill. Ghost towns are still being added. Thessalon being the latest substantial one to come to my attention. The saw mill there recently closed down on account of shortage of supplies; let us hope something else will turn up for the town.

From the foregoing it is apparent that a sane forest policy is one under which as much timber as possible is cut from a given area while assuring another crop of trees as good or better than the original. The care necessary to assure the new crop naturally requires the expenditure of more time and money than would be necessary under a "cut out and get out" policy. Such extra expenditure could hardly be warranted if the area carefully logged on behalf of the future, is likely to be ravaged by forest fire. Our forest fire record is a national scandal of which we all ought to be thoroughly ashamed.

Therefore, a condition of undertaking a programme of sane forest management is dependable protection from fire; the essential and urgently necessary work to improve fire protection services is therefore the first to be here considered in connection with forestry problems in reconstruction.

Fortunately, in this connection, there was presented at the Canadian Society of Forest Engineers meeting to which I referred, a very able paper by Mr. Peter McEwen, Regional Forester with headquarters in Sudbury, on the subject of Forest Fire Protection in Post-War Rehabilitation. Mr. McEwen gets down to details and cases for the Sudbury District which comprises some 20,000 square miles and which might be considered typical of the forested area under organized fire protection in Ontario, some 170,000 square miles. His figures, however, are in my opinion conservative, and deal only with bringing the Sudbury District up to a reasonable efficiency—making up for past omissions and neglect.

The kinds of work enumerated by Mr. McEwen are:

1. *Hazard Disposal,* which deals with—
   - (a) Safety Belts around Villages. 20,000 man-days
   - (b) Safety Belts along Roads and Railroads................200,000 "
   - (c) Broadcast burning.......... 80,000 "

     Total.............300,000 man-days (without the winter burning)
   - (d) Winter Burning............. 50,000 man-days per year while cutting continues.
2. *Transportation Improvement.* There is a direct relation between the time required to get to a fire and the damage done. If it takes a day or more to reach a fire, as it often does, the expense of fire-fighting is greatly increased and the hope of controlling it without rain lessened. Time is of the utmost importance.

   Transportation improvement includes:
   - (a) Streams, portages and lakes......... 200,000 man-days
   - (b) Roads (include trails) .............. 640,000 "
3. *Communication Improvement.*

   Telephone System...................... 40,000 man-days
4. *Detection Improvement.*

   Lookout towers and trails thereto....... 20,000 man-days

The totals under these four headings is 1,200,000 man-days, or based on a 200-day year would give employment to 3,000 men for two years.

Multiplying by eight to get an idea of useful work that needs to be done in the forested area of Ontario on *fire protection* alone, you have a total of 9,600,000 man-days or 24,000 men for 200 days per year for two years.

Much of the work outlined presupposes surveys and mapping, both ground and aerial, preliminary to its undertaking. No estimate of the men or time required for such surveying and mapping is given by Mr. McEwen. It would doubtless be considerable.

These labour figures have been given in terms of a two-year period, because such work might be considered stop-gap employment; there is no reason why a smaller number of men could not work for a much longer time and there would be a number of obvious advantages in such an arrangement.

Scientific forestry practice requires the maintenance of roads and permanent river improvements so that the mature crop, wherever it is, may be harvested when ready and also that fungus or insect-infected timber may be salvaged; the removal of such diseased timber, operates to stop the spread of the epidemic and is the only satisfactory way to deal with it, so far discovered.

The building of such a permanent transportation system could well be linked to the improvement of transportation in fire protection mentioned above and many of the roads would serve both. No estimate of time required for such construction is as yet available as far as I know except for very limited areas, but it will doubtless be forthcoming, and very considerable.

What has been said, deals with the possibilities of work in the forest to bring its facilities and organization to a point where the fire protection system has a chance to cope with the danger, and the forest operator can, if required, do scientific logging without such a high initial charge for roads, stream improvements, etc., against his operation.

As has been suggested, the emphasis on the future timber crop while logging the present one, involves the expenditure of time and money, and although the amount will differ very greatly on different sites and types of forest, a fair estimate would be that the number of men required in woods operations, marking of trees, burning of slash, inspection, etc., would be 25 per cent more than at the present time—representing an investment in the present for the future—an investment, however, that should be repaid several times over by the improvement in quantity and quality of the new crop—if one can judge from European practice. As yet in Ontario (and this is generally true throughout Canada with the exception of the province of Quebec) we have no scientific forestry, if we disregard a few minor experimental cuttings.

That wood is used for many thousands of purposes is a fact few take time to consider. The war has brought it forcibly to our attention with the increasing scarcity of many other materials. The Germans have long appreciated it and have sacrificed their forests mercilessly for the basic material that helps them make up deficiencies in food, shelter, clothing, war essentials and motor fuel—in the hope, of course, that they will be able to rest their forests after they have acquired control of the rest of the world.

They have at least a well thought out plan. We, in Ontario, have had no plan worthy of the name, and those from other provinces will know to what degree this is true of theirs.

I might add that we have done comparatively little research into the multitudinous problems involved in keeping a forest productive although we have spent and are spending vast amounts on agricultural research.

If, after the war, a sane forest policy should be adopted in Ontario, we would find ourselves hamstrung for lack of trained technical foresters. Before the war, we had about twenty foresters in the employ of the provincial government of Northern Ontario, largely occupied with fire protection, or an average of one for each 8,000 square miles. The Government Forest Service of Ontario alone, with any rational forest plan, could use from 200 to 250 foresters without difficulty, the product of 25 average graduating classes of the Toronto Forest School. We have had no plan of training secondary personnel for ranger duty, cut inspectors, etc., and in this we are far behind the province of Quebec, which has had a ranger school for twenty years. The dearth of technical foresters and the low estate of the forestry profession can be attributed largely to the unenlightened course followed by our provincial authorities; only in the provinces of Quebec and New Brunswick has the value of four years specialized university training and forestry experience been recognized by legislation.

Proper forestry management will pay big dividends and protect the future of the vast investment in Canadian forest industries. It will increase the demand for woods labour and can maintain in perpetuity the many communities now dependent on the products of the forest. We must discontinue the ridiculous practice of taking money from forest revenue for the general funds of the provinces while the forest is deteriorating and being destroyed by fire, disease and waste. In Ontario the direct forest revenue thus taken is a small fraction of the total provincial revenue, but its application to the maintenance of the forest would make a tremendous difference.

This paper was to deal primarily with Forestry in relation to Post-War Reconstruction; I hope you will not mind my concluding it with an appeal for your sympathetic interest in the problems of those technical foresters and other conservationists who are striving to bring those responsible for the administration of the forests to some idea of their possibilities for the future of Canada.

Technical foresters and engineers of all kinds have much in common; I solicit your interest in this problem.

# DISCUSSION

**The Committee earnestly invites further discussion on the subject of post-war planning and reconstruction. Contributions will be welcome from members of the Institute and non-members as well. They should be addressed to Headquarters of the Institute, 2050 Mansfield Street, Montreal, Que.**

G. MacL. Pitts, m.e.i.c.[3]

The reconstruction programme will require a great deal of co-operation, particularly the co-operation of the large element of educated and scientifically trained men that we have in this country.

Having the honour at the present time of being the president of the Royal Architectural Institute of Canada, I may say that in that body we have had to make some concise and exact studies with regard to the possibilities of the wartime period and the post-war period. We have tried to be realistic about this matter, and to reduce the idealism to a minimum, in order that practical results may be of the best.

In that Institute we have associated ourselves with other organizations, such as The Engineering Institute and the Canadian Construction Association, through the National Construction Council. We feel that no one organization can plan such a comprehensive scheme as will be required.

Our feeling at present is that we are away behind schedule. If there is to be a building programme ready to commence constructive work within the next two or three years, very definite plans should be well under way now.

In making these plans there is a tendency to depend too much on the government. It is easy, in time of war, to place the responsibility for a great many things upon the government which the government is not properly organized to carry out. If we continue to do so the government will be inclined to accept that theory and serious difficulties may arise.

We have in our Institute drafted a proposal which we are sending to the government, as to how we think a workable organization could and should be set up for the carrying out of the post-war reconstruction planning scheme. We appreciate the limitations which housing presents. A great many people think that the housing situation will be solved by simply building a large number of small houses to house our working men.

Now, there is nothing to indicate that a working man wants to own a house. In a great many cases he does not want a house because the economic set-up of his employment may make it necessary for him to move to some other community.

Another thing to be remembered is that the housing proposition is a very flexible one. In time of depression we found that people could double up at a surprising rate, and the necessity for housing could be very materially reduced.

As an Architectural Institute, we are carrying out a survey of all the work that has been on the board. Progress has been held up by the war itself, or by the restrictions that have been placed on materials and labour during the war, and although our returns are not yet complete, you would be surprised at the volume that we have at present before us as being work that can be carried out by the industry when the situation permits.

We find too that the government, in its anxiety to see that the greatest effort is put forth for the winning of the war, has imposed upon us a great many regulations, the actual effectiveness and efficiency of which in the prosecution of the war, we can not quite appreciate.

As far as the construction industry is concerned, we are terribly lacking in plans for communities where buildings can be carried out. There is no use trying to build before we know what we are going to build, where we are going to build, and how we are going to carry out the scheme. It is most desirable that the engineering profession, and those interested in town planning should cooperate with us, and we with them, to see that these difficulties are overcome.

As far as reconstruction problems are concerned, none of us are selfish in our approach. We are trying to plan for our fellow Canadians, and see that they will live in the future under the very best conditions that our technical knowledge and our humanitarian point of view can possibly develop. We are not in this for profit, we are in it to make a country worth living in. Let us not depend too much on the government, but let us do something for ourselves.

[3]Maxwell and Pitts, Architects, Montreal, Que.

Francis Hankin, affiliate e.i.c.[4]

Mr. Cochrane has done well in drawing public attention to the general nature of the post-war problem of ensuring full employment. His adaptation of the General Electric analysis of post-war possibilities and needs to Canadian conditions is valuable, though some people may not accept all the items he includes under "capital goods production", and may feel that the proportion of the total national production he allots to capital goods of 35 per cent is a little high. But differences of this sort do not detract from the worth of what he has done in stressing the importance of capital goods and consumers' durable goods in our economy.

If past experience is a guide, they will together form not less than one-third of our national income. Like construction in the United States which dropped from nine billions in 1925 to one and a third billions in 1933, they will be subject to great fluctuations in volume and, therefore, will cause from time to time considerable unemployment unless we bring their production under better social control than we have hitherto done. To accomplish this, we should do the following things:

1. We should even out and stabilize our total annual expenditures for capital goods required both by public bodies and private enterprises.

2. We should adopt measures that will maintain the purchase of consumers' durable goods, such as radios, automobiles, etc., at a high and constant level. We need not worry very much about expenditures for food, clothing, and other essentials of life because, if the considerable fluctuations in the other areas of production are brought within reasonable bounds, such expenditures will automatically be constant and at a high level.

Accomplishment of these purposes requires the co-operation of all individuals and organizations in the community, and, among the latter, the state must be included. What form should the effort take, and how can it be brought about?

First, we should examine the action we may expect from government at its various levels, federal, provincial and municipal. Clearly, each authority should plan its public works with the dual object of providing useful service, and of affording employment when it is needed. Each should prepare as many projects as possible to the blueprint and specification stage so that the most appropriate may be launched promptly when needed. Where possible, they shall be used as "fill-ins" when private enterprise is stagnant. In financing them, our governments should follow the Swedish plan of budgeting public works separately from current operations. And we should pay for them out of loans during depressions, and out of taxes during prosperity.

Through its power of taxation, government can do much to maintain purchasing power for consumers' goods which depends upon the receipt by each citizen of a sufficient share of the national income. Adequate social insurance which, in the words of Mr. Churchill, "brings the magic of averages to the rescue of millions" is an important con-

[4]President, Francis Hankin and Company, Limited, Montreal. This discussion was not presented at the meeting, but contributed in writing afterwards.

tributor to that purchasing power and, therefore, to prosperity. Remove the fear of disaster from accident, sickness, unemployment, and death, and nine-tenths of the population will not find it necessary to save for a rainy day. Instead, they will spend nearly all their income on consumers' goods, and thus keep the wheels of industry moving regularly, reducing thereby the cost of insurance itself. If proof is wanted, see what unemployment benefits, and even the dole did to maintain purchasing power in England after the last war.

Through taxation of excess profits of monopolistic enterprises, government can induce big business to keep prices low or wages high so that purchasing power will be maintained at an adequate standard. Graduated taxation also is used to remedy inequities in income distribution.

Government can do many other things as well that will help to maintain prosperity and full employment. Education, for example, fits a man to produce better, and good health keeps him constantly at his bench or in his office.

What can business and other organizations do ? Private enterprise must find some way to controlling its capital expenditures on the principle advocated above for public works. Possibly, concerted effort by employers working through their trade associations will be needed to do this. Government also may take a hand, as it has already done, by remitting taxation on capital expenditures during depression, and by offering financial aid similar to that available from the R.F.C. (Reconstruction Finance Corporation) in the United States. The final responsibility, however, rests on the shoulders of private enterprise itself. If it is to survive, it must find ways and means of eliminating violent employment fluctuations in capital goods industries. It must level out its demand, and it must also be ready to venture into new fields of effort which will require new buildings and new equipment.

But the most important responsibility of private enterprise is to ensure the distribution of the greatest volume of the things it is in a position to produce. The instruments for doing this are prices and wages. Prices must be low enough to call forth the greatest volume of purchases, or alternatively, wages must be high enough to enable the recipients to buy all that comes on the market. Through trade associations, which may have to be subject to government supervision, industry should pursue a policy of striving for the greatest possible distribution. Only by doing so can unemployment be avoided, and the possibility of state capitalism forestalled.

The foregoing suggests that full employment demands the collaboration of all the interests concerned with it. How can it be brought about ? Mr. Cochrane mentions the Committee for Economic Development organized in the United States and financed by business men. It proposes to cooperate with agencies of government and "to stimulate and work with local community groups and business men, learning from them as it goes along". This Committee may do good work, but I think it will be hampered in its efforts because, apparently, it will work from the top down. I prefer the method proposed by the Canadian Chamber of Commerce which suggests that local committees on reconstruction "should be comprised of nominees from various bodies in which the following might be included:

- The Board of Trade or Chamber of Commerce of the city.
- The Junior Board of Trade or Chamber of Commerce if such exists.
- Co-operative societies, if such exist in properly organized form.
- Citizens' committees on Rehabilitation.
- Labour organizations, such as Trades and Labour Council, the Canadian Congress of Labour, and the Catholic Unions.
- Farmers' organizations, if they exist.
- Construction organizations such as the Architects' Association, The Engineering Institute of Canada, Canadian Construction Association or Builders' Exchange.
- Canadian Manufacturers' Association.
- The university or senior teachers' association.
- The Canadian Medical Association.
- Social service organizations.
- Major trade associations.
- Any already established community committees on such matters as public works, slum clearance, town planning, etc.
- Other women's organizations.

Though boards of trade may inaugurate the committees and make available to them their secretarial facilities, I think it is of the greatest importance that neither they nor any other organization should dominate them. The committees must be truly communal, and, therefore, the members should not be chosen by the boards of trade but nominated by the organizations interested in reconstruction.

It has been suggested that an organization of organizations might engender fascist tendencies. There will be no danger of such a development providing the committees avoid entanglement with government. It is their business to prod government and to criticise it. They should cooperate with government but not be tied to it. Only if they preserve their independence and freedom will the committees be free from politics and command the confidence of the community they serve.

What can they do ? Through their own or *ad hoc* subcommittees of experts, they can ensure the preparation of a shelf of public works for their community; can assist small local industries to plan for change-over and expansion for peace-time work; can educate producers, workers, and public to the importance of proper price and wage policies; can plan for appropriate educational and health facilities; and can help to create an informed public opinion which will decide wisely on the matter of social insurance.

This will be true communal work from which the individual will benefit and in which he can participate, for, after all, powerful organizations and associations, and also the state itself are composed only of individuals like ourselves. There is need that each one of us, working through our appropriate organizations, shall apply his intelligence and his energy to the problem of providing full employment and a decent standard of living for everybody when war ceases so that we may this time win the peace that ensues and make it permanent and prosperous.

# THE TRAINING AND EDUCATION OF ENGINEERS

S. D. LASH, PH.D., M.E.I.C., ASSOC. M.INST.C.E.
*Assistant Professor of Civil Engineering, Queen's University, Kingston, Ont.*

It is reasonable to expect that, in the post-war period, careful consideration will be given to the whole subject of engineering training, and it is probably well for us to start thinking about it now. In support of this view attention is directed to the presidential address to the Institution of Civil Engineers delivered last year by Professor C. E. Inglis[1] and to the recent address by the president of The Engineering Institute reported in *The Engineering Journal*[2]. It is the purpose of these notes to emphasize some of the principles outlined in the above addresses and to suggest application to conditions in our universities.

In order to plan engineering training it is necessary to decide what sort of people we want engineers to be, and how, if at all, such people can be trained. Remembering that the engineer is the man "who directs the great sources of power in nature for the use and convenience of man" and remembering also that the term engineer originally meant "one who contrives, designs, plans or invents" (1702) it is suggested that the primary function of engineers are the planning, designing, constructing and maintenance of structures and machines of all descriptions.

Successful planning of engineering projects requires a breadth of outlook which engineers (and others) often lack. In the development of American railroads, for example, immense sums of money were wasted through improper planning and what is even more important, improperly motivated planning. In the post-war period, many engineering projects will have to be examined, not only for technical soundness, but also for economic soundness, social soundness and for the aesthetic satisfactions that they may be expected to bring. The making of such studies is a proper task for the engineer and the engineers who make them must be men of broad general education with a predominantly scientific outlook. In a recent broadcast, Professor Inglis[3] said: "Those who plan and carry out vast engineering works must be men who possess forward-looking minds, coupled with great resolution and powers of leadership, just the type of leaders we want in these days and in the days of post-war construction." To broad general education must be added specialized knowledge in one or more fields. Specialization gives rise to the most difficult problems in the engineering education. To what extent should the universities attempt to impart specialized knowledge, to what extent should they attempt to teach subjects of a general cultural nature and in what way should such subjects be approached? Some attempt must be made to answer these questions.

It is widely recognized that the training of engineers cannot be entirely accomplished by universities. However competent the teaching or however well planned the courses, practical experience will always be an essential part of an engineer's training; moreover, an engineer continues to learn things throughout his professional life. The young engineer has ample opportunities after graduation of obtaining detailed technical knowledge of the fields in which he is interested. As Professor Inglis[1] has put it "A beginner in an electrical firm will get little credit for his knowledge of electricity, for in that particular direction he will be surrounded by others far more knowledgeable. But if, perchance, a problem involving stress calculations comes along, which he alone is capable of solving, seen against a black background of ignorance he will gain credit out of proportion to his merits."

In the past, men with engineering training have frequently been engaged in work of a predominantly non-technical nature. Sir Clement Hindley[4] has estimated "that in carrying through an engineering project probably 75 per cent of the directing engineers' time, energy, and brain power are absorbed in overcoming human difficulties and the remaining 25 per cent in solving material and physical problems." The better paid positions are often executive rather than technical. For men in such positions, highly specialized knowledge such as is commonly imparted at a university is valueless, but a scientific outlook is of inestimable value. By a scientific outlook is meant "a critical, logical attitude, and a wholesome respect for correct reasoning, precise definitions, and clear grasp of underlying assumptions."[5]

University courses consist at present of an intensive diet of technical subjects leavened with a few other subjects which students feel to be largely unnecessary. The effect of this intensive diet is to produce mental indigestion of the worst kind. An average student may regurgitate sufficient information at examination times in order to get a degree but only an exceptional student can be expected to assimilate such an excess of mental food. Forty years ago it was recognized that courses were too crowded—they are probably still more crowded now and as a consequence there is very little time left for thinking. The average graduate finds, say ten years after graduation, not only that he has forgotten most of the material he studied so intensively for examination purposes; he will find that he has forgotten that he ever knew it. Probably the only reason that university training has worked as well as it has, is that it serves as a sort of intelligence test, picking out those who are bright and rejecting those who are dull.

In most Canadian universities, an engineering course consists of two years spent largely on fundamental subjects such as mathematics, physics and chemistry followed by two years of more or less specialized study in some branch of engineering. This system was apparently introduced into American colleges from France during the 19th Century. On paper it looks like a logical system but in practice there are disadvantages. Perhaps the most serious of these is the division of outlook produced in the students' minds. The fundamental sciences are regarded only as prerequisites to engineering studies and are not closely related to them. Another drawback is that, in mathematics for example, too much material is presented in too short a time. In the opinion of the author it is unreasonable to expect the average student to assimilate the elements of co-ordinate geometry, differential and integral calculus, differential equations, spherical trigonometry and various other topics within two years.

The need appears to be for more extensive and more varied fundamental courses together with a considerable reduction in the time spent on specialized work. It is the latter suggestion which will probably arouse the greatest doubts in many minds. But unless courses are lengthened this is what we must do. Consider, for example, the field of structural engineering. It is common for undergraduate students to study all, or many, of the following topics: arch design, moment distribution, rigid frame analysis, strain energy, virtual work, photoelasticity, wind stresses in tall buildings, continuous trusses, suspension bridges, and so forth. These subjects are all interesting and some are important, but it is maintained that practically none are essential in undergraduate training. Only in exceptional times is the young engineer called upon to design the more complicated types of structure. The average employer expects the graduate to be able to proportion simple beams, columns, connections and perhaps, trusses. It is only after gaining experience in the design of such simple structures that an engineer is qualified to tackle more complex problems. A structural engineer should know what a suspension bridge looks like and he should understand the general structural principles involved in supporting the loads, but only one man in a hundred will ever design such a bridge. The bridge designer can study the exact methods of design which have been used in previous bridges and in a week, at the most, learn as much about the subject as he could have done in any undergraduate course. In subsequent weeks he will, of course, learn far more.

Matters such as those listed above are more suitable for study by graduates and the universities might well offer a variety of short intensive summer courses, perhaps lasting not more than three weeks, on such subjects. Many engineers would welcome an opportunity of studying recent theoretical developments in their own particular field.

The pruning of courses must be carried out thoroughly if a new healthy growth is to be encouraged. Such new growth will be characterized by a renewed interest in fundamental subjects such as mathematics, together with an interest in subjects which are comparatively new to the curriculum but which are nevertheless of wide interest to engineers, subjects such as regional and town planning aesthetics, management, traffic control.

It seems almost essential to introduce some further element of specialization during the final year at college. Whilst this may appear contrary to some of the preceding arguments it nevertheless appears a necessary consequence of the general advance of engineering science. Moreover, the student taking a civil engineering course, for example, usually has a fairly clear idea as to whether he wishes his future work to be in the field of structural engineering or that of municipal engineering. Similarly the student studying electrical engineering will know whether he is interested chiefly in radio or in the design of heavy electrical machinery. Thus, further use can be made of elective courses in the final year. For those who do not wish to specialize at all, it is suggested that a course in general engineering be offered.

We are now perhaps able to answer in a little more detail the question asked at the beginning of this discussion. What sort of people do we want engineers to be? It appears that engineers need to have:—

1. An understanding of scientific methods of thought.
2. A broad grasp of the basic principles underlying the design and construction of structures.
3. An understanding of the economic structure of society.
4. A specialized technical knowledge in some particular field of engineering.
5. The ability to express ideas clearly and concisely.
6. An appreciation of culture.

With the above ideals in mind let us attempt to construct an ideal curriculum. Consider first the general engineering course. The four years might be spent somewhat as follows:

*First Year*

English—*Writing* of laboratory and engineering reports and essays. *Reading* books on the history of engineering developments, descriptions of engineering works, biographies of engineers, recent papers of a general non-technical nature in engineering and allied fields.

French or German—Acquire a reading knowledge of the language.

Mathematics—Basis of mathematical reasoning, logic, number systems, equations, series, plane co-ordinate geometry, trigonometry, very elementary calculus ("Calculus made easy"), introduction to ideas of mathematical philosophy.

Physiology—Elementary human physiology, the body as a machine and the necessary conditions for its efficient operation.

Psychology—Elementary human psychology, emphasis on basic psychological conditions for well adjusted living, methods of learning.

Shopwork—Carpentry, machine shop, blacksmith shop. To gain practical knowledge of the properties of materials and of the way in which they are worked.

*Second Year*

Mathematics—Co-ordinate geometry, functions, elementary calculus, moments of inertia, kinematics, accelerated motion, statics, hydraulics.

Physics—Elementary heat, sound, light, magnetism and electricity.

Chemistry—Chemical properties of common engineering materials. Chemistry of common industrial processes. Introduction of general ideas of modern chemistry.

Properties of Materials—Physical properties of common engineering materials. Laboratory testing.

Drafting—Systems of projection, lettering, structural and machine drawing, descriptive geometry.

Social Science—Introduction to principles of economics, money credit, business cycles, government control, historical development of capitalist and socialist society.

Surveying—Principles and practice of elementary plane surveying.

*Third Year*

Mathematics—More advanced calculus, partial differentiation, elementary differential equations, damped oscillations, solutions of equations, curve tracing, dynamics, hydraulics.

Electrical Engineering—Fundamental principles of electrical engineering, including electronics.

Structural Engineering—Statics, simple framed structures, stress and strain, beams, columns, shafts, elementary structural design. Principles involved in structures of various types.

Mechanical Engineering—Power plants, including internal combustion engines, machines, heating and ventilating, thermodynamics, hydraulic machinery. Selection of machinery.

Aesthetics—Aesthetics of engineering structures, architectural design.

Social Science—Economic structure of Canada, Dominion-Provincial relations.

*Fourth Year*

Mathematics—Differential equations, vectors, probability and statistics, philosophy of mathematics.

Municipal Engineering—Town planning, zoning, street layout, traffic control, highway construction, water supply, sewage treatment.

Transportation—Air, rail, road, water—history, economics, operation, location, construction of airports, railways, highways, docks and harbours.

Social Science—Industrial relations. Business and works administration. Social effects of engineering methods.

Construction—Brief description of construction methods.

Production—Technique of mass production. Industrial design for mass production.

For a specialized degree the first three years would be substantially the same as for the general degree but greater specialization would be permitted in the final year. For example a degree course in structural engineering might have a final year as follows:—

Mathematics, Social Science } As for general course.

Theory of Structures—Continuous and restrained beams, trusses.

Structural Design—Elementary structural design in wood, reinforced concrete and steel.

Structural Laboratory—More advanced testing of materials, testing of structural models, photoelasticity.

Structural Engineering—Principles involved in design of building, bridges, retaining walls, tanks, towers and other structures.

Foundations—Soil mechanics, proportioning of foundations for buildings, bridges and other structures.

The above outlines are only intended to convey an idea of the sort of topics to be discussed in an engineering course. There are doubtless serious omissions and possibly the pruning process has not been carried far enough.

It may be objected that undue attention is given to mathematics in the above programme of studies. Mathematics has been given the most prominent position for a number of reasons. Firstly, it is obviously of fundamental importance—more so than any other subject. Secondly, to form a link between the work of different years. Thirdly, subjects such as mechanics and hydraulics are regarded as branches of mathematics rather than as separate subjects. Fourthly, it is planned to introduce mathematics gradually as required for engineering studies. It is desirable that as much as possible of the mathematics instruction be given by men with engineering training and experience, so that the subject may be constantly related to practice.

In all subjects it is hoped that the present trend toward increasing laboratory instruction, problem periods, and seminars will continue with an accompanying decrease in formal lectures. In subjects such as structural engineering, students could well be encouraged to build actual structures on a suitable scale under field conditions subsequently loading them and measuring actual stresses. In this way an appreciation of construction problems and of the errors involved in ordinary design assumptions can be obtained. Dachau deserves to be remembered not for its notorious concentration camp but for the 'Bauhaus' established by Dr. Gropius[6]. At the Bauhaus, students were taught the fundamentals of architecture not only in the drawing office but also in the work-shops and by actually working on carefully planned and directed building projects.

It cannot be too strongly emphasized that there is no fundamental conflict between theory and practice. One of the pioneers of engineering education, Professor Rankine[7], put the matter thus:—

"At length during the Renaissance the truth began to be appreciated that sound theory in physical science consists simply of facts, and the deductions of common sense from them, reduced to a systematic form. The science of motion was founded by Galileo and perfected by Newton. Then it was established that celestial and terrestrial mechanics are branches of one science; that they depend upon one and the same system of clear and simple first principles; and that those very laws which regulate the motion and stability of bodies on earth, govern also the revolutions of the stars and extend their dominion through the immensity of space. Thus it came to be established that no material objects however small, no force however feeble, no phenomenon however familiar is insignificant or beneath the attention of the philosopher; that the processes of the work shop, the labours of the artizan, are full of instruction to the man of science; that the scientific study of practical mechanics is well worthy of the attention of the most accomplished mathematician. Then the notion that scientific men are unfit for business began to disappear. It was not court favour or high connection which caused Newton to be appointed Master of the Mint but a knowledge that Newton's skill both theoretical and practical rendered him the fittest man in all Britain to direct the execution of a great reform of the coinage."

References:


①Inglis, C. E., Presidential Address, *Jour. Inst. C.E.*, Nov. 1941.

②Young, C. R., "Can professional education be liberalized," *Eng. Jour.*, Oct. 1942.

③Inglis, C. E., "The status and work of engineers," *The Engineer*, Oct. 30, 1942.

④Hindley, Sir Clement, "Engineering economics, organization, and aesthetics," *Jour. Inst. C.E.*, Nov. 1941.

⑤Richardson, M., "Fundamentals of Mathematics," p. v., (New York, 1941).

⑥Gropius, W., "The new architecture and the Bauhaus" (London, 1935).

⑦Rankine, W., "Applied Mechanics," 1858.

# FISHWAY PROBLEMS ON QUEBEC RIVERS

PERCY E. NOBBS, M.A., F.R.I.B.A.
*President, Province of Quebec Association for the Protection of Fish and Game*

**Paper presented before the Montreal Branch of The Engineering Institute of Canada on February 4th, 1943**

## A. Introduction

The diminution of the inland fisheries of Quebec is due to three main causes: (i) poaching, (ii) pollution and (iii) obstructions. Very few species can be fished out, but the brook-trout unfortunately is one of these. The answers to poaching and pollution are not here under consideration; the answer to obstructions, whether natural falls or man-made dams, is the fishway, which is our present concern.

Consider the rivers in our farming country; half their length is barren of useful species. Perch, for example, have totally disappeared during the period between the wars from long stretches of river where they once were plentiful, in waters which are neither polluted nor much poached, but are much dammed. The fathers and grandfathers of the present 'habitant' farmers in many a long Quebec valley caught and salted all the fish they needed, where to-day they have recourse to sardines and salt cod on Fridays.

Consider our trout waters increasingly invaded by lumbering and water storage operations. The fishway and the spawning sanctuary are more economical answers to this than the hatchery, the proper functions of which are to re-establish stock where greatly depleted and to plant stock in virgin waters, not to maintain stock against legitimate angling.

Consider our salmon rivers with respect to sea netting and the food market. In a hundred years these waters have been reduced by 75 per cent. But what remains of them could be doubled in length and productivity by easing the passage at natural falls. Besides this, there are a number of rivers, once producing salmon, on which lumbering has now ceased, or will soon cease, and where permanent industrial dams are established. These could be restored as salmon rivers to the great profit of the inhabitants of this fair province.

And lastly, consider the commercial fisheries of our great rivers. An adequate fishway at the Montreal Island Power dam and passage at the Carillon Canal dam would soon recreate the shad fisheries all the way up to Ottawa. The harnessing of the St. Lawrence between Lake St. Francis and Lake St. Louis threatens the valuable sturgeon fisheries (which could be further developed) and the still more valuable eel fisheries, to say nothing of the carp and doré and half a dozen other existing fisheries that provide a livelihood for hundreds of families and very desirable supplies to our markets.

In all this, the engineer can make his contribution. River management is a practical science. As in farming, scientific research is a basic necessity; but, as in farming, common sense and energy and an ability to count the cost and to estimate the profits is what matters most.

The fishway engineer has to understand his fish as well as his water. The mathematical formulae involved are neither abstruse nor recondite. There is a good deal of romance in harnessing a river with a dam, for a river can be a very wild thing on occasion; and there is a good deal of sport in getting fish to do what one wants in the matter of ascending a fishway—as much as in getting them to take the fly and come to the bank. And when fish, through their use of a fishway, are fruitful and multiply, there is a satisfaction such as no dead fish, however fine a trophy of one's skill, can rival.

## B. General Considerations

The earliest recorded fishway legislation appears to be that of Alexander II of Scotland (c. 1225) which provided for room for a pig to turn around in, as an opening in all dams on salmon rivers. Haliburton (in Sam Slick) records a heavy daily fine imposed upon a dam-owner at Liverpool, Nova Scotia, in 1853, for not keeping the fishway open. Present fishway legislation in the province of Quebec provides for fishways in all dams "unless" and "unless", etc., with the result that there are (in 1942) very few fishways in the province, as the following table shows.

| | |
|---|---|
| Dams in the province of Quebec, about | 450 |
| Dams needing fishways, about | 180 |
| Ineffective fishways on dams | 18 |
| Effective fishways on dams | 12 |
| Waterfalls needing fishways | 110 |
| Fishways at waterfalls | 1 |
| Projected fishways studied | 10 |
| Fishways unknown to the author, possibly | 10 |

That is to say, in a province twenty times the size of Scotland, with ten times Scotland's river mileage in its accessible parts, there are only about a dozen effective modern fishways known to the author.

Probably the main reason for this state of affairs is that drawings for the type of fishway originally designed by Mr. Cail of Newcastle, England, about 1874, got into the hands of the authorities in various eastern states and provinces and became standard practice. Now this type of fishway is easy and cheap to build and works quite well, if only about half a dozen steps are required. Its defects will be explained later. The apathy of the authorities and the hostility on the part of most dam-owners and of some engineers with respect to fishways may be attributed to the fact that a long obsolete type continued to receive official endorsation in the eastern states and provinces for half a century after better types of fishway had come into general use elsewhere.

The waste of water, that is to say, the use of more water than is necessary for the passage of fish, during far more months than is necessary in the year, has also very naturally increased the general prejudice against fishways.

### Migratory Fish and Dams

All the fish about which the author knows anything are more or less migratory, either in relation to seasonal search for food or seasonal movement to spawning grounds, or both. Every dam, therefore, causes diminution of stock, yet some few dams are very useful in diminishing an undesired species in favour of a desirable one. But, in this connection, we should not assume that suckers are undesirable in trout lakes. True, suckers eat trout eggs; but trout eat young suckers and this produces that balance which results in good sized and even very large trout. The author knows of no lake which can be rated a good trout fishery, producing lots of 2-lb. four-year-old fish and a fair stock of 6 to 8-lb. fish, to which the suckers do not have access. He knows of scores of lakes (and there are thousands in the province) full of 3-oz. four-year-old trout where suckers are absent; and several lakes exist which once held an abundance of 2 to 6-lb. trout where the construction of a dam has ruined the fishery and resulted in starving millions of old small trout. There are, of course, other contributing factors, but this is a matter worthy of biological study which might cause a revision of opinion on the sucker question in relation to fishways. However, there still remain some dams without fishways which are best as they are, serving as they do to keep German carp, bass and pike out of trout waters above.

There is many a long reach of river in Quebec which could support a large stock of some desirable species which cannot do so, solely because a dam prevents access from the reach in question to some suitable spawning and nursery stream above. There is in southwestern Quebec, as revealed by the 1941 river survey (conducted by the Province of Quebec Association for the Protection of Fish and Game in co-operation with the Department of Game and Fisheries), a matter of 400 miles of such barren or unused river reaches.

#### CLIMATIC FACTORS IN DESIGN

The climatic eccentricities of our province exercise certain limiting factors on the design and construction of our fishways. The spring floods are apt to be tremendous affairs if the snow melts quickly; they usually bring ice down with them, sometimes in enormous masses. Furthermore, our severe frosts render it necessary to drain our fishways for the winter. Concrete is not a material easy to use, far from highways, at the back of beyond where most of our fishways must be. Moreover, once broken up by frost and ice and undercutting, the repair of concrete is difficult and expensive. The cost of concrete fishway work can never be less than $300 per foot of rise, while the cost of wooden fishway work need rarely be more than $30 by the same measure; and repair or alteration of woodwork is easy and cheap. Moreover, we are poor, when all is said and done. Most fishways in this province, for a long time to come, must therefore be in wood construction, which necessarily involves some annual maintenance work and inspection for defects.

These things being so, it follows that only certain forms of pool and steps, readily constructable in wood, can usually be used in the designs for fishways in Quebec; and only forms not too readily destructible by ice and frost, whichever material is employed. Many effective and some economical types of fishway recently evolved by designers in other countries are thus barred out, so far as this province is concerned; and some refinements of streamlined form, appropriate enough to concrete construction, have no place in a wooden flume fishway. Some fishways recently constructed in this province which have met with the approval of fish of certain kinds will be fully described further on.

Within the fishway proper there are three things to avoid. The first of these is undue velocity, both over the fishway as a whole and at the points of rapid flow if such there be; the second is turbulence, the enemy of rest and comfort for fish; and the third is aeration which deprives the water of that solidity which is as necessary for the tail of a fish to drive against as for the paddle of a canoe. All three are interconnected; all three are fatally easy to bring about by feeble design or slight errors in execution, and any one of them produces inefficiency. The longer the fishway, the more important it becomes to eliminate each and all of them. Observe that turbulence and aeration are unqualified while it is "undue" velocity that is to be avoided, for there must of necessity be a velocity suited to the kind of fish and the circumstances of the case.

### C. Types of Fishway

#### (a) THE DIAGONAL BAULK FISHWAY

This is one of the cheapest and most efficient types of fishway (see Fig. 1a). It can only be formed in the case of a dam with an even moderate slope from the crest to the foot of the apron and consists of a baulk, set at an appropriate angle so as to form a channel up the dam at a low gradient. There must be a notch in the crest of the dam at the head of the baulk for the easy passage of fish at the top. Unfortunately neither a baulk nor its attachments can stand ice cakes sliding down, besides which very few dams in this province have suitable faces. This type may be regarded as inapplicable here.

#### (b) THE DISHED CHANNEL FISHWAY

In the rare case of a dam with a low enough gradient for fish to ascend, the provision of a channel to give adequate depth at all times is a simple device. Such a channel, however, cannot be readily closed and uses a lot of water (Fig. 1b). It cannot be recommended for use here.

#### (c) THE DENIL FLUME FISHWAY

This consists of a simple flume with a corrugated baffled floor and sides to dissipate the energy of the flow and reduce the speed of the current passing through (Fig. 1c). In cases where flow varies, the flume has to be made deep; and most rivers vary in level from day to day. Recent experiments* have shown that certain kinds of coarse fish prefer this type of fishway. If in wood construction the complicated floor required would necessitate protection and drainage in winter to prevent ice forming in the fishway. This type could be used here in cases where concrete flooring for the flume is possible.

#### (d) THE ALTERNATE OBSTACLE FISHWAY

For fishways of this general type many kinds of baffles on the sides have been tried. These slow the flow appropriately, but most of them provoke a variable surging flow and a stream of mixed velocities in which only small fish could find rest. Such fishway flumes cannot be recommended for long ascents, unless interrupted by frequent large resting pools. Furthermore the baffles, when pointing upstream as they usually do, give lodgment for debris (Fig. 1d). This type is of very doubtful application in this province, but is suitable for small fish such as alewives.

#### (e) THE PAIRED OBSTACLE FISHWAY

Such fishways only differ from the last type considered in that the baffles are not staggered (see Fig. 1e). They are

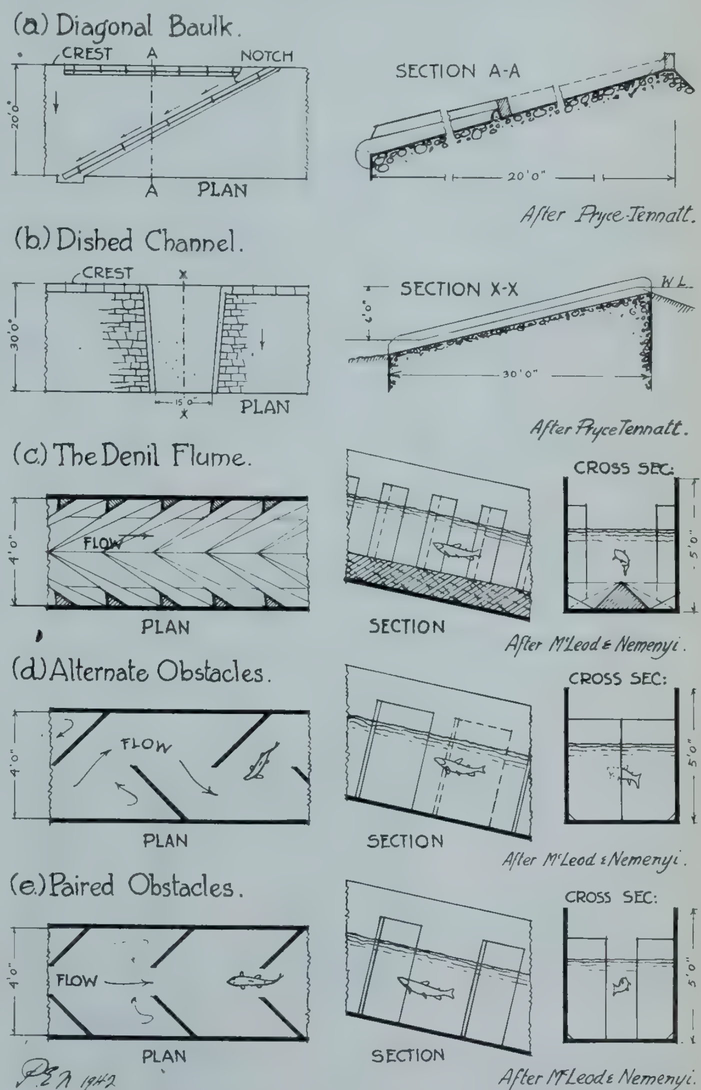



**Fig. 1 — Types of fishway, a, b, c, d, e.**

* A. M. McLeod and Paul Nemenyi, London, Eng., and University of Iowa, U.S.A.

simple and economical to construct and do not provoke surging. With a resting pool after every 8 or 10 pairs of obstacles or baffles and for short fishways with a small rise they are workable but they are wasteful of water compared to certain other types. They are, however, practical for a rise up to 6 or 8 ft.

(f) THE POOL AND OVERFALL FISHWAY

The flume of suitable gradient interrupted by cross walls, or weirs, is an old device. When little water is coming over, the fish are expected to jump from pool to pool, and when there is a rush of water over the cross walls they are expected to take rest and refuge below them (see Fig. 2f). Such fishways use too much water. This type must be regarded as obsolete.

(g) THE "CAIL" OR POOL AND ORIFICE FISHWAY

Most of the fishways of this and our other provinces are of the Cail Type, illustrated in Fig. 2g, consisting of a flume with cross walls having submerged orifices at the bottom of each and staggered as to position. Such a fishway works well enough for a four to six step affair. The flow necessarily accelerates from top to bottom and this is met by diminishing each orifice in succession. In a long series the lower orifices give rise to small high velocity jets passing as much water as the top one does. The result in the lower pools is much aeration and turbulence, two things to be as much avoided as high velocity. Also the pools fill up with trash which blocks the orifices. No more Cail fishways should be built in this province for more than a 4-ft. rise.

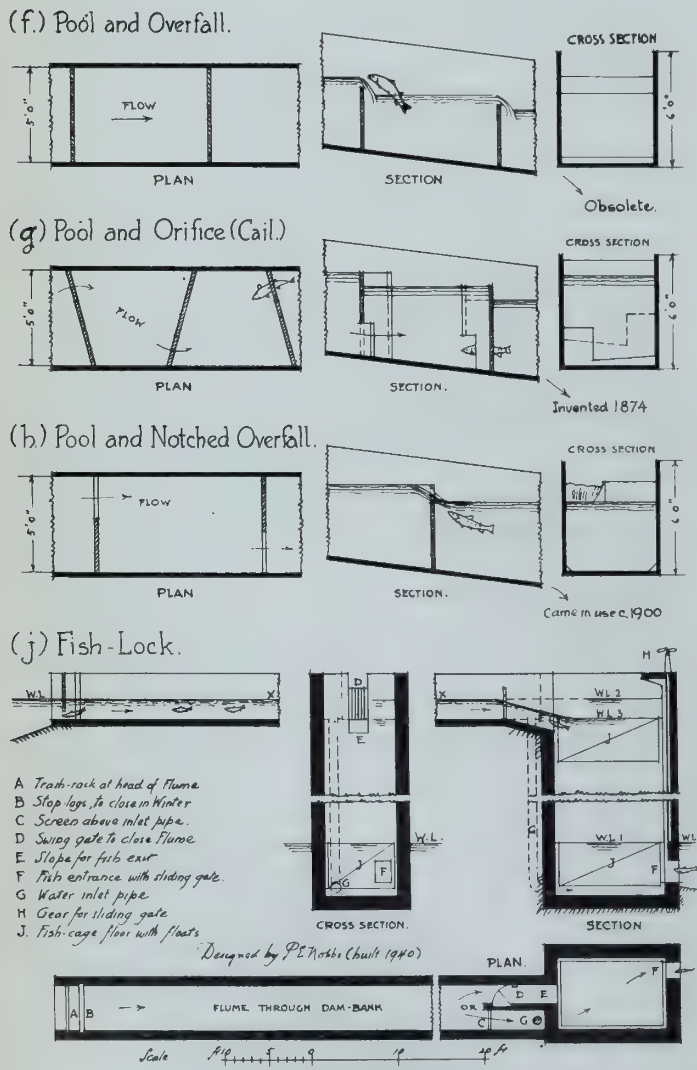



**Fig. 2 — Types of fishways, f, g, h, i.**

(h) THE POOL AND NOTCHED OVERFALL FISHWAY

This is the basic type for many successful fishways built between 1914 and 1942, in the British Isles. The cross walls are notched at alternate ends giving a series of easy flows from pool to pool and economizing water (Fig. 2h). When properly proportioned there is no acceleration, each pool receiving and delivering the same flow owing to what may be called its own internal dissipation of energy. Various recent improvements have been made in the design of the notches. The modern notch is a slide rather than a step. The earliest fishway of the type (but without slides) in this province was designed by Mr. Hocken of the Department of Fisheries at Ottawa for concrete construction at St-Ours on the Richelieu about forty years ago. It is working to-day and many sorts of fish continue to use it. This type appears to be pre-eminently appropriate for adaptation to most fishway problems in Quebec.

(j) FISH LOCKS

Automatic fish-locks have been designed and patented and fish-locks operated by hand are quite feasible. There is no doubt that they are very economical of water. One constructed at Ile Juillet, Beauharnois Dam No. 1, is operated by hand and contains, before raising the level, 500 cubic feet of water, being 8 by 12 ft. in area (Fig. 2j). This accommodates about 350 3-lb. fish at most; it takes twenty minutes to fill up and pass the fish on, and about half an hour for a fair "haul" of the fish present outside to enter. But to cope with the vast number of fish subsequently found to be present outside, an area at least ten times as great would be required and to attract large fish the flow might have to be increased. Besides economy of water there is great economy of construction on the scale carried out. There would, however, be no economy of structural cost, or water, over an ordinary fishway in a case where 3,000 to 4,000 fish had to be passed every hour. This type thus has its very definite limitations of application.

## D. The Design of a Pool and Notched Overfall Fishway for Wood Construction

THE FISH ENTRANCE

Unless fish come naturally to the foot of a fishway, or can be induced to do so by alterations to the river bed, there is, of course, no way of getting them to come in and begin the ascent. The determination of the position of a fishway is often largely conditioned by the nature of the dam to be surmounted and the uses made of it. This may mean that the point below the dam to which fish would naturally come cannot be used for the fishway. It then becomes a matter of making a better place (and possibly ruining the good natural place) so that fish will come to the neighbourhood of the entrance. That is an operation of what is called "river improvement work".

The actual fishway entrance needs a sharp flow. As there may be only five cubic feet of water per second passing down the fishway, this means a narrow opening, as the depth at the fish entrance will be anything from two to four feet. An opening 16 to 20 inches in width will let anything but a 100-lb. sturgeon through. A fish entrance 18 by 36 inches (or 4½ sq. ft.) passing five cubic feet a second gives a flow of a little over a foot a second which is the least velocity advisable. This mild small stream must deliver into a heavy stream and this can be obtained by constructing a by-pass or by arranging that a sluice gate adjoining the fish entrance should be the last to be closed in case of low water. With the water very low, fish would, of course, not be in any mood to run (see Fig. 3c).

THE FISH EXIT

Passing to the other end where the water comes in and the fish go out, we have the following problems. Salmon will need an orifice at the head to be 18 by 18 inches and, if there is a gate, they will need at least 12 inches of water over the sill. At the water intake there must, first of all, be a trash rack, preferably adjustable as to levels, to extend 12 inches below the water level which, of course, is usually variable; and then stop logs to close the fishway off all winter. Next comes the head gate to adjust flow and after that anything from one to three cross walls with submerged orifices for the passage of fish under variations of the water levels above. Lastly there must be an overflow for adjustment of water levels in the fishway. All these elements come above the highest notch (see Fig. 3a).

#### WATER LEVELS

The first thing to establish is the normal high and low water levels above and below the dam, or waterfall, and their variations. Next, one must determine the levels at those times of the year when fish will *not* run. That leaves the "working" levels, which usually do not have a range of more than 3 feet above and 1½ feet below the obstruction. The floor of the flume at the head and at the foot can now be fixed at, say, 3 feet below for trout, etc.

#### THE BOTTOM STEP

The bottom step (which will consist of a traverse or cross wall with a notch in it and a slide in the notch like the rest) should be fully awash at "working" low water level below, to make sure that fish can get over it easily. In the case of a dam reached by the tide one may take half tide as "working" low water. One would not put in a lot of steps down to low tide level, because fish would not try to move at low tide; but it would not do to let them in only at high tide because they are apt to move for an hour or two before or after that. And so, with the seasonal floods and operational levels.

#### THE SCALE OF LEVELS

With the level of the lowest cross wall's top and its notch so established, it is a simple matter to decide how many steps are needed to reach the "working" high water level above. Higher levels above are kept out by the control gate and over-flow; and ior "working" low level above, the orifices in the cross walls at the top provide adjustment. The height of the steps is, within limits, determined by the length of fishway there may be room for, or the amount of money available; in other words, by the grade. For salmon, 15 inches is not uncommon and 18 inches is sometimes used, but the author prefers 12 inches for salmon, 8 inches for trout and 6 inches for all other fish. With that settled, one can set up a scale of the number of steps with their water levels and a scale of feet beside it (see Fig. 3d).

#### GRADE OF FLUME

Of course, the shorter the fishway the easier it is to find a place for it and the cheaper it is to build. There is a prevailing idea that one ought to be able to get fish up a 1 in 4 slope and one can do this with a Denil fishway if the height to be surmounted is only 6 to 8 feet. The idea at the back of the Cail, the Denil and all the many baffled flume types is to so disturb the water that it must go slow. But all this disturbance produces states of turbulence and aeration which fish do not like, and, in extreme cases, cannot swim in, possibly because they become "drunk" with too much oxygen, and certainly because foam is not solid enough to grip. As a consequence of all this, many fishways have been failures and confidence in all types of fishways gets shaken in many quarters. Given an invitingly contrived fish-entrance, fish should be able to move up quickly without undue struggle. The fact that a fresh salmon with a good take off out of water 15 feet deep can jump 11 feet and bury his nose in the head of a fall, and get over the crest, has nothing whatever to do with fishway design. Gravid fish in cold water from 2 feet to 4 feet deep cannot be expected to do gymnastics. To get sure results with salmonoid fish, the grade should not exceed 1 in 10. For a short fishway for trout 1 in 8 will do at a pinch; but 1 in 12 is better than 1 in 10 for salmon, giving more length-room in the pools. For non-salmonoid fish in general, a grade of not less than 1 in 12 is recommended. The small black sucker is the gamest fish that swims and can move for quite a long time against water running 15 feet per second. In such water a salmon could only make a few yards and then fail. It follows from the above that with steps 12 inches high the pools would in general be from 10 to 12 feet long. In a fishway for coarse fish with steps 6 inches high the pools should be at least 6 feet long.

#### WIDTH AND DEPTH OF FLUME

The cost for length should never be pinched. Of course the longer and wider and deeper the pools are, up to 8 by 16 ft. and 5 ft. deep, the better; but for wide deep pools the costs mount up, especially in wood construction. A salmon fishway flume need not be more than 5 feet wide with pools 3 feet deep at the upper end and 4 feet deep at the lower end (average depth 3 ft. 6 in.). For trout, 3 ft. 6 in. of width and 2 ft. 6 in. of average depth is quite sufficient.

#### NOTCH SLIDES

Mr. J. Rook (the English fishway designer) was probably the first to introduce streamlined notches with slides in place of mere square openings in the cross-walls. The slides usually have a grade of 1 in 2. For salmon a 2 ft. wide notch is advisable, as deep as the rise from pool to pool, say 12 inches; for trout 1 ft. 6 in. by 8 in. will do. It will thus be seen that the flow through a fishway need have a sectional area of not more than two square feet for salmon and about one square foot for trout. The pool and notch

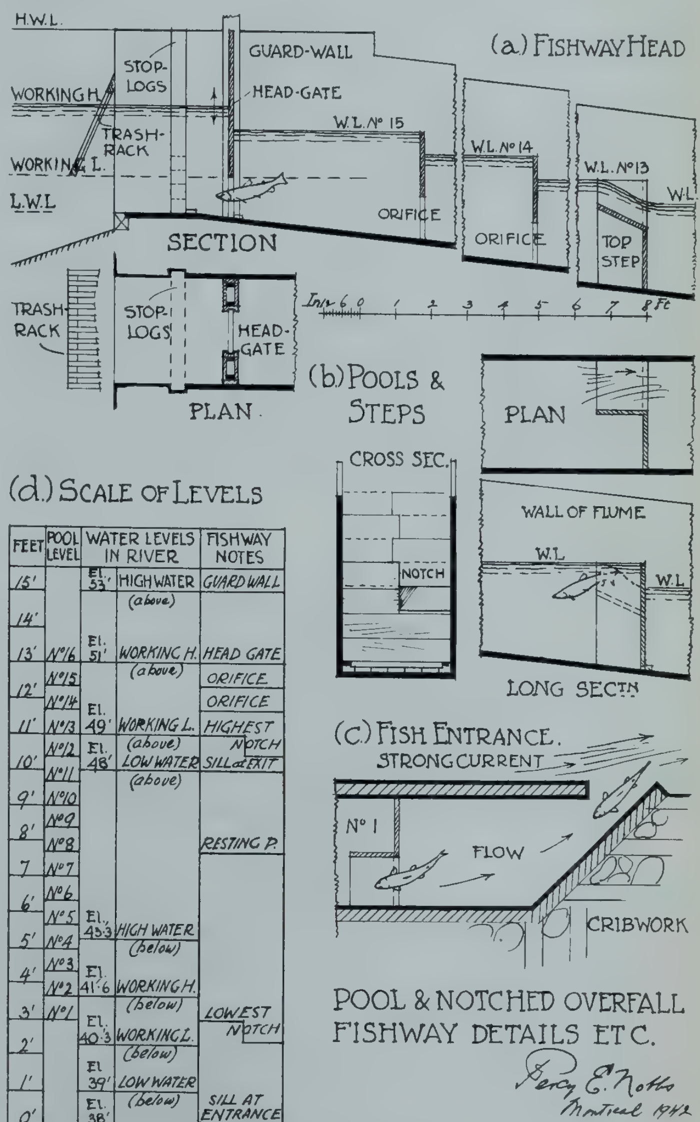



**Fig. 3 — Details, pool and notch overfall fishway.**

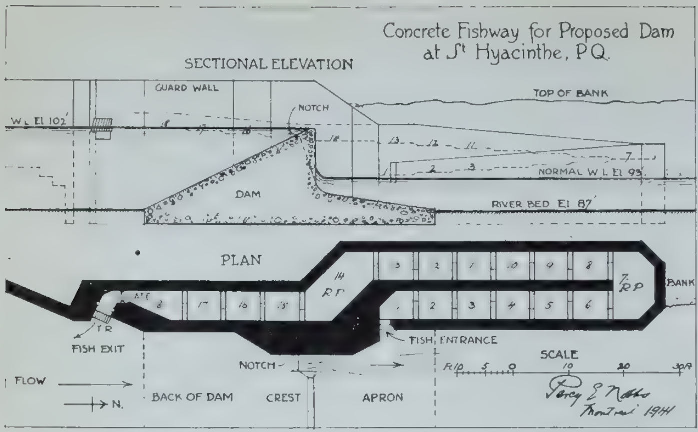



Fig. 4 — Proposed fishway at St-Hyacinthe, Que.

overfall type of fishway thus requires less water than any other type. Allowing for three months' operation in the year this is a moderate consumption. Compensation for leakage in the flume can readily be made by slightly narrowing the lower notches in the case of a long fishway, so as to keep all pools equally full (see Fig. 3b).

#### TURNING POOLS

When a fishway has to be over 100 feet long it should be interrupted with a larger resting pool. In practice, fishways of such length and over usually have to double back and forth like flights of stairs from a landing. The turning pool thus comes out from twice to three times the area of the pools in the flights and serves as a resting place (Fig. 6). This resting is not necessarily a matter of fatigue. A fish will not charge up a set of steps in the eye of the sun; even with the sun across the flight a fish may refuse the notches on the sunny side. These turning pools count as steps; it is well to make them a foot deeper than the outgoing flume and to give each a drain plug. With weep-holes at the floor in the cross walls of the flight above, each flight with its turning pool below becomes a separate drainage unit.

A flight of seven steps works well between turning pools. The number must be uneven so as to get the notches leading in and out of the turning pools at the ends of the broad sides, not close together at the centres. This may be regarded as the basic pattern for a long fishway, and a fishway may be considered long if the rise is in the neighbourhood of 20 ft. For a very long fishway, 70 ft. of rise, let us say, two or three really big resting pools, with natural bottoms if possible, and capable of harbouring 40 or 50 salmon in comfort, are desirable (see Fig. 4).

#### SHORE AND CENTRAL LOCATIONS

Most fishways occur on the shore at the side of a dam and it is important that the river bed below the dam at its other end should not be too inviting. There is some evidence that salmon will work back and forth below a dam to find a way up, if there is one; but this may take weeks and expose them meantime to poachers. When a fishway is not at the shore, a long crib with a hollow centre for the fishway is necessary. This arrangement is useless if the crib extends below the foot of the apron of the dam. The entrance to the fishway should be at the foot of the apron or within it, and the fishway with the cribwork on each side of it should extend up into the pool above the dam. Fish may nose back and forth below a dam to find an opening, but once they get their noses to a dam apron they cannot be expected to turn round or drop back to seek an opening lower downstream (see Fig. 5).

A fishway is converted into a fish-trap by the simple processes of breaking out the lowest cross wall or blocking the flow at the head. (Examples: at Windmill Dam, Richelieu River; and Penman's Dam, Yamaska River). A fishway must therefore be securely enclosed with a lock-up access gate and the stream below the fish entrance should be strewn with concrete blocks with iron spikes in them against netting. The Nova Scotia law prohibiting angling within 100 feet of the foot of a dam or fishway has much to be said for it. The angler may have a gaff, or else a spear nearby.

### E. Present Procedure and Improved Legislation

#### CONSTRUCTION DIFFICULTIES

When the fishway designer has produced a plan that meets with the approval of the appropriate authorities in the Department of Game and Fisheries, the plan goes to the dam-owner. In the case of small owners the plans have to be in pretty full detail, while in the case of large concerns employing their own engineers the plans given omit structural details such as reinforcement of concrete or the framing of supporting staging for wood construction. The designer, if anything is to be achieved, must visit the site and explain matters to the builder. Most fishways are in out-of-the-way places and the construction foremen usually have no fishway experience. Fishways are tricky things and very small errors in construction disarrange the flow. The result when the designer inspects the fishway on its alleged completion usually involves some rectifications, great or small. One present difficulty is to provide inspection during construction. The Quebec Streams Commission (with its engineers stationed or moving about, as some of them do, all over the province) could provide this service economically. Visits to the site and inspections by an independent expert may easily, in the case of a small fishway, cost quite as much as the construction.

#### MAINTENANCE DIFFICULTIES

With our fishways of necessity mostly of wood construction, annual inspection and maintenance is essential. Flood damage, or a leak from decay, not only tends to grow if neglected, but usually puts a fishway out of commission at once. Annual inspection and attention to see that repairs are promptly made is costly. Here again the Streams Commission could be of great service at far less cost than sending the designer round all his fishways in the province. The Department of Game and Fisheries, Quebec, has no engineers or builders on its permanent staff.

When a fishway is completed instructions should be given as to the flow desired and the annual dates between which such flow should be maintained for the fish concerned. As things are, these instructions get lost or the servant of the dam-owner who knows about them gets moved. Thus a fishway may waste a lot of water to no purpose. Both the charge and management of fishways should be in the hands of the fish and game wardens who are in touch with the Departmental officials.

#### OWNERSHIP OF FISHWAYS

The present legislation could be greatly improved by providing (1) that the dams must have a suitable site and

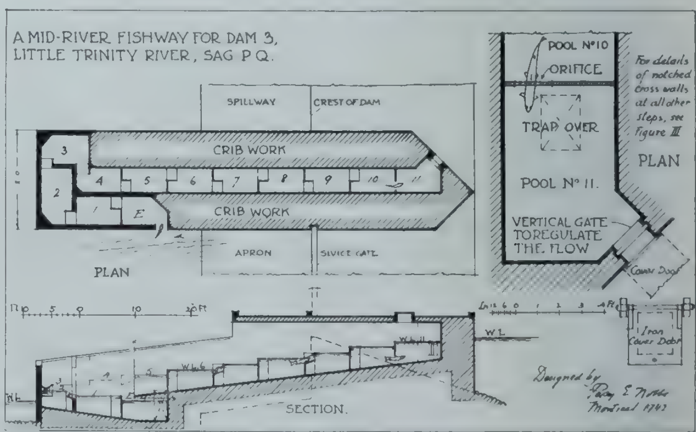



Fig. 5 — Trinity River fishway, Dam No. 3.

opening for a fishway provided by the owner; and (2) that the Department of Game and Fisheries would construct, maintain and operate such fishways as it might consider necessary. If this change were made the construction and maintenance could very properly be handed over to the Streams Commission while the operation would be in the hands of the game wardens.

The conversion of a fishway into a fish-trap is a five-minute job and this very prevalent offence would be less practised if the fishways were Government property and the game wardens had charge of them and responsibility for their enclosures.

### F. Storage and Hydro-Electric Dams

#### STORAGE DAMS

A very clear distinction must be made as between storage dams and dams at which power is generated. In the first case great areas are inundated, producing a pollution from decaying vegetable matter which may take half a century to pass away and the storage is usually for winter use and derived from the spring flood which ceases to occur below the dam and may be greatly reduced over the river below. Thus the pond above a storage dam may be full all summer and be all but empty in February; and this "pond" may be a lake 50 to 100 square miles in area. But, in some cases, usually small affairs, the storage may be for summer use of the water. Thus, if there is any question of a fishway in connection with a storage dam, the flow in the river throughout the year has to be taken into consideration.

If the dam in question is operated for lumbering in the spring, a great many fish will wash out and the object of the fishway may be the return of these fish to the waters above. In that case the designer of the fishway is only concerned with spring levels. Or, in the case of storage for summer use there may be no spring wash out of fish but there may be the autumn run to take into consideration.

Where a storage dam exists for winter use of the water, there is apt to be a complete upset of the fish life above and a fishway to facilitate the ascent of fish from below may be quite useless. Mr. W. L. Calderwood, the Scottish expert, in the January, 1942, number of the *Salmon and Trout Magazine*, writes an illuminating article on the compensating work involved in such cases. The principle accepted in Great Britain which he enunciates is a sound one. In such a case no fishway is required, but whatever river improvements works, such as opening up new spawning streams, the construction of new spawning grounds, etc., will tend to maintain the stock of fish in the river system in question, may be called for instead.

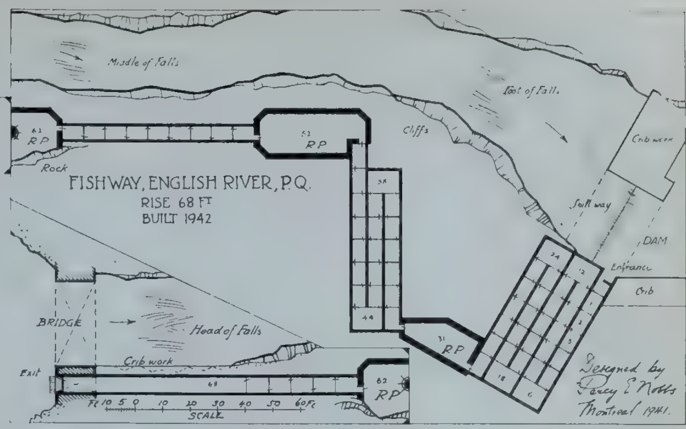


Fig. 6 — The English River fishway, 68 feet.

#### HYDRO-ELECTRIC POWER DAMS

In the case of a dam with a hydro-electric plant upon it, the water levels above and below naturally vary very little, being under control. The barrier is in most such cases long, but the fish-holding water is usually immediately below the power house in question. The best position for the fishway is then likely to be a very difficult matter to arrange after the power house is built and in operation. A case in point may be cited at the Montreal Island Power Company's plant. There a fishway leading from shallow quiet water, and of the Cail type, has proved quite useless and the only practical solution is a fishway through the structure, which happens in this case to be possible.

#### LONG DAMS ON GREAT RIVERS

Very long dams on great rivers present many difficulties Sites for fishways at the shore ends are preferable because most fish in large rivers work upstream near the shore, particularly sturgeon. But in such dams there is constant adjustment of the great gates causing not only variations in water levels, which are difficult enough to deal with, but also sudden variations of terrific currents and the back eddies they set up, so that fish at a given point may be headed one way one day and in the opposite direction the next. The problem of contriving suitable conditions outside the fish entrance under these difficulties is outside the control of the designer. Fishways in a central position within a double pier may offer the best solution in such cases, but they would involve greater expense than shore-based fishways.

## DISCUSSION

Vernon E. Johnson[1]

Having some experience in the location of fish within the province, I have no hesitation in approving the intent of Mr. Nobbs' paper—that is to promote better and more accessible sport fishing, commercial fishing for the moment being a separate issue. The pulp and paper industry recognizes the necessity of promoting better possibilities for sport and pan fish, but it is necessary to determine whether or not fishways are required. Where shall they be built? Who will pay the cost and who will look after their maintenance?

It is quite certain that trout and salmon will, to some extent, use fishways. Most of the logging and pulpwood operations are confined to waters carrying these species. However in some cases bass, pike, and doré inhabit the driveable streams and lakes where logs or pulpwood are handled. I have no convincing examples that these fish will use fishways if provided. On the other hand, coarse fish such as suckers will use a fishway more readily even than trout. Is it necessary that industry be burdened with costs for such an uncertain result?

I will not comment on the structural design of Mr. Nobb's fishways, he is critical of a sample which I have—a model of one that produces reasonable results.

Before we commit any one to legislation or expenditures, it appears that continued study must be made to show that fishways are required—first, in specific cases, then a more general installation based on sound results.

There are three types of dams referred to:

1. Logging dams—usually of a temporary nature though often maintained for periods up to ten or twenty years.

2. Power dams—such as those on the Saguenay, St. Maurice, or Gatineau.

3. Storage dams—administered and controlled by the Quebec Streams Commission.

There is no doubt that fishways in logging dams can be provided—but the majority of these dams are opened during the summer and fall, or even during the spring driving

[1] Manager, Woodlands, Canadian International Paper Company, Montreal, Que.

period for the passing of logs, and therefore water levels fluctuate rapidly.

In the case of large power dams such as those on the St. Maurice or the Gatineau, it does not seem possible to construct a fishway that would be economical or used by the fish. When the gates are open a fishway could not be used and the cost of building and maintenance would run into a heavy expenditure. The storage dams are in much the same class, except that they are closed for greater portions of the year—more frequently opened in winter.

In any case, why does a fish want to get on the other side of the dam? If we want more fish above the dam perhaps stocking with suitable species can answer the problem in many cases at a greatly reduced expenditure.

There are exceptions where large quantities of fish accumulate at the foot of dams—and are taken by fishermen at will until depleted. There are cases where sport fishing is ruined by power dams—such as the ouananiche at Lake St. John. If this type of fishing is lost, we might have to substitute red trout or land-locked salmon in the quiet waters above the dam.

The industry feels that administration of the forest assets, including fish and game, can best be handled by one authority. If we do not co-operate it is easy to get an autocratic rule which does not fit with the present field staffs of the industry. There is, to-day, among forest operators a more tolerant attitude toward sportsmen, for whom the forest roads and camps now provide greater facilities of access. We, however, must face the risk and danger of more fires if more people are in the woods. We have shown to the government our willingness to co-operate by using fire rangers as game wardens. In some instances, the forest industries have built up, protected and maintained both good hunting and fishing within controlled areas. These demonstrations show that similar results can be had in other areas if properly studied and developed.

In some cases there has been a great increase in numbers and size of fish where dams have been created, due to the formation of more feeding and spawning grounds.

If it is demonstrated that fishways are necessary, industry will readily co-operate in a plan for wider use of our national assets. Water can be used for both fish and industry if properly planned. There is no criticism of the suggestion that the forest industries when building dams should provide a place for a fishway—but our present attitude is that some other agency should pay the cost of fishway construction and maintenance.

O. O. Lefebvre, m.e.i.c.[2]

Dr. Lefebvre remarked that he was not entirely in agreement with Mr. Nobbs as regards the injury to fish life caused by large storage dams. In his experience there was often an increase in fish in the waters above such dams, and while in such cases to build a fishway would be a waste of money, he questioned the necessity of the river improvement works of which the author had spoken.

In regard to the water needed by a fishway, it must be remembered that in addition to the water passing down the fishway itself, a considerable additional flow had to be provided to make a stream past the fishway entrance so that the fish might find their way in. In the case of a large fishway like the $5,000,000 installation at the Bonneville dam on the Columbia River, in the United States, which passes 25,000 fish per hour the total water needed was some 6,500 cu. ft. per sec.

Dr. Lefebvre had in the past been somewhat averse to fishways but his views had been modified by recent information. He now thought that more rivers in the province —specially salmon rivers — should have fishways, particularly where natural obstacles now exist.

[2]Vice-President, Quebec Streams Commission, Montreal, Que.

J. A. McCrory, m.e.i.c.[3]

Engineers in the province of Quebec are not antagonistic to the provision of fishways in the dams with which they are concerned, but it must be acknowledged that they have been apathetic. One reason for this is the lack of agreement on the part of the experts as to the design of fishways that will be acceptable to the fish themselves. This is shown by the large proportion of ineffective fishways in the total number of fishways in the province as given in the tabulation on page 202 of the *Journal*. Another reason is the practical difficulties that would be encountered in the provision of acceptable fishways in the large structures with which engineers are usually concerned. A third reason is that most of these large structures have been located on rivers which have never been frequented by valuable fish species. It is possible that the reason for this condition is the existence near the mouths of these rivers of impassable natural barriers such as Shawinigan falls on the St. Maurice, the tremendous series of falls and rapids in the short reach of the Saguenay between Lake St. John and the mouth of the Shipshaw, Montmorency falls on the Montmorency river and the Seven falls on the Ste. Anne de Beaupré.

The provision of fishways in the large power and storage dams, as Professor Nobbs has pointed out, would have been an expensive and very difficult matter and the problematical benefits derived would hardly have justified the expense. It seems to the writer that one of the most difficult problems involved would be the arrangement of a workable exit at the upper end of the fishway. The pond levels in most of the large storage reservoirs vary considerably from year to year and even in the case of many of our power dams there is a large variation in the forebay levels brought about by varying operating conditions.

Professor Nobbs has confined his discussion of the subject to the consideration of timber crib dams of comparatively low head. Most dams of this type in the province of Quebec have been built for logging operations. When used for this purpose the dams are opened and the ponds emptied shortly after the spring flood to assist in flushing the winter's accumulation of logs downstream. The dams then remain open throughout the summer and fall. During the years when logging is not carried on along the streams served by these dams, their operation is sometimes taken over by the power companies to augment the storage along the river. In this case the cycle of operations is different, introducing an entirely different fishway problem.

The amount of water required to operate the type of fishway recommended by Professor Nobbs is given in the paper as 5 cu. ft. per sec. This is the theoretical discharge through a notch with free fall 12 in. deep by about 18 in. wide. Over a period of three months, which is given as the normal period during which fishways should be operated, this discharge will amount to approximately 40 million cu. ft., not a great amount. However, one company that I know of operates 25 such dams ranging in head from 5 to 16 ft. If each of these dams were equipped with a fishway operated for a period of three months the total discharge would be considerable. As the period of operation of the fishways would probably not coincide with the period during which withdrawal from storage for production of power would be required this water would be wasted. On the St. Maurice alone this would amount to a loss in power output of 7,000,000 kwh. or a reduction in capacity of approximately 4,100 hp. When one applies the same reasoning to all of the river systems in the province which are important for power production it would seem that some more economical means of fish propagation might be devised.

Professor Nobbs points out that "the diminution of inland fisheries of Quebec is due to three main causes (1) poaching, (2) pollution, (3) obstructions." It would be interesting to know which of these three is the most responsible for this condition. So far as the fishing with which most of us are

[3]Vice-President and chief engineer, Shawinigan Engineering Company, Montreal, Que.

familiar, namely trout fishing, is concerned I am inclined to believe that poaching is the villain in the piece. However in the case of the commercially valuable species of fish, the protection of which, after all, is the only consideration on which any great expenditure for fishways can be justified, it is possible that the other two causes may enter to a greater extent.

M. V. Sauer, M.E.I.C.,[4] and L. H. Burpee, M.E.I.C.[5]

Mr. Nobbs has done an excellent job in preparing this paper on fishway problems, and it is our hope that it may be the means of interesting many other people in this important subject. The following remarks deal with some features of the fishway constructed at the Ile Juillet dam in the St. Lawrence river, which Mr. Nobbs has referred to and which is indicated on his Fig. 2(j). The Order-in-Council approving the design of the dam stipulated that a fishway must be provided, and Mr. Nobbs was appointed by the provincial government to supervise the layout of the fishway. It was built during 1940-41, and during the past year a close record was kept of the operating results. Through the co-operation of the Quebec Association for the Protection of Fish and Game, the services of Dr. V. D. Vladykov were made available for carrying out these observations.

There is no doubt that on a large river it is difficult to maintain suitable approach conditions for the fish below the dam. In this case there are 14 large sluice gates and the range of flows is such that there may be from two to ten gates open throughout a normal season. The head at the dam may vary from about 6 to 15 ft. with the consequent variations in velocity. The fishway is located near the south abutment of the dam, and in such a position that fish working up against the current along the south shore are most likely to find the entrance. Results proved that the arrangement of open gates needed to be kept in mind for the maintenance of proper currents.

Some of the results of Dr. Vladykov's observations are as follows:

1. The season of migration of fish in the St. Lawrence river extends for about four months from April to July (inclusive).
2. The important species of fish found in this part of the St. Lawrence river are sturgeon, maskinongé, doré, smallmouth and rock bass, various kinds of suckers, and eels.
3. Only a very few doré passed through the fishway during its first season of operation, but this is probably due to the fact that it was not put into operation until the middle of May, after the spawning season for doré.
4. Maskinongé and sturgeon were seen in considerable numbers near the entrance to the fishway, but did not enter. This may be due to inadequate size of opening (18 by 18 in.), or to insufficient flow of water to attract them.
5. The other fish passed up the fishway in large numbers, about 33,000 having been counted last season, but even this number appears to be a very small proportion of the fish observed immediately below the dam looking for a way to get up.
6. Light conditions played an important part in the way the fish acted. Fish entered the well readily when the sun shone down into the well, or at night when a light was arranged to shine towards the entrance door. Except for the eels, they did not enter the well at night without the light, and did not enter as readily in day-time until the sun was well up. On the other hand, fish came out of the well into the flume quickly when the flume was wholly or substantially shaded, but would not come out into the flume when it was all in sunshine.
7. With best light conditions and with suitable currents to attract the fish to the entrance, as many as 300 fish entered the well in 15 minutes.

In a general way it can be said, then, that this type of fishway worked well from a mechanical and hydraulic point of view. It was relatively inexpensive to build, but requires a man to operate it for a four month's period each year. It is operated with a very small amount of water, but that feature is of little importance in the case of the St. Lawrence. Various types of fish entered the well in large numbers and passed easily through the flume. By the knowledge gained in the first season of operation, it is expected that very much larger numbers of fish can be passed up the fishway in future years. The relative economic advantage of the lock type over the stepped type increases with the height of the dam.

In concluding these remarks about the Ile Juillet fishway, we should like to say that the success of this particular fishway is due to painstaking efforts of Mr. Nobbs in the care with which he designed it, and in the great amount of time which he gave to the experimental operation of it during the past season.

[4]Hydraulic Engineer and General Superintendent of Generating Stations, Montreal Light, Heat and Power Consolidated, Montreal, Que.
[5]Montreal Light, Heat and Power Consolidated, Montreal, Que.

The Author

Mr. Nobbs, in reply, remarked that in making a study of fishway problems he had been animated quite as much by the interests of the pot fishermen and the inland commercial fishermen as by the sporting interest. He was a little tired of hearing that no fishways should be built for the commoner fish till we knew more about how to make them. The only way to learn was by trial and failure and Mr. Hocken's old fishway at St-Ours had been a success for such fish till the head of the dam was raised subsequently.

Mr. McCrory had asked which did most damage to fisheries—poaching, obstructions or pollution? On the whole, pollution was our worst enemy of fish life because it affected all kinds of fish where it occurred.

As to lumber dams in operation for ten years, fishways were hardly to be considered, but such dams should be opened up when done with. The cribwork and apron usually remained as an obstruction. The fishway policy should be directed chiefly to the rivers where lumbering had now ceased or would soon cease, and where permanent dams for local industries had been established. Many rivers in this category could be restored for salmon and many others could be saved, or restored, as general fisheries for the good of the local population, by the construction of fishways. On those rivers, where lumbering is a thing of the past, very few of the dams were for water storage with variable levels, so the problem was usually simple—the lip of the dam fixing the upper water levels.

R. N. Coke, M.E.I.C.[6]

In thanking the speaker, Mr. Coke observed that many of the fishways, which under the existing law had in the past been constructed in this province, were mere tokens to comply with the law. No one had expected fish to use them and the fish had not used them. He had been greatly interested in seeing fish go up certain of the fishways referred to by Mr. Nobbs in his paper.

Bibliography

The bibliography of fishways runs to some 167 useful works according to Mr. Paul Nemenyi and there are a considerable number of others which one may regard as more or less obsolete. The author has found the following very short list of use:


1. *Salmon Passes* (No. I and No. II) by W. L. Calderwood, Fishery Board for Scotland, 1926.
2. *Fish Passes* (The Buckland Lectures for 1937) by T. E. Pryce-Tennatt. Edward Arnold & Co., London.
3. *An Investigation of Fishways,* by A. M. McLeod and Paul Nemenyi, University of Iowa (Bulletin 24) 1939-40.
4. *An Annotated Bibliography of Fishways,* by Paul Nemenyi, University of Iowa (Bulletin 23), 1939-40.
5. *Fish Pass Making* (a review of the report of the Civil Engineers' Committee) by W. L. Calderwood, *The Salmon and Trout Magazine* No. 106, (Sept., 1942), Fishmongers Hall, London.


[6]Vice chief engineer and general superintendent, Montreal Light, Heat and Power Consolidated, Montreal, Que.

# HANDLING LARGE CAPACITY TRANSFORMERS

HERBERT L. WAGNER, M.E.I.C.
*Assistant Engineer, Hydro-Electric Power Commission of Ontario, Toronto, Ont.*

During the past twenty-five years, electric power transformers have greatly increased in capacity and weight. The ultimate size of these transformers is, to a large extent, controlled by the shipping facilities of the railway companies. These companies have, concurrently with the growth in individual transformer capacity, improved their road beds, increased the carrying capacity of their rolling stock, and developed new centre-depressed cars as shown in Fig. 2, with the result that in Canada to-day, they are able to carry transformers having a shipping weight of 135 tons. Such transformers when in service with their full equipment (including oil in place of the nitrogen gas used in shipment) weigh in the neighbourhood of 200 tons. Transformers that have an ultimate weight much in excess of this would have to be shipped in parts and assembled at their destination.

Owing to the loss of capacity in the event of one of these large transformer banks being out of service, it is necessary, in case of failure, to resort to a speedier method of handling than the slow and cumbersome method often employed in moving smaller transformers. This applies particularly where transformers may have to be shipped back to the maker for repairs.

In moving smaller transformers, a method frequently used is to lay timber tracks and move the transformer on rollers. This method is neither practical nor sufficiently expeditious for larger transformers, which are therefore moved on their own wheels, the railway siding, where possible, being extended to the transformer foundation, permitting the transformer to be wheeled directly from the railway car to its permanent position. Where it is impossible to extend the siding to the transformer foundation, an auxiliary track is installed, extending between the railway siding and the foundation, the transformer being carried over this track on a special transfer truck.

The accompanying series of photographs shows a heavy transformer being received by the Hydro-Electric Power Commission of Ontario at one of its transformer stations. At this station an interesting problem presented itself. The nature of the site is such that it not only prevents the railway siding from being extended to the transformer foundation, but the auxiliary track between the railway siding and the foundation has a right-angle track intersection. To cope with this condition a transfer truck was designed having two sets of wheels, one set for each direction of track.

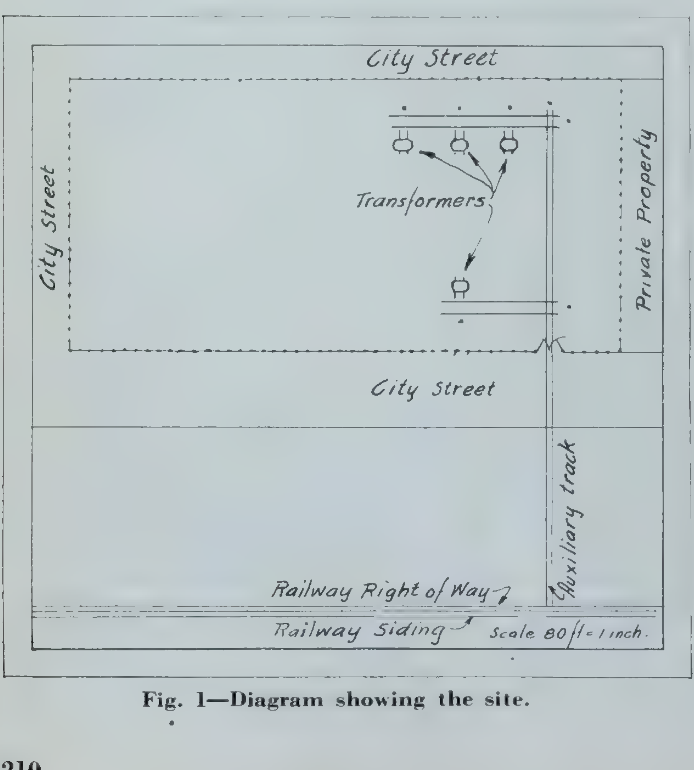



Fig. 1—Diagram showing the site.

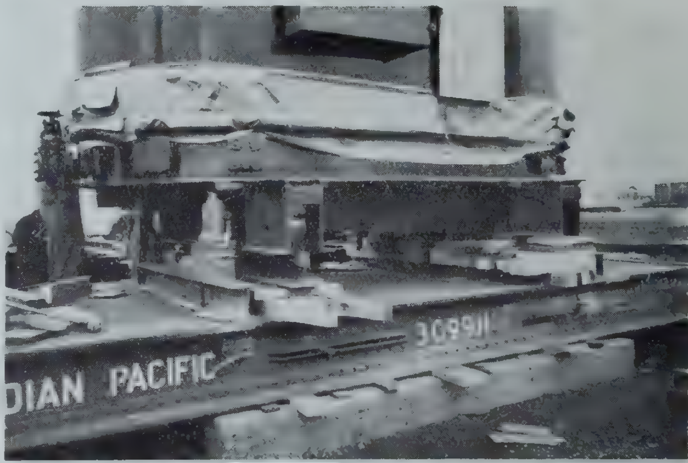



**Fig. 2—Rail placed under wheels at one side of the transformer.**

To begin with, the body of the centre-depressed car is raised to its unloaded height and supported on timbers. This relieves the springs from the weight of the transformer, and prevents the body of the car from tilting as the transformer is removed from the car. The method of jacking up the transformer is such as to permit rails to be placed under the transformer wheels.

Figure 2 shows a rail placed under the wheels on one side of the transformer. The jacks are supported on steel beams which transmit the weight of the transformer to the car girders.

Figure 3 shows the transformer after it has been moved on its own wheels from the car to the transfer truck.

Figure 4 shows the loaded transfer truck at the auxiliary track intersection and in the process of being changed from one track to the other. The position of one set of truck wheels (consisting of four wheels) is fixed relative to the frame of the truck. The other set of truck wheels can be lowered, after raising the truck, to run on the right angle track. The truck when travelling on the movable set of wheels is therefore two inches higher than when travelling on the fixed set of wheels, this difference in height permitting the flange of the fixed wheels to clear the railway track when the transfer truck is moved from the intersection.

Fig. 3—Transformer on transfer truck.

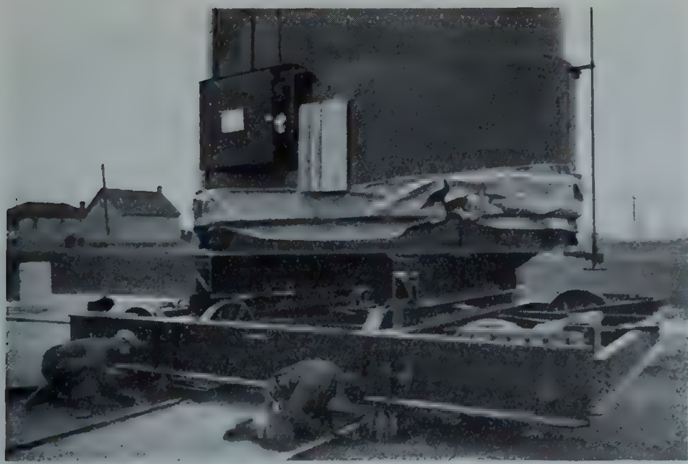


Fig. 4—Changing wheels on transformer truck.

Fig. 5—Pulling transformer onto its foundation.

The movable wheels are each individually mounted in separate frames. When these wheels are carrying load, their frames are connected to the truck frame by means of two pins. To raise a wheel (resulting in the lowering of the truck), one pin is withdrawn, and the frame containing the wheel is rotated about the remaining pin. The frame of each movable wheel is equipped with a screw jack to facilitate the raising and lowering of the wheel and to hold the wheels in the raised position. To change from the fixed to the movable wheels, the truck is jacked up, the movable wheels are lowered, and their frames pinned. First one side of the truck is jacked up and the wheels changed, then the opposite side. In Fig. 4 the rear side of the truck has still to be raised, and the wheels lowered. This can be detected by examining the rear right hand wheel on the truck as shown in the figure. (Note the angle of the wheel frame with respect to the horizontal).

Figure 5 shows the transformer being moved from the truck to its foundation.

In its permanent position, the transformer is supported on steel stools which raise it so that the wheels clear the rails by about one-eight of an inch. This precaution is taken because it has been the experience of the Commission that, when transformers remain stationary for long periods of time on their wheels, the bearings seize, making it difficult to put the transformers in motion when the occasion arises to move them.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

### AN ARMY MARCHES ON ITS ENGINEERING

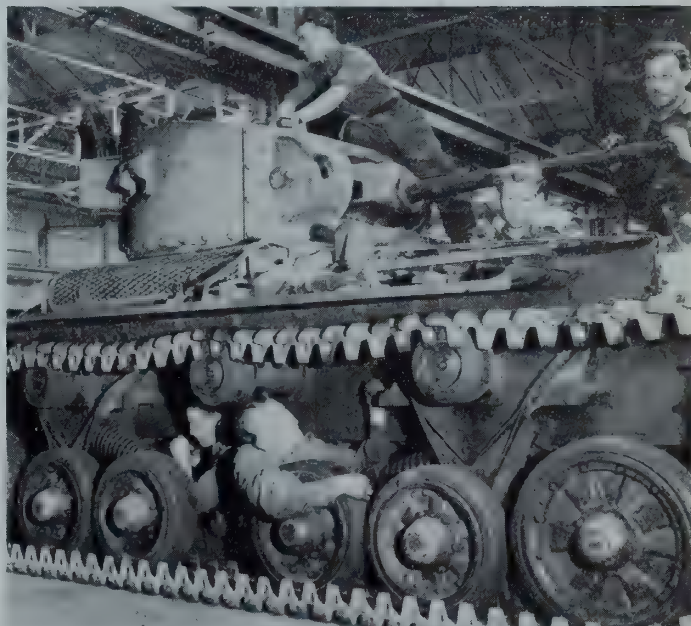
If Napoléon were taken to a modern battlefield he would revise his famous dictum that an army marches on its stomach. To-day it marches on the skill and ingenuity of its engineers.

In peace-time, Britain was world-famous for the durability and meticulous accuracy of her engineering products. She was therefore fortunate when war broke out in having a pool of highly-trained technical men ready to hand. They became instructors of eager and intelligent young men who now form one of the vital elements in a mobile and resourceful army.

It is a tradition in the Royal Engineers that nothing can stop them. They will build a bridge in a matter of minutes; not a flimsy structure capable only of carrying troops but sturdy enough to take the heaviest equipment used in modern warfare—tanks, big guns, tractors. They will cut a road through ground that is broken by trenches or shell holes in the time it takes to smoke a cigarette. They will make raft ferries under fire capable of taking line transport, such as anti-tank guns and tanks, across a river. They will lay a minefield under the enemy's nose or —most perilous job of all—crawl on their stomachs through the enemy's minefields and discover and dig up his mines.

Recently a new engineering corps has been added to the British Army, or rather it is new only in name, for its personnel were drawn from existing units; it is the corps of Royal Electrical and Mechanical Engineers. These men are the front line armourers of the army, a hospital service for inanimate objects. The unofficial motto of the R.E.M.E. is, "Anything that the Army can break we can mend."

The operations of this repair corps cover all the weapons and equipment that an army carries. They will mend a derelict tank or put a new leg on a messroom chair. They



A rush overhaul job on a big tank, in one of the largest R.E.M.E. workshops.

will instal guns on merchant ships or solder a leaking saucepan. They will overhaul a typewriter or dig a tank out of a shell hole.

The Engineers of the British Army have proved their ingenuity in battlefields in three continents. Their skill in improvisation helped materially to rob Hitler of a decisive victory at Dunkerque. Their genius for overcoming obstacles enabled the British Army in 1941 to travel 1,840 kilometres through East African mountain, desert and jungle in the record time of 50 days, with the resultant loss to Mussolini of a vast empire and an army of half a million men. It is the Engineers of the British Army who have encased the shores of Britain in fortifications which Hitler has not dared to assault. In the desert of North Africa, engineers have dug wells and supplied a large British Army with filtered and sterilized water. In Persia, British Army Engineers have built and maintained new roads and railways, which are now carrying an ever increasing quantity of war material to the Russian Army.

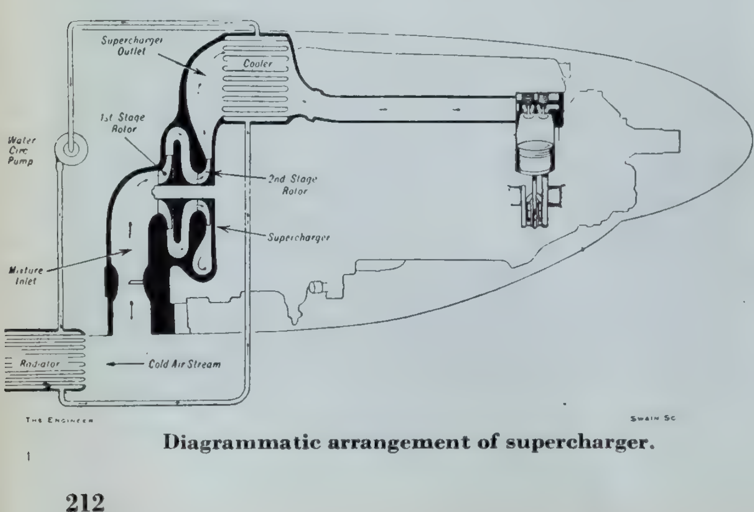
It must not be thought that the Engineers can wield nothing more lethal than a spanner. They are all trained fighters. They can use a rifle as effectively as the ordinary infantryman. They have had courses in unarmed combat. They will, when necessary, leave the lathe to take part in a bayonet charge, or cross a river by a bridge of their own making and wipe out the hostile machine-gun nests that tried in vain to stop the construction.

So important are the technicians in a modern army that it is estimated that one man in every 12 in Britain's land forces is a sapper. Wars are won nowadays by the brains behind machines. In that particular form of brain capacity, Britain has excelled for centuries.

## THE ROLLS-ROYCE "MERLIN 61" SUPERCHARGED FIGHTER ENGINE

From *The Engineer* (London), December 18, 1942

Last week we accepted the invitation of Rolls-Royce, Ltd., to inspect an example of the firm's new "Merlin 61" supercharged aero-engine, which is being fitted by the Royal Air Force to the improved "Spitfire" now operating with Fighter Command. By using a double-stage supercharger, with a water-cooled passage between the first and second stages of the supercharger and a cooler between the supercharger outlet and the induction pipe to the rear cylinder, it is found possible with the new engine to develop double the power output as compared with that of the "Merlin III" the first engine to be fitted to the "Spitfire" fighters. When operating at a height of 40,000 ft., the charge of air and fuel is now raised by the supercharger to six times the pressure of the surrounding atmosphere. Accompanying this article we reproduce a diagrammatic drawing giving a section through the supercharger and illustrating the arrangement of the cooling system.




**Diagrammatic arrangement of supercharger.**

*Engine Particulars*

| | |
|---|---|
| Number of cylinders | Twelve in two banks of six |
| Cylinder bore | 5.40 in. |
| Piston stroke | 6.00 in. |
| Compression ratio | 6.0 to 1 |
| Total capacity | 1647 cubic inches, or 27 litres |
| Cooling medium | Water under pressure, with 30 per cent "Glycol" |
| Net weight of dry engine (estimated) | 1600 lb. plus 2¾ per cent |

*Reduction Gear*

| | |
|---|---|
| Type of gear | Direct spur |
| Ratio | 0.42 to 1 |
| Direction of rotation | Airscrew, right-hand; engine, left-hand |

### PROGRESS IN FIGHTER ENGINE DESIGN

It may be recalled that at the beginning of the war and during the Battle of Britain every R.A.F. first-line fighter aircraft was fitted with the Rolls-Royce "Merlin III" engine, and the complete defeat of the Luftwaffe in August and September, 1940, definitely established the technical superiority of British machines. The superiority was not obtained by chance, but every move of the enemy had been anticipated and a definite counter-move worked out. Early in the war, German aircraft resorted to low-flying tactics, and in order to counter this, Rolls-Royce immediately increased the sea-level power of the "Merlin" engine by 40 per cent by raising the supercharger pressure. This move so improved the performance of the "Spitfire" at low altitude that German aircraft were forced to fly higher, and throughout the Battle of Britain there was a noticeable tendency for the German "ME. 109's" to go higher and higher into the substratosphere, in order to try to escape from our fighters. It seemed at this stage that the German aircraft had an advantage owing to their smaller dimensions and lighter weight, but fortunately Rolls-Royce had ready for production a new supercharger, giving more power at high altitudes, and were able to introduce the "Merlin 45" and "Merlin XX" engines into the "Spitfire" and "Hurricane" classes of fighter, respectively, thereby enabling our fighters to maintain their superiority.

These increases in engine power output were achieved without any radical change to the aircraft, and the flow of fighters from our factories was not affected in the slightest by the modifications made. A continuous supply of improved fighters to the R.A.F. was maintained, as the basic engine remained unaltered, excepting that new supercharger had to be manufactured in large quantities. The war demands that the performance of all types of military aircraft, and particularly that of fighter aircraft, shall continually improve. Ranking above the need for more and more aircraft of all types is the over-riding necessity that our aircraft shall have technical superiority over those of the enemy. It soon became apparent that in the "Spitfire" we had a supreme aircraft from the aerodynamic and military points of view, and all that was required to keep this machine on the top of the list was a steady improvement in the performance of the "Merlin" engine with which it was fitted. An advantage to the R.A.F. was that any improvement thus obtained could be immediately applied to existing aircraft and could be put into service with the minimum of time. With these facts in mind, Rolls-Royce, Ltd., has continually striven to increase the power output of the "Merlin" engine by improvement to the supercharger and carburetor, a logical development being the "Merlin 61," with two-stage supercharger and cooler.

The advantages of the system may be effectively reviewed by comparing the aero-engines which power the various first-line aircraft to the nations engaged in the war. German engines, without exception, are fitted with a single-stage supercharger, designed to maintain ground level pressure in the engine induction system up to a height of 20,000 ft.

Rolls-Royce engines, equipped with a single-stage superchargers designed to maintain the same pressure up to 30,000 ft., and with supercharger rotors running at speeds up to 28,000 ft., have been made, and the increase in altitude thereby gained has been the main means of our achieving technical superiority so far. Certain American engines are equipped with turbo-superchargers, which also maintain sea-level pressure up to 30,000 ft. Although this system is excellent when applied to bomber aircraft, there are, however, technical reasons which make it less suitable for fighter aircraft. Finally, the two-stage supercharger maintains the desired pressure up to 40,000 ft., and stands out above all others as the most successful means of obtaining high power and high altitudes. At 40,000 ft. the charge is compressed to a pressure of six times the surrounding atmospheric pressure, the power of the original "Merlin III" engine being doubled, while at a height of 20,000 ft. the output of the new engine is 50 per cent larger than that of the original "Merlin III."

SUPERCHARGER DESIGN AND ARRANGEMENT

It will be seen from the accompanying drawing that the two-speed, two-stage supercharger has two rotors mounted on a common shaft, the arrangement being two superchargers in series. The mixture of air and petrol drawn through the carburetter is compressed by the first-stage supercharger, and it then passes through a cooled passage to the inlet of the second-stage supercharger, in which its pressure is again raised. After passing through a cooler, which is supplied from an air-cooled radiator, the mixture is delivered to the main induction pipe, which feeds the twelve cylinders, grouped in vee formation in two banks of six. The cooling of the mixture as it is delivered from the outlet of the second stage is effected in the square, box-like structure containing the cooler elements, which is mounted between the rear of the cylinder blocks and the supercharger casing. As previously mentioned, in addition to the main cooler there is a water-jacketed passage between the two-supercharger stages, which contributes to the cooling of the charge. The supercharger cooling system is entirely separate from that of the engine, and the radiator for cooling the circulating fluid and dissipating the heat abstracted from the compressed charge can be placed in any convenient position in the aircraft.

In the "Spitfire" it is mounted under the wing of the machine in a duct which also contains one of the main engine cooling radiators. The other engine cooling radiator is placed in a similar position on the opposite wing, and alongside it is arranged the engine oil cooler. An advantage of the liquid cooling system is that it can be made considerably smaller than if the heat exchange was made direct with the atmosphere. By this means a short induction system is retained, the space taken up being small, while the view of the pilot is unimpaired.

The results obtained from the improved "Spitfire" powered with the new engine we have described have, we learn, more than fulfilled the hopes and expectations of all who have helped in the work. Every aspect of this wonderful fighter aircraft has been tremendously improved by the introduction of the "Merlin 61." This outstanding development of an already fine engine should do much to counteract the tendency there is in this country to belittle the qualities of our military equipment and to exaggerate the good points of our adversaries' equipment. The completion and entry into service of the "Merlin 61" is a proof, if such were needed, that we are in no way lagging behind either in the matter of technical development or in the speed with which new ideas are put into service. The advent of the new "Focke-Wulf 190" on the battle front, with its 1600 H.P. air-cooled supercharged engine caused some uninformed persons to believe that the Germans had stolen a march on us in the high-performance fighter class of aircraft, but, as enemy fighter losses continually show, the improved "Spitfire" with its new "Merlin 61" engine was there to surpass it.

## SCIENCE STUDIES RUBBER SOURCES

FROM *Scientific American*, FEBRUARY, 1943

And so, in the war emergency, it was finally decided to turn to synthetic rubber as the nation's best bet—at least for the short-time pull—and most of us agreed that it was a practical solution.

And the daily tumult died away, when those who had sincerely believed that certain vegetable, or plant sources of emergency rubber were the best bet, found that they had not won, and got behind the synthetic plan that was adopted and helped push. Whereupon, the old argument slid off the front pages of the newspapers.

No one should run away with the idea, however, that we have heard the last about rubber from plant sources. Quietly it is receiving most careful attention. As soon as the decision to go for synthetic rubber for the immediate need was made, it became possible for a large corps of scientists and technologists to begin a study of plant sources of rubber, unhampered by urgencies and other expediencies. Thus we shall hear from time to time of the quiet, calm research that is proceeding.

Goodrich, for example, is specializing in the careful study of three rubber-producing plants that seem at present to look best to its scientists—the well-known goldenrod, the Russian dandelion, called kok-sagyz (pronounced, according to the Russian-American Chamber of Commerce, "kuk sag-iz"), and a twining vine heretofore little publicized, called Cryptostegia. This is a perennial which grows wild in Mexico (but has no relation to guayule, which also grows wild in Mexico) and contains rubber latex in all its parts. The tips can be harvested 30 times a year. We may hear more of these hopes.

Then, if ways can be found to handle this weed, it is believed that the same ways will enable us to handle others that grow wild in every fence corner—dandelions, dogbanes, wild lettuce, and others—all of which yield some rubber.

On common fence-corner plants, the New York State College of Agriculture, at Cornell University, has been doing outstanding research, between 1,500 and 2,000 species having already been tested there. A method of testing a given plant or weed in five minutes was developed. A thin section of leaf, stem, or root is cut by means of a razor, placed on a microscope slide, stained with a dye dissolved in solvents, and examined. The stain renders rubber and accompanying resins visible. If the test gives promise, the plant is later analyzed quantitatively in the laboratory. (A very crude, though simple, field test is to rub out a leaf between the fingers. If the milky latex coagulates into a cohesive ball, there probably is some rubber in the plant. How much rubber is, of course, the next question.) Cornell also grew the Russian kok-sagyz last summer and gained a better production than the average Russian yield, but this plant remains on the doubtful list.

So ineluctable are the basics of economic law that, when the war is over, our permanent source of rubber will be the one which can produce it most cheaply—unless, of course, some artificial obstruction is permitted to interfere with the pure logic of economic law. If synthetic rubber from petroleum, or limestone, or other source; or, if synthetic rubber from one weed, or plant, or another; or if even the old Hevea rubber tree, proves to be one cent or even one mill per pound less expensive, then that will be our future rubber source.

It has been said, for example, and rightly, that in normal times the rubber industry would have had to buy its plantation rubber from the opposite side of this planet, even if the suburbs of Akron, Ohio, had been a forest of rubber trees—the decisive factor would have been labour costs.

In the meantime, while we let the facts decide on our future source of rubber, the rubber chemists who are now holding the fort with their work on synthetic deserve the nation's thanks. There is pretty solid ground for the assertion that they are right now saving our future skins.—A.G.I.

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

## THE STATUS OF PROFESSIONAL PERSONNEL IN THE SERVICES

Discrimination shown in the treatment of persons of equal attainment and status has long been a criticism aimed at the armed forces. Examples exist in great numbers, particularly where the various engineering services are concerned. This discrimination includes rank, special pay, authority and competence. For example, in one service a medical doctor right out of college with no more experience than his internship or a dentist direct from college, receives $7.50 per day whereas, under similar circumstances, an engineer with equivalent training and experience receives $4.25 per day. The doctor gets a rank higher than the engineer plus $1.50 per day as professional pay, thus building up the $3.25 advantage he holds over his professional brother.

Shortly after the beginning of the war, the Institute approached the Department of National Defence to see if something could be done about this, but after an elapse of one year and two months a reply was received to the effect that "this matter has been considered by the Military Members of Defence Council and the conclusion arrived at was that no action can be taken to increase the pay of Engineer Officers." Other considerations besides pay were included in the Institute's brief but pay was the only one upon which any answer was received.

Complaints of the same discriminations and in some instances of an elaboration of them, continue to come to the Institute, both from members and non-members. Consequently, Council has set up a committee, as announced in the March *Journal,* to investigate the various situations, and to recommend any action that should be taken in an endeavour to eliminate these anomalies.

Persons should not dismiss this complaint with the simple thought that now is not the time to worry an already overworried and overworked administration. It is not just a matter of fair treatment for the engineers. It goes much farther because these discriminations are having a serious effect on enlistment in the engineering services. It was reported to the writer that recently in one month out of approximately twelve hundred candidates for commissions, many of them engineers, only three offered for ordnance mechanical engineers, while, at the same time, there was a need for two hundred and fifty in that service.

In none of the fields in which the engineers are complaining is the solution easy to find. Inquiries reveal many complicated and involved situations that have been built up over long years of use and custom. It will not be easy to adjust or correct conditions, but the committee hopes to assemble the facts and present them clearly and emphatically in the belief that a clear understanding will lead eventually—if not now—to a more equitable treatment of the engineer.

The terms of reference for the new committee and certain other information from the minutes of the first meeting are reproduced herewith. It is proposed to keep the membership of the Institute informed of the committee's work and progress as events transpire.

### Terms of Reference

(a) Consideration of rank given engineers on enlistment as compared to that given other professions.

(b) Consideration of professional allowance as given to other professions.

(c) Consideration of the status of officers on the Stores side of the Ordnance Corps, as compared to officers on the Engineering side. This would involve the question of promotions and authorities.

(d) Consideration of the frequent appointment of non-technical persons to technical positions.

(e) Study and recommendations as to the advisability of the Canadian Corps following the British Army procedure in establishing the Royal Electrical and Mechanical Engineers (R.E.M.E.) to replace the engineering branch of the Ordnance Corps.

After proper information has been gathered and conclusions reached, the committee is to recommend to Council the procedure which it believes should be taken.

## PRESIDENT'S VISIT TO THE MARITIMES

President Cameron is planning to visit the branches of the Institute in the maritime provinces, in April. A regional meeting of the Council will be held in Saint John, N.B., on Saturday, April 17th, at the Admiral Beatty Hotel, at 10 a.m.

The custom of inviting past councillors and other past officers of the Institute to attend such meetings has been continued, as their knowledge of local affairs is of great assistance to Council.

The president will be accompanied on his tour by the general secretary and, it is expected, by officers of other branches. Members from all parts of the country who may find themselves on the route of the presidential party will be welcome at branch meetings. The itinerary follows:

| | | | | | |
|---|---|---|---|---|---|
| Montreal | Lv. | 7.30 p.m. | Tuesday | Apr. 13 | C.N.R. |
| Moncton | Arr. | 3.15 p.m. | Wednesday | Apr. 14 | C.N.R. |
| | | Meeting with Moncton Branch, Wednesday Evening. | | | |
| Moncton | Lv. | 4.45 a.m. | Thursday | Apr. 15 | C.N.R. |
| Saint John | Arr. | 8.40 a.m. | Thursday | Apr. 15 | C.N.R. |
| | | Thursday—Visit to University of New Brunswick, at Fredericton. | | | |
| | | Friday evening—April 16th—Meeting with Branch. | | | |
| | | Saturday—April 17th—10.00 a.m. Meeting of Council, Admiral Beatty Hotel. | | | |
| Saint John | Lv. | 11.10 a.m. | Sunday | Apr. 18 | C.N.R. |
| Halifax | Arr. | 9.40 p.m. | Sunday | Apr. 18 | C.N.R. |
| | | Monday evening—April 19th—Meeting with Branch. | | | |
| | | Monday or Tuesday—Visit to Nova Scotia Technical College. | | | |
| Halifax | Lv. | 7.50 p.m. | Tuesday | Apr. 20 | C.N.R. |
| Sydney | Arr. | 9.30 a.m. | Wednesday | Apr. 21 | C.N.R. |
| | | Wednesday evening—Meeting with the Branch. | | | |
| Sydney | Lv. | 7.15 a.m. | Thursday | Apr. 22 | C.N.R. |
| Truro | Arr. | 4.40 p.m. | Thursday | Apr. 22 | C.N.R. |
| Truro | Lv. | 5.35 p.m. | Thursday | Apr. 22 | C.N.R. |
| Montreal | Arr. | 7.30 p.m. | Friday | Apr. 23 | C.N.R. |

## TWENTY-FIFTH ANNIVERSARY

The May number of *The Engineering Journal* will mark the twenty-fifth anniversary of the first appearance of this publication. Although the Institute was founded in 1887, the publications up to 1918 consisted of proceedings and transactions. In view of war conditions, it is not proposed to make any great celebration of this event, but it is felt that it should not pass unnoticed.

The anniversary number will include a series of short articles dealing with the history of various industries in which engineers are concerned, over this period of twenty-five years. It will also contain communications from prominent members of the Institute and from sister societies. An interesting feature will be extracts from the original number of the *Journal*, and comparisons of Institute activities at that time with the present.

Examination of the original number indicates that the first editor, Fraser S. Keith, had a splendid conception of the possibilities of such a publication. It is a compliment to him, and must afford him considerable satisfaction to see that so much of the spirit and form of the original publication has been retained until the present day.

The history of the *Journal* indicates the usefulness of a monthly organ for the Institute. For twenty-five years it has presented to a professional audience the best papers on current engineering and scientific topics, and has distributed between branches the news of activities of all branches from coast to coast. Twenty-five years of this type of service is something of which to be proud. The May number will emphasize this fact to all readers.

## SUSPENSION BRIDGES UNDER INVESTIGATION

After the failure of the Tacoma bridge the need for a comprehensive investigation of the design of long-span suspension bridges, particularly with respect to the effects of aerodynamic forces, was apparent. A group of engineers in the United States, concerned with this problem, approached the Public Roads Administration with the suggestion that a programme of investigation be initiated by the Administration.

This proposal was accepted, and representatives of interested organizations were invited to serve on a committee known as the Advisory Committee on the Investigation of Long-Span Suspension Bridges. The work of this group is to prepare a comprehensive programme of investigation work that may be undertaken.

The Engineering Institute has been invited to participate, and at the March meeting of Council Mr. P. L. Pratley, who was recommended by the Administration, was appointed as the Institute's representative on the Advisory Committee.

Other organizations represented include—

Agricultural and Mechanical College of Texas.
American Association of State Highway Officials.
American Institute of Steel Construction.
American Society of Civil Engineers.
California Institute of Technology.
Highway Research Board.
John A. Roebling's Sons Company.
National Bureau of Standards.
Mackinac Straits Bridge Authority.
Port of New York Authority.
Public Roads Administration.
Princeton University.
San Francisco-Oakland Bay Bridge Division.
Triborough Bridge Authority.
Washington Toll Bridge Authority.
Yale University.
Golden Gate Bridge and Highway District.

Those members of the Institute whose activities are along structural lines, will be particularly interested in this work. The *Journal* hopes to present from time to time to all members, news of the findings of this committee.

## WARTIME BUREAU OF TECHNICAL PERSONNEL

From a recent report prepared by the Bureau some interesting figures have been made available. The Bureau has completed two years of service, and the report shows the importance of its work. It is difficult to give in figures anything like a real picture of what has been accomplished, but to anyone who has had experience in professional personnel work the following statistics will tell a story. For instance "known placements" will be well below actual placements, because most people have not reported back to the Bureau. If this figure was added the number of persons who on advice of the Bureau decided not to change position, the total would be very high.

The portion of the tabulation reproduced here covers only the ten months between April, 1942, and January, 1943. The year preceding this was given over largely to organizing, circulating questionnaires, tabulating, classifying, preparation of legislation, and so on.

| | | |
|---|---|---|
| Inquiries received for personnel | | 907 |
| Known Placements—Civilian | 781 | |
| Active Service | 113 | |
| | —— | 894 |
| Permits issued | | 3,327 |
| Interviews | | 8,821 |
| Records of technical personnel referred to employers | | 6,919 |
| Questionnaires (blank) sent to technical personnel | | 11,498 |
| Questionnaires (completed) received | | 12,048 |
| Total of questionnaires on file from technical personnel | | 27,000 |

## BROADCASTS ON POST-WAR PROBLEMS

Members will be interested to know that the chairman of the Institute Committee on Post-War Problems, Warren C. Miller, city engineer of St. Thomas, Ontario, has been selected as one of a group of advisers to the Canadian Broadcasting Corporation, in relationship to a series of broadcasts being given under the title, "Of Things to Come —Inquiry on the Post-War World."

These broadcasts can be heard on Sunday afternoons from 5.03 to 5.30 p.m., and are in the form of round-table discussions.

If any members have suggestions to make, Mr. Miller will be glad to have them sent direct to him. These might take the form of suggested topics for discussion or names of persons who might be invited to participate.

## MEETING OF E.C.P.D. COMMITTEE

One of the most active branches of the Engineers' Council for Professional Development is its Committee on Professional Training, whose function is "to develop plans for the further personal and professional development of young engineering graduates and also those without formal scholastic training."

This committee follows the practice of holding meetings every second month, the last one being convened on the evening of February 25 at AIEE Headquarters in the Engineering Societies Building, New York City. Members of both senior and junior committees attended, the seniors under the chairmanship of Everett S. Lee, AIEE, and the juniors under F. J. Van Antwerpen, AIChE. One of the EIC representatives on the junior committee, Mr. J. W. Brooks, Jr.E.I.C., of Niagara Falls, was present.

The first item of business concerned the Reading List for Junior Engineers, compiled by ECPD for the guidance of young graduates. The list includes books on natural science, economics and sociology, history, fine arts, and religion and philosophy. As later events proved, the religion and philosophy section contained a few texts which some of the Roman Catholic universities found objectionable, and these institutions proposed substitute books.

The matter had been referred to the junior committee, and Mr. Van Antwerpen presented several recommendations from his committee. After considerable discussion, it was decided that the junior committee would handle the problem under the heading "The Evaluation of Reading Material." In other words, one of the tasks of the junior committee is to keep in close touch with the reading list at all times, revising it from time to time as required to maintain it at the optimum of usefulness.

The next item involved the proposed Manual for Junior Engineers. Perhaps listing the tentative chapter headings is the best way of illustrating the proposed scope of the booklet:

1. Heritage of the Engineer.
2. Engineering Student.
3. Engineering Graduate.
4. Engineer in his Practice.
5. Engineer in Continued Education.
6. Engineer in Civic Affairs.
7. Engineer in his Professional Society Life.
8. Engineer and his License.
9. Detours.
10. Engineer and the Second Mile.

After a general discussion on the manual as to length, cost, and possible authors, the meeting was adjourned.

## THE JAMES WATT INTERNATIONAL MEDAL

It will be remembered that this medal is awarded every two years by the Institution of Mechanical Engineers (Great Britain) to some one who has won distinction in mechanical engineering; a large number of national technical societies are asked to suggest names, and these suggestions are given consideration by the Institution.

A. G. M. Michell, F.R.S.

The most recent award of this, the highest honour in the gift of the Institution, was made to Anthony George Maldon Michell, F.R.S., of Melbourne, Australia, a choice which had the support of the Institution of Engineers, Australia, as well as of The Engineering Institute of Canada and of the South African Institution of Engineers. A formal presentation ceremony took place in London, on January 22nd, at which The Engineering Institute was represented by Major General C. S. L. Hertzberg, Chief Engineer of the First Canadian Army, in place of General McNaughton who was unavoidably absent.

Unfortunately Mr. Michell could not be present, but to make up for this, the B.B.C. arranged for a broadcast, beamed to Australia, so that he could at least listen to the proceedings. The citation was delivered by Professor Andrew Robertson. In the absence of Mr. Michell, the medal was handed by the president of the Institution to the Rt. Hon. S. M. Bruce, P.C., C.H., High Commissioner for the Commonwealth of Australia, who accepted it on behalf of Mr. Michell, and expressed the gratitude of the Institution of Engineers, Australia, and the engineering profession of that commonwealth, for the mark of high distinction which had thus been conferred on one of their members.

In his citation, Dr. Robertson sketched the career of the recipient of the medal, mentioning that after his early education in England, Mr. Michell returned to Australia and graduated with distinction at the University of Melbourne, where his elder brother John later became professor of mathematics. After various engagements as surveyor and assistant engineer, Anthony entered a firm specializing in hydraulic engineering, and with his partner, invented and developed a successful regenerative centrifugal pump. In 1903 he commenced consulting practice on his own account, dealing mainly with power plant and hydro-electric installations. Turning his attention to the theory of lubrication, in 1905 he published a paper for which he became justly famous. It dealt with an important development of the classical researches of Beauchamp Tower and Osborne Reynolds on the phenomena of lubrication in terms of the theory of the viscous flow of liquids. Starting from the fact that relatively moving parts whose surfaces are fully lubricated are separated by a film of lubricant which is not of uniform thickness, Michell investigated the case of an inclined rectangular sliding surface of finite size and succeeded in evaluating the leakage at the sides, a feature which had not been dealt with previously.

Having solved this mathematical problem, Michell invented the tilting pad for use as a rubbing surface, thus providing a bearing surface which could adjust itself automatically to the inclination appropriate to the load and speed. When applied to thrust blocks—formerly the most troublesome kind of bearings to operate and maintain—this idea proved to be a great practical advance. In fact, the success of the Michell bearing has had a marked effect on the design and development of all high speed bearings, including journal bearings for certain duties, particularly in marine steam turbines and other modern high speed machinery. In 1917 he began the development of a crankless engine, which has had considerable success.

His inventive genius and his mathematical achievements earned for him the unusual honour of being elected a Fellow of the Royal Society in the same year, 1934, as that in which his name was proposed.

Notwithstanding his celebrity, Michell is a man of retiring nature who finds his chief recreation in the pursuits of country life.

## FOURTH VICTORY LOAN

A billion dollars used to be a lot of money, but within one's mind, if not within one's pocket, great changes have taken place. Large figures have ceased to awe us, even when they represent the national debt in which we are prime participators, but we must not be blasés about the Fourth Victory Loan which has slightly over a billion dollars as its objective.

To collect this amount of money by voluntary methods is a colossal task. One of the drawbacks of a democratic form of government is the privilege it gives us of being as inefficient, thoughtless and selfish as we wish. Theoretically one would think that all a free government would need to do to raise money necessary to the national welfare would be to announce that the money was needed. Free citizens—theoretically—would walk up to the altar of their temporary sacrifice and make their maximum contribution (at 3% interest).

But it does not work that way. Instead, an army of thirty thousand workers has to be assembled and trained for the sole purpose of approaching the free citizen and urging upon him that he should invest a small part of his income or savings in the cause of protecting not only the income and savings themselves, but his very life, his property, and his civilization.

Doubtless human nature will not change in time to help with this emergency and therefore we must be ready fo the Victory Loan canvasser when he calls. Let us appreciate the size and seriousness of his task and give him our support quickly and gladly. Let us pull together enthusiastically that we may continue to live freely.

The Fourth Victory Loan opens April twenty-sixth. It is planned to raise over five hundred millions from private subscribers which, based on previous statistics, indicates that thousands of new subscribers will have to be found, and old subscribers will not only have to repeat but will be required to amplify their effort.

The War Finance Publicity Committee has circulated some figures on the costs of war equipment. Many of them are reproduced herewith. It is interesting to see just what your subscription will buy, as well as some of the reasons why war is so expensive.

| | |
|---|---|
| **Miscellaneous** | |
| .303 rifle and machine gun ammunition | 3½cents |
| Steel helmet | 2.50 |
| Hospital bed | 35.00 |
| Tank periscope | 250.00 |
| Sighting telescope | 125.00 |
| Silk or nylon parachute | 225.00 |
| Anti-aircraft searchlight | 18,000.00 |
| Protective gas mask | 7.75 |
| Haversack | 2.05 |
| No. 4 rifle and bayonet | 65.00 |
| Soldier's water bottle | .60 |
| Soldier's clasp knife | 1.05 |
| Soldier's emergency medical kit | .80 |
| Complete personal kit for one soldier, including clothing rifle and bayonet, anti-gas equipment, etc | 200.00 |
| **Aircraft**—(Complete) | |
| Elementary trainer | 12,000.00 |
| Single-engined advanced trainer | 30,000.00 |
| Twin-engined advanced trainer | 50,000.00 |
| Bombing and gunnery trainer | 75,000.00 |
| Single-engined transport | 40,000.00 |
| Fighter | 35,000.00 to 50,000.00 |
| Dive bomber | 50,000.00 to 75,000.00 |
| Amphibian patrol bomber | 200,000.00 |
| Four-engined long range bomber | 400,00 to 500,000.00 |
| **Ammunition** | |
| 25-pdr. shell | 13.00 |
| 40-mm. A.A. shell | 6.00 |
| 3.7" A.A. shell | 22.00 |
| 4" naval shell | 30.00 |
| 4.5" Howitzer shell | 20.00 |
| **Army guns** | |
| 25-pounder (complete) | 30,000.00 |
| 40mm. Bofors (complete) | 30,000.00 |
| 3.7" A.A. | 50,000.00 |
| 2-pounder tank | 1,200.00 |
| 2-pounder anti-tank with carriage | 4,000.00 |
| 6-pounder tank | 2,500.00 |
| 6-pounder anti-tank with carriage | 5,500.00 |
| **Small arms** | |
| (Complete fighting equipment with accessories and spares). | |
| Sten sub-machine carbine | 40.00 |
| Bren gun | 375.00 |
| Browning aircraft | 250.00 |
| **Automotive Equipment**—(Complete units) | |
| Reconnaissance car | 6,000.00 |
| Armoured car | 12,000.00 |
| Scout car | 4,000.00 |
| Field artillery tractor | 3,000.00 |
| Field ambulance | 3,500.00 |
| Workshop lorry | 7,500.00 |
| Universal carrier | 3,000.00 |
| Derrick truck | 3,000.00 |
| Dental lorry | 4,000.00 |
| Crash tender | 6,500.00 |
| Compressor trailer | 7,500.00 |
| Snowmobile | 5,000.00 |
| Snow fighter | 25,000.00 |
| **Ships** | |
| 10,000-ton cargo | 1,750,000.00 |
| Corvette | 950,000.00 |
| Minesweeper | 700,000.00 |
| Wooden minesweeper | 175,000.00 |
| Trawler | 500,000.00 |
| Fairmile patrol boat | 125,000.00 |
| Motor torpedo boat | 200,000.00 |
| Whaler | 1,350.00 |
| Collapsible assault boat | 225.00 |
| Ram tank (30 tons) | 90,000.00 |
| 2" trench mortar bomb | 2.00 |
| 500-pd. aerial bomb | 50.00 |
| Depth charge | 90.00 |
| Anti-tank mine | 5.00 |
| Hand grenade | 2.00 |
| **Navy guns** | |
| 12-pounder | 3,500.00 |
| 12-pounder mounting | 5,000.00 |
| 4" | 20,000.00 |
| 4" single mounting | 25,000.00 |
| 4" twin mounting | 50,000.00 |
| 2-pounder | 4,000.00 |
| 2-pounder single mtg | 7,500.00 |
| 2-pounder multiple mounting | 50,000.00 |
| 2" trench mortar | 175.00 |
| 2" bomb thrower | 125.00 |
| 3" trench mortar | 563.00 |
| 4" smoke discharger | 40.00 |

## ENGINEERING GRADUATE APPOINTED TO BENCH

Members of the engineering profession are naturally highly pleased at the appointment of Robert Everett Laidlaw, K.C., an honour graduate in civil engineering, of the University of Toronto, of the class of 1915, as a Judge of the Appellate Division of the Supreme Court of Ontario. So far as is known, this is the highest judicial appointment that a graduate engineer has ever received in Canada.

Mr. Justice Laidlaw was born at Durham, Ontario, in 1892 and received his early schooling at the Durham Public School and the Owen Sound Collegiate. Following graduation in engineering he was employed for a time on railway valuation. Out of this work, which lay on the borderline between engineering and law, he developed an interest in the law which was so consuming that he abandoned a remunerative position to enter Osgoode Hall and to serve under articles at a small fraction of the salary that he had previously enjoyed.

His course at Osgoode Hall was one of distinction. In the first and second years he won cash prizes given by the Law Society of Upper Canada and in his third year he received the Silver Medal and the Christopher Robinson Memorial Scholarship. In addition, he won the gold medal for public speaking.

Called to the Bar in 1919, he became associated with the prominent legal firm of McCarthy & McCarthy and during that association was entrusted with many important legal tasks. For example, he was Crown counsel in the investigation of the disastrous Haileybury fire, which had involved a loss of approximately $6,000,000.

In 1923, he joined the legal staff of the Central Region of the Canadian National Railways as solicitor and was appointed assistant regional counsel in 1927. He became a King's Counsel in 1935.

During his long service with the Canadian National Railways, Mr. Justice Laidlaw had an extensive, responsible and highly successful experience in the practice of law in the courts, including the Supreme Court of Canada. He was an outstanding counsel, always courteous to the Court and to his opponents, while, at the same time, insistent and indefatigable in the ferreting out of the truth.

For twenty-one years Mr. Justice Laidlaw, as he now is, was special lecturer in engineering law in the Faculty of Applied Science and Engineering of the University of Toronto. His classes were amongst the most popular in the Faculty, a circumstance that was due not only to rich experience and a capacity for clear expression, but as well to the fact that he thoroughly enjoyed lecturing to groups of interested and questioning students. Growing out of this work, he published (in 1937) in association with Dean Young, the volume "Engineering Law," of which considerable use has been made in the universities of Canada.

With a sound knowledge of engineering and with a long and highly successful career as a member of the Bar, Mr. Justice Laidlaw brings to his new duties a training and experience of unusual breadth, a judicial mind, and a demonstrated capacity for hard and effective work. His friends are confident that he will bring great distinction to the Bench.

C. R. Young.

## LAVAL AT WORK

With the slogan, "The Faculty at Work," the Faculty of Science of Laval University, Quebec, inaugurated on April 6th the practice of opening its laboratories and lecture rooms to the inspection of the public for an entire day. Nearly three thousand persons testified to the propriety of such an innovation and visited the buildings on the Boulevard de l'Entente.

In the afternoon, about a thousand boys from high schools and classical colleges witnessed the experiments carried out by the students in the laboratories as part of their regular schedule. The usual fireworks in the physics laboratory and black magic tricks in the chemical laboratories were staged for the amazement of the younger visitors. Before leaving the buildings, each boy was provided with informative literature, with which was a copy of the booklet published by the Institute on "The Profession of Engineering in Canada."

To the more mature persons who crowded the buildings at night—including many engineers to whom boisterous manifestations of Nature's laws are no secret—the inspection disclosed the thoroughness of the training given in the youngest of our Canadian engineering schools. More strikingly than the physical organization, which is most modern and complete, did the eagerness and self-expression displayed by the students testify to the excellency of the instruction dispensed at Laval.

Laval University has been giving degrees in medicine, law, theology and arts for nearly a century but only in recent years has extended its activities to the field of pure and applied science. It was in 1937 that the Faculty of Science was established as such. Previously, instruction in science was given in the Faculty of Arts. Courses in surveying were started in 1907 and the School of Forestry was established in 1910. In 1920, the School of Chemistry was founded and soon became a very active centre of studies and research.

With the establishment of the Faculty of Science, the School of Chemistry was incorporated with the faculty and expanded into a department of chemical engineering. Shortly afterwards, a department of mining and metallurgical engineering was opened and the first degrees were granted in 1941. Last September, a department of electrical engineering was inaugurated and full instruction is now given in this field.

The engineering courses offered at the faculty are very similar to those in other Canadian universities. The first two years are devoted largely to the fundamental sciences and students branch off to specialized fields in the third year. After successful completion of the fourth year, the degree of bachelor of applied science is given, with mention of the specialized branch in which the student graduated.

The dean of the faculty is Dr. Adrien Pouliot, M.E.I.C. Dr. Paul E. Gagnon, M.E.I.C., is director of the department of chemical engineering and of the School of Graduates. The department of mining and metallurgical engineering is headed by Mr. Gérard Letendre, and Mr. René Dupuis, M.E.I.C., is the director of the new department of electrical engineering. Mr. Dupuis is chairman of the Quebec Branch of The Engineering Institute for 1943.

All engineers of Canada will join in extending wishes of success to Laval in its new field of endeavour, confident that the high standards of the profession will be well maintained.

## CORRESPONDENCE

Mining Building,
University of Toronto,
Toronto, Ont., February 25th, 1943

The Honourable Mr. Justice R. E. Laidlaw,
Osgoode Hall, Toronto, Ont.

Dear Mr. Justice,

At the last meeting of the Council of the Engineering Institute of Canada during my term of office as President, I was asked to convey to you the warm congratulations of the Institute on your elevation to the Bench. It is with the utmost heartiness that I do so, both for the Council and for the membership generally.

We are very conscious of the high honour that has been accorded one who trained in the engineering profession and had made a promising start in it. It is seldom that one of our members receives so great a distinction in a profession other than his original one. We believe that the prestige of the engineering profession will, along with that of the law, be strengthened and enhanced by your appointment.

With best personal regards, I am

Yours sincerely,
(Signed) C. R. Young,
Immediate Past President.

Osgoode Hall,
Toronto, Ont., February 27th, 1943.

My dear Dean Young,

At your convenience will you please convey to the Council of the Engineering Institute of Canada an expression of my gratitude for the congratulations and good wishes extended to me in your courtesy of February 15th.

I am justly proud of my qualifications as an engineer, and fully conscious of the great part my training in that profession has formed in my practice of law. I know too that the knowledge of practical science and engineering will better fit me in my present vocation to determine and apply the principles of justice. It is, therefore, with a feeling of deep personal interest and sincerity that I express the hope that from time to time I might find opportunities to emphasize the distinction of the engineering profession and the high place in public esteem to which engineers are properly entitled.

I send you my kindest personal regards.

Yours sincerely,
(Signed) R. E. Laidlaw.

## MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, March 13th, 1943, at ten o'clock a.m.

*Present:* President K. M. Cameron in the chair; Vice-President C. K. McLeod; Councillors J. E. Armstrong, H. E. Brandon, E. V. Gage, R. E. Heartz, W. G. Hunt, N. B. MacRostie, G. M. Pitts, and H. J. Ward; Treasurer V. C. Christie; Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

The president reminded Council that at the February meeting in Toronto it had been decided that a committee should be selected by the president to examine the whole question of the Institute's relations with engineering bodies and in particular the American Institute of Electrical Engineers, and to report to Council at the earliest opportunity.

Following Council's instructions, President Cameron had asked Dr. Challies if his Committee on Professional Interests, which has had wide experience in matters of this kind in its negotiations with the provincial professional associations, would undertake this task. Dr. Challies had accepted on behalf of his committee, but as he had been out of town, and had only just returned, no report was available for this meeting.

Professor Christie, the Institute's Treasurer, had been in close touch with A.I.E.E. activities in Canada over a long period, and the president asked him if he would express his views on the present situation.

Professor Christie gave an interesting outline of A.I.E.E. activities in Montreal during the past fifteen years and encouraged co-operation with the Engineering Institute.

The general secretary pointed out that while such an attitude on the part of the Montreal Branch would undoubtedly be helpful as far as the local section was concerned, recent correspondence and interviews between President Osborne of the A.I.E.E. and Past-President Young had indicated that the matter should now be studied from the point of view of national co-operation.

President Cameron stated that this and other points brought out in the discussion would be taken into consideration by the Committee, which it was expected would have a report ready for the next meeting of Council.

President Cameron reported that Mr. F. H. Peters, of Ottawa, had accepted the chairmanship of a committee to study the proposed Canons of Ethics for Engineers. Certain names have been suggested to Mr. Peters, and subject to his approval and the acceptance of the members concerned, it was unanimously resolved that the committee be appointed as follows:

| | |
|---|---|
| F. H. Peters | Ottawa, Chairman |
| H. F. Bennett | London |
| R. J. Durley | Montreal |
| E. P. Fetherstonhaugh | Winnipeg |
| I. S. Patterson | Ottawa |
| Kenneth Reid | Victoria |
| Dr. F. H. Sexton | Halifax |
| G. St-Jacques | Quebec |

President Cameron reported that following the last meeting of Council, at his request, Professor D. S. Ellis, of Kingston, had accepted the chairmanship of a committee to examine conditions affecting engineers in the active services with particular reference to professional recognition and the establishment of a corps similar to that now working so effectively in the Imperial Army, known as the Royal Electrical and Mechanical Engineers (R.E.M.E.).

As a progress report, the general secretary read the minutes of the first meeting of this committee, which are as follows:

"Minutes of a meeting of the Committee on the Engineer in the Services, held at the home of Professor D. S. Ellis at Kingston on March 11th, 1943.

Present: Professor D. S. Ellis, Chairman, Col. D. M. Jemmett, Lieut.-Col. L. F. Grant, and the General Secretary.

It was agreed that the Committee should be known as the Committee on the Engineer in the Services.

The chairman selected the following persons to act on the committee: Col. D. M. Jemmett, Professor of Electrical Engineering, Queen's University, Kingston; Major H. W. Tate, Toronto Transportation Commission, Toronto; Major E. Gray-Donald, Quebec Power Company, Quebec, P.Q.

The secretary was instructed to communicate with certain individuals in Montreal to see if they would be free to act.

*Terms of Reference:* It was agreed that the terms of reference of the committee would include the following:

(a) Consideration of rank given engineers as compared to other professions.
(b) Consideration of professional allowance as given to doctors and other persons.
(c) Consideration of relationships between officers on the Stores side of the Ordnance Corps, as compared to officers on the Engineering side. This would involve the question of promotions and authorities.
(d) Consideration of appointment of non-technical persons to technical positions.
(e) Study and recommendations as to the advisability of the Canadian Corps following the British army procedure in establishing the Royal Electrical and Mechanical Engineers (R.E.M.E.).

After proper information has been gathered and conclusions reached, the committee is to recommend to Council the procedures which it believes should be taken in order to bring the recommendations to the attention of the proper authorities.

The general secretary was instructed to gather the necessary information relative to the practices in the British army and in the Canadian army. It was recommended that after this information had been assembled and distributed to members of the committee, a meeting be held at some central point so that a full discussion of the information might be possible. From such discussion a brief should be prepared and referred to the Council of the Institute with certain recommendations as to the next steps to be taken.

The general secretary was instructed to communicate with Lieut.-General A. G. L. McNaughton, informing him of the purposes of the committee, in order to make certain that the programme outlined did not run contrary to any of his plans or wishes.

It was the opinion of the meeting that after a strong brief had been prepared, arrangements should be made for a delegation to wait on the Minister of National Defence, in order to be certain that the recommendations were brought to his attention and given full consideration.

It was agreed that all suitable material dealing with the R.E.M.E.'s should be printed from time to time in *The Engineering Journal*, so that members of the Institute might become aware of the new development."

The general secretary explained that Colonel Grant was leaving almost immediately on a special mission to the Old Country. While there he would gather certain information for the use of the committee.

On the motion of Mr. Pitts, seconded by Mr. Heartz, it was unanimously resolved that the terms of reference be approved, and that the minutes be accepted as a progress report.

President Cameron reported that following the last meeting of Council he had asked Councillor MacRostie, of Ottawa, to accept the chairmanship of a committee to make representations on behalf of the members of the engineering profession in the Civil Service to the Advisory Committee of the Treasury Board which had recently been set up to inquire into and report on conditions of work and remuneration of employees in the Civil Service.

Mr. MacRostie had accepted the appointment, and a committee had been set up consisting of Mr. deGaspé Beaubien, of Montreal, the general secretary, and the president, ex-officio.

As immediate action was necessary in order to make representations to a meeting of the Advisory Committee being held in Ottawa on March 5th, the Institute committee had met in Ottawa and had spent three days gathering information and preparing a brief, which had been duly presented. The Institute Committee, accompanied by Mr. L. E. Westman, representing Mr. Dobson, President of the Dominion Council, had been very well received by the Advisory Committee.

A copy of the brief, and the accompanying graph, was submitted for the information of Council. The general secretary explained how the information had been secured, and how the various averages had been determined. The complete report was published in March *Journal* for the information of all members of the Institute, and reprints have been sent to the branch executive committees.

In accepting the report, President Cameron thanked Mr. MacRostie and his committee for the very valuable presentation, which, in his opinion, was one of the most effective documents on this subject which had been prepared.

Mr. Armstrong, chairman of the Institute Committee on Civil Defence, reminded Council of the joint submission relative to certain aspects of civil defence, presented to the Prime Minister in November last over the signatures of the presidents of the Royal Architectural Institute, the Canadian Construction Association and The Engineering Institute. No action had yet been taken by the government on this submission, and, following further conferences between the three presidents, it had been decided to seek an interview with the Hon. C. D. Howe, Minister of Munitions and Supply, whose Department would be most interested in the submission. It was expected that such a meeting could be arranged at an early date, following which the committee would report further to Council.

The committee was keeping in close touch with the branch committees. Mr. Armstrong had been particularly interested in two recent newspaper clippings, one about an enemy plane over Sydney, Australia, and another regarding the protection of our own east coast. He had been in communication with the branch committees regarding these two items, and hoped to circulate shortly certain information which would be of assistance to the committee chairmen in organizing their territories. Some of the branches were well organized, particularly the London branch area. In others, as far as the E.I.C. was concerned, little had been done, but his committee would see that information continued to reach the committee chairmen with a view to improving the situation.

Reports were received on the following matters which had been referred to the Committee on Post-War Problems for consideration.

*Construction Council of Canada*—At the November meeting of Council it had been decided that the Institute would be ready to co-operate with the National Construction Council by appointing representatives to regional committees which the Council proposed to set up in twenty of the more important cities in Canada to study and make recommendations on post-war projects. On instructions from the President the matter had been referred to the Institute's Committee on Post-war Problems for an expression of opinion before any definite action was taken.

The general secretary read a letter from Mr. Miller, chairman of the committee, which indicated that while approving of the Institute supporting the general proposal, he felt that the Institute should not be committed to any recommendations that would be made on social problems that concerned construction. In his opinion these should be a matter for an individual member and not for an organization.

Mr. Miller approved of the suggestion that representatives of his committee would make suitable representatives on the proposed regional committees, and following some discussion it was unanimously resolved that the Institute support the National Construction Council in this matter, and that Mr. Miller be asked to name the Institute's representatives on the various regional committees.

*Industrial Democracy and Its Survival*—At Council's request Mr. Miller had read Mr. Ackerman's paper on "Industrial Democracy and its Survival" and did not recommend any additional publicity for this paper, as suggested by a resolution of the Montreal Branch which had been referred to this committee.

From the discussion which followed, it appeared that the consensus of opinion was that Mr. Ackerman's paper was of an economical rather than an engineering nature, and as the government has recently set up a committee to study this question, it was unanimously decided to suggest to the Montreal Branch that no action should be taken by the Institute regarding publicity for this paper until the parliamentary committee had made its report.

*C.B.C. Broadcasts*—The general secretary read the following letter from Mr. Miller:

"I would like to call attention to a series of broadcasts each Sunday afternoon at 5.03 p.m. lasting for half an hour. They are round table talks on the subject of 'Of things to come—Inquiry on the Post-War World.' By virtue of his position, the Chairman of your Post-War Problems Committee has been asked to act as an Honorary Consultant to this programme along with representatives of a number of other organizations.

"Any members having any comments on any of these programmes already given or those to follow may clear them through your Chairman. Several of the programmes will deal with construction problems and I would be glad to pass along any suggestions as to matters that might be discussed for the consideration of the director of the series."

Council unanimously approved of Mr. Miller's acceptance of the position of honorary consultant and suggested that any members having any comments to make on these broadcasts should communicate with Mr. Miller as soon as possible.

*Beveridge Report*—Mr. Miller reported that two members of his committee had undertaken to study the Beveridge report and advise on any matters therein that would, in their opinion, be pertinent to the work of his committee.

The general secretary informed the meeting that on seeing in the papers that Sir William Beveridge was planning to visit Canada, he had cabled offering him the facilities and co-operation of the Institute. No reply had yet been received.

It was noted that the financial statement for the first two months of the year had been examined and approved.

On the recommendation of the Finance Committee it was agreed that the general secretary should make a survey of a section of the membership in order to determine, if possible, the cost to the Institute of making Life Membership automatic. It was intimated that under such circumstances a longer period of corporate membership, namely thirty-five instead of thirty years as at present, and an age of seventy instead of sixty-five, might be appropriate.

Following the practice established two years ago, it was unanimously resolved, on the recommendation of the Finance Committee, that the annual fees of members resident in the United Kingdom and other combatant areas be remitted for the year 1943.

A letter had been received from the Public Roads Administration of the Federal Works Agency, Washington, inviting the Institute to appoint a representative to an Advisory Committee on the Investigation of Long-Span Suspension Bridges, which has recently been established. The committee had suggested that on account of his professional attainments and his interests in the problems concerned, Mr. P. L. Pratley would make a valuable addition to the membership. On the recommendation of the Finance Committee it was unanimously resolved that Mr. Pratley be nominated as the Institute's representative on the committee and that some aid be provided in meeting travelling expenses.

The general secretary made a brief report on the operations of the Wartime Bureau of Technical Personnel, basing his remarks on a recently issued review of the history of the Bureau. It was the opinion of Council that a digest of this material be printed in the *Journal*. It was agreed that the general secretary should communicate with the Bureau to suggest that the general secretary of each of the three constituent organizations should be invited to any future meetings of the Advisory Board of the Bureau.

The general secretary referred to the suggestion contained in National Selective Service legislation that the Bureau might be taken over entirely by the Department of Labour. The Bureau was steadily working in closer co-operation with the Department, and it might readily appear to be a logical development, particularly for the post-war period, to have the Bureau as a complete government agency.

A letter had been received from the Canadian Engineering Standards Association asking the Institute to nominate a representative to a committee recently established to investigate the use of sawdust and shavings for insulation purposes and to draft an appropriate specification. On the motion of Mr. Pitts, seconded by Mr. Ward, it was unanimously resolved that Mr. H. E. Brandon be nominated as the Institute's representative on this committee.

A number of applications were considered and the following elections and transfers were effected:

| | |
|---|---|
| **Elections** | |
| Members | 17 |
| Juniors | 5 |
| Students | 20 |
| Affiliate | 1 |
| **Transfers** | |
| Junior to Member | 7 |
| Student to Member | 2 |
| Student to Junior | 7 |
| Student to Affiliate | 1 |

The Council rose at one twenty p.m.

## ELECTIONS AND TRANSFERS

At the meeting of Council held on March 13th, 1943, the following elections and transfers were effected:

*Members*

**Aubert, Marcel A.,** B. A. Sc., C.E. (Ecole Polytechnique), civil engr. Aluminum Co. of Canada, Montreal, and Professor at Montreal Technical School.

**Blais, Robert,** B.A.Sc., C.E. (Ecole Polytechnique), superintending engr., Chief Engr.'s Branch, Dept. of Public Works, Ottawa, Ont.

**Duquette, Roland R.,** B.A.Sc., C.E. (Ecole Polytechnique), supervising engr., McDougall & Friedman, Montreal, Que.

**Gardner, Cyril James,** M.Sc. (London), mgr., Production Planning Dept., Hamilton Bridge Co., Hamilton, Ont.

**Jane, Robert Stephen,** B.Sc. (Univ. of B.C.), M.Sc., Ph.D. (McGill), Director, Electro-Metallurgical Research Dept., Shawinigan Water & Power Co. Ltd., Montreal.

**Janelle, Waldeck Alexis,** B.A.Sc., C.E. (Ecole Polytechnique), Laboratory technician, Aluminum Co. of Canada, Ltd., Shipshaw, Que.

**Lace, George Sutton,** engr. officer, Aircraft Production Branch Dept. of Munitions & Supply, Winnipeg, Man.

**MacDonald, Charles Donald,** B.Eng. (N.S. Tech. Coll.), asst. prof. of Engineering and Plant Supt., Mount Allison University, Sackville, N.B.

**Moffatt, Edward Hopkins,** S.B. (Harvard), research engr., Canadian Car & Foundry Co. Ltd., Montreal, Que.

**Noakes, Frank,** B.Sc. (Univ. of Alta.), M.S., and Ph.D. (Iowa State College), lecturer, Dept. of Elec'l. Engrg., University of Toronto, Toronto, Ont.

**Tylee, Arthur Kellam,** B.Sc. (Mass. Inst. of Tech.), supervisor (overhaul and repair div'n), Aircraft Branch, Dept. of Munitions & Supply, Ottawa, Ont.

**Weaver, Howard Lewis,** chief dftsmn., Standard Steel Construction Co., Welland, Ont.

*Juniors*

**Duncan, Allan S. E.,** B.Sc. (Queen's Univ.), plant mgr., Oxygen Co. of Canada, Ltd., Montreal, Que.

**Gardner, Donald,** B.Sc. (Univ. of Alta.), student engr., Canadian General Electric Co. Ltd., Peterborough, Ont.

**McKenna, Joseph Victor,** B.A.Sc. (Univ. of Toronto), junior layout man and engr., General Motors of Canada, Oshawa, Ont.

**Parrish, Vernon McLeod,** B.A.Sc. (Univ. of Toronto), sales-service engr., Bailey Meter Co. Ltd., Winnipeg, Man.

**Woermke, Orville R.,** B.Sc. (Queen's Univ.), plant designing engr., Electric Reduction Co. of Canada, Ltd., Buckingham, Que.

*Affiliates*

**Winterburn, Fred,** electrical supt., Howard Smith Paper Mills, Ltd., Cornwall, Ont.

*Transferred from the class of Junior to that of Member*

**Boutilier, Andrew Pringle,** B.Eng. (N.S. Tech. Coll.), A/Major, R.C.E., chief Works Officer and O.C., 3rd Fortress Company, R.C.E., Sydney, N.S.

**Hayes, Herman Rutherford,** B.Sc. (Univ. of Alta.), gen'l supervisor of standards, Burns & Co. Ltd., Calgary, Alta.

**Hood, George Leslie,** B.Sc. (Univ. of Man.), asst. meter and relay engr., Hydro Electric Power Commission of Ontario, North Bay, Ont.

**Jones, Arthur R.,** B.Sc. (Univ. of Alta.), asst. induction motor engr., Canadian General Electric Co., Peterborough, Ont.

**Stanfield, John Yorston,** B.Sc. (N.S. Tech. Coll.), Major, 15th H.A.A. Battery, R.C.A., Canadian Army, Labrador.

**Thurston,** Arthur Monroe, B.Eng. (McGill Univ.), plant mgr., Dominion Electric Protection Co., Montreal, Que.

**White,** Walter Edmund, B.A.Sc., B.E., B.A.Sc., (Univ. of Toronto). test engr., Radio Division, Research Enterprises Ltd., Toronto, Ont,

*Transferred from the class of Student to that of Member*

**Connolly,** John Lawrence, B.Eng. (N.S. Tech. Coll.), asst. plant supt. Demerara Bauxite Co. Ltd., McKenzie, British Guiana.

**Morin,** Alphonse G., B.A.Sc., C.E., (Ecole Polytechnique), res. engr., Quebec Roads Department, St-Cyrille de Wendover, Quebec.

*Transferred from the class of Student to that of Junior*

**Bourbonnais,** George Valois, B.Eng. (McGill Univ.), Captain, R.C.E., 2nd i/c B. Company, 3rd Battalion, Canadian Army Overseas.

**McArthur,** Donald Smith, B.Sc., M.Sc., (Univ. of Sask.), junior research engr., National Research Council, Ottawa, Ont.

**Olafson,** Magnus Joseph, B.Sc. (Univ. of Sask.), asst. machine tool engr., Modern Tool Works, Toronto, Ont.

**Richardson,** George Wm., B.Eng., (McGill Univ.), chassis engr., Dept. of Automotive Engineering, Ford Motor Co. of Canada, Windsor, Ont.

**Ring,** Alfred Jackson, B.Sc. (Univ. of N.B.), foreman, Defence Industries, Ltd., Montreal, Que.

**Weldon,** George Horace, B.Sc. (Univ. of Man.), supervisor, Defence Industries, Ltd., Winnipeg, Man.

**Zweig,** Irving Israel, B.Sc. (Sir George Williams Coll.), senior research asst., National Research Council, Ottawa, Ont.

*Transferred from the class of Student to that of Affiliate*

**Little,** Harry, sales mgr. and director, R. & M. Bearings Canada, Ltd., Montreal, and director of Aircraft Bearings Ltd., Toronto, Ont.

*Students Admitted*

**Backer,** George Ernest, (McGill Univ.), 21 Second Ave., Grand'Mère, Que.

**Berry,** Arthur Herbert, (McGill Univ.), 610 Green St., St. Lambert, Que.

**Bloom,** Charles Abe, (McGill Univ.), 6116 Durocher Ave., Outremont, Que.

**Brooks,** Douglas Austin, (Univ. of Toronto), 89 Charles St. W., Toronto, Ont.

**Crawford,** George Byron, (Univ. of Toronto), Box 390, Bowmanville, Ont.

**Curzon,** David Macklem, (Univ. of Toronto), 46 Elora St., Guelph, Ont.

**Dahl,** Henry Lewis, (Univ. of Man.), 555 Wellington Cresc., Winnipeg, Man.

**D'Angelo,** Joseph A. (Univ. of Man.), 901 Riverwood Ave., Fort Garry, Man.

**Davis,** Gordon Thurlow, (Univ. of Man.), 612 Alverstone St., Winnipeg, Man.

**Eisenhauer,** Daniel Andrew, (Dalhousie), Lunenburg, N.S.

**Gold,** Manuel Theodore, (McGill Univ.), 67 Maplewood Ave., Outremont, Que.

**Hannon,** Matthew Stuart, (Univ. of Toronto), 465 Avenue Rd., Toronto, Ont.

**Kuster,** Norman Walter, (Matric. Prov. of Sask.), senior dftsmn., Tool Design Section, Canadian Car & Foundry Co., Fort William, Ont.

**Kuzyk,** William John, (Matric. Prov. of Alta.), senior dftsmn., tool and jig, Canadian Car & Foundry Co. Ltd., Fort William, Ont.

**Morehouse,** Rupert Henry, (Univ. of N.B.), 645 Union St., Fredericton, N.B.

**Onasick,** Peter, (Univ. of Toronto), 85 Gorevale Ave., Toronto, Ont.

**Peckover,** Frederick Lionel, (Univ. of Toronto), 233 Ellis Ave., Toronto, Ont.

**Pellegrind,** Antonio John Joseph, (Univ. of N.B.), 560 Needham St., Fredericton, N.B.

**Rogers,** JohnDouglas, (Univ. of N.B.), Box 185, St. Stephen, N.B.

**Stanners,** James Ellwood, (Univ. of Toronto), 566 Spadina Ave., Toronto, Ont.

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

*Students*

**Alberta**

**Campbell,** Donald Kilgour, (Univ. of Alta.), 11138-87 Ave., Edmonton, Alta.

**Hannah,** M. Russell, (Univ. of Alta.), Sub-Lieut., R.C.N.V.R., Fleet Mail Office, Halifax, N.S.

*Members*

**New Brunswick:**

**Hill,** Major E. S., res. engr. on constrn., Civil Aviation Divn., Dept. of Transport, Princeton, B.C. (Home—St. Stephen, N.B.).

**MacLatchey,** C. W., Works' & Buildings Branch, R.C.A.F., North Sydney, N.S. (Home—Moncton, N.B.).

**Nova Scotia:**

**Draper,** Charles Frederick, M.A., B.A.I., (Trinity College, Dublin), engr. of constrn., Foundation Maritime Ltd., Halifax, N.S.

**Saskatchewan:**

**Stewart,** EaSl, B.Sc., (Univ. of Sask.), chemist, Sewage Disposal Works, City Engineer's Dept., Regina, Sask.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**C. C. Lindsay,** M.E.I.C., of Montreal, has recently been made Honorary Lieutenant-Colonel of a Royal Canadian Engineers unit. He is a veteran of the last war during which he won the Military Cross and the Belgium Croix de Guerre. He served overseas from 1915 to 1919, first with the Sixth Field Company, Royal Canadian Engineers, and then with Second Indian Field Squadron before being attached to the 202nd Field Company of the Royal Engineers. While in the field he was promoted to acting major and was later confirmed to his rank.

In civilian life, Colonel Lindsay is a consulting civil engineer and Quebec land surveyor. He is vice-president of the Corporation of Professional Engineers of Quebec, vice-chairman of the Montreal Branch of the Institute, a director of the Corporation of Quebec Land Surveyors, a director of the Canadian Institute of Surveying and a member of the Montreal Tramways Commission.

Kenneth Reid, M.E.I.C.

J. H. Fregeau, M.E.I.C.

P. N. Gross, M.E.I.C.

**A. W. Ahern,** M.E.I.C., is now with the Northeastern Paper Products Limited at Quebec. A graduate of McGill University in the class of 1922, he had been connected with The James Ruddick Engineering and Construction Company, at Quebec, since 1924, as vice-president of the company.

**C. B. Fisher,** M.E.I.C., of Northern Electric Company, Montreal, has been on loan to the British Ministry of Supply Mission in Washington and Detroit, since May, 1942. As of March 1st, 1943, he was loaned from the British Ministry of Supply Mission to Eicor Incorporated of Chicago, where he occupies the position of vice-president. Born at Wresville, Alta., he was educated at the University of Alberta and later went to the University of Toronto where he received the degree of B.A.Sc., in 1930. He did post-graduate work at McGill University, Montreal, and obtained the degree of M.Eng., in 1933. He joined the staff of the Northern Electric Company of Montreal in 1931 as a development engineer in the special products division. Later he became engineer in charge of the radio receiver engineering department.

**C. E. Frost,** M.E.I.C., has recently been commissioned as a Flying Officer in the R.C.A.F. and, after a period of training, has been posted at the Directorate of Signals at R.C.A.F. Headquarters, Ottawa. Before enlisting, F/O Frost was on the engineering staff of the Bell Telephone Company of Canada, at Montreal. A graduate of McGill in the class of 1931, he was on the staff of the National Harbours Board, Montreal, as an assistant engineer until he joined the Bell Telephone Company in 1937. He was chairman of the Junior Section of the Montreal Branch of the Institute, in 1937.

**Kenneth Reid,** M.E.I.C., is the newly elected chairman of the Victoria Branch of the Institute. Born at Victoria, B.C., he studied engineering at McGill University, Montreal, where he obtained his degree of B.Sc. in electrical engineering, in 1926. Upon graduation he joined the staff of the Canadian General Electric Company Limited, at Peterborough, and, in 1928, he accepted a position as assistant engineer with British Columbia Electric Railway Company at Vancouver. In 1930-31, he was assistant chief electrician with Consolidated Mining and Smelting Company Limited at Trail, B.C. He joined the Light Department of the City of Victoria, as assistant engineer, in 1934.

**J. H. Fregeau,** M.E.I.C., was elected chairman of the St. Maurice Valley Branch of the Institute at the annual meeting held last month at Shawinigan Falls. Born at Beebe Plain, Que., he received his education at McGill University. Upon his graduation, in 1910, he joined the staff of the Shawinigan Water and Power Company and has always remained with the firm. From 1911 to 1914 he was in charge of the electrical installations at various stations. From 1915 to 1923 he was in charge of the construction of transmission lines. In 1923, he was transferred to Trois-Rivières as superintendent and, in 1927, he became divisional manager, a position which he still holds. Since 1939, Mr. Fregeau has also been manager of the St. Maurice Transport Company.

Mr. Fregeau was a councillor of the Institute representing the St. Maurice Valley Branch in 1941-1942.

**P. N. Gross,** M.E.I.C., has been elected vice-president and general manager of Anglin-Norcross Corporation Limited of Montreal.

Born at Worcester, Mass., in 1901, he received his engineering education at McGill University, Montreal, where he graduated as a B.Sc. in 1926. Upon his graduation he joined the engineering staff of Anglin-Norcross Limited at Toronto. In 1929 he was appointed Ontario manager of Anglin-Norcross Limited and later became vice-president and manager of Anglin-Norcross Ontario Limited. He joined the Royal Canadian Engineers at Toronto in 1940 and proceeded overseas in 1941. He returned recently to Canada with the rank of Captain.

**Edward C. Hay,** M.E.I.C., has recently accepted an appointment with the Army Engineering Design Branch of the Department of Munitions and Supply, Ottawa. He was previously sales engineer in charge of the Regina Office of Canadian Westinghouse Company Limited. A graduate of the University of British Columbia, in 1930, Mr. Hay had been with the Westinghouse Company since graduation. From 1933 to 1936 he was in Hamilton and in 1936 went to Toronto where he stayed until 1938 when he received his Regina appointment.

**A. J. Lawrence,** E.D., B.Sc., M.E.I.C., who has been granted leave of absence for the duration of the war by the Northern Electric Company, Limited, has been appointed head of the Production Control Department of Allied War Supplies Corporation, Montreal. During the last war, Mr. Lawrence did inspection work on ammunitions for the Imperial Ministry of Munitions.

**J. G. McGregor,** M.E.I.C., is the newly elected chairman of the Calgary Branch of the Institute. Born in Scotland, in 1905, he received his education at the University of Alberta where he graduated in 1929. Upon graduation, he joined Canadian Utilities Limited at Calgary and in 1931 he became district superintendent at Vegreville. He now occupies the position of assistant manager at Calgary.

**J. G. McGregor, M.E.I.C.**

**J. T. Dyment, M.E.I.C.**

**Roland A. Lemieux, M.E.I.C.**

**A. M. Macgillivray,** M.E.I.C., the newly elected chairman of the Saskatchewan Branch of the Institute, holds a unique distinction. In addition to being chairman of the Branch, he is councillor of the Institute for the Branch, president of the Association of Professional Engineers of Saskatchewan and representative of the Association on the Dominion Council of Professional Engineers. Mr. Macgillivray is district engineer for Canadian National Railways at Saskatoon.

**F/O Jacques Price,** M.E.I.C., is now works and buildings engineer officer at No. 1 "Y" Depot, R.C.A.F., at Halifax, N.S. Before joining up, F/O Price was engaged in airport construction with the Department of Transport and later with the Department of National Defence. He studied engineering at the University of Toronto.

**R. H. Stevens,** M.E.I.C., waterworks engineer for the city of Edmonton, Alta., is now assistant waterworks engineer, No. 2 Western Command, R.C.A.F., and is stationed at Comox, B.C.

**J. W. Ward,** M.E.I.C., has recently been transferred from Arvida to the Beauharnois plant of the Aluminum Company of Canada Limited where he now occupies the position of electrical superintendent. Mr. Ward is a councillor of the Institute representing the Saguenay Branch.

**W. Taylor-Bailey,** M.E.I.C., vice-president and general manager of the Dominion Bridge Company Limited, Montreal, was recently elected to the board of directors of Robert Mitchell Company Limited, Montreal.

**Maurice Gérin,** M.E.I.C., departmental manager, Canadian Fairbanks Morse Company, Montreal, has been appointed a director of the Corporation of the Ecole Polytechnique of Montreal. Mr. Gérin graduated from the Ecole Polytechnique, in 1920, and obtained his degree of M.Sc. in mechanical engineering from the Massachusetts Institute of Technology in 1921. He has been with Fairbanks-Morse since 1922.

**J. T. Dyment,** M.E.I.C., assistant superintendent, engineering, Trans-Canada Air Lines, has been elected chairman of the Winnipeg Branch of the Institute. Born at Barrie, Ont., he received his engineering education at the University of Toronto where he graduated in 1929. After a few months spent in the airplane division of the Ford Engineering Laboratories at Dearborn, Mich., he joined the staff of the Aero Division of the Department of National Defence, Ottawa, in 1930. In 1937 he transferred to the aeronautical division of the Department of Transport as aeronautical engineer and in 1938 he accepted a position in the same capacity with Trans-Canada Airlines in Winnipeg. Later he became chief engineer.

**D. G. Geiger,** M.E.I.C., transmission engineer, western area, Bell Telephone Company of Canada, Toronto, was recently appointed a member of the national committee on communication of the American Institute of Electrical Engineers.

**Sarto Plamondon,** M.E.I.C., has recently been admitted as a Junior Member of the American Society of Heating and Ventilating Engineers. He is the engineer in charge of the Division of Industrial Hygiene of the Department of Health of the Province of Quebec.

**Squadron Leader W. J. Inglis,** M.E.I.C., is now construction officer at R.C.A.F. Headquarters, Ottawa. Before enlisting in April, 1940, he was a designer with Bloedel, Stewart & Welch, Limited, Vancouver. After graduation at the University of British Columbia, in 1934, he was employed with British Columbia Electric Railway of Vancouver, until October, 1935, when he joined the staff of Hamilton Bridge Company (Western) Limited, Vancouver. From August, 1937, to May, 1938, he was in England where he acquired valuable experience in the design and construction of industrial plants with Sir Alexander Gibb and Partners and later with the British Air Ministry.

**Rolland A. Lemieux,** M.E.I.C., has been appointed recently city manager and engineer at Arvida, Que. He had occupied the position of city engineer and secretary-treasurer of the municipality of Sillery, Que., since 1941. Previously he was engaged as assistant to the district No. 1 engineer in the Department of Roads of the Province of Quebec. Mr. Lemieux graduated from Ecole Polytechnique in 1937.

**Paul-Emile L'Heureux**, Jr.E.I.C., who for the last few years had been assistant division engineer of the Department of Highways of Quebec, at Sherbrooke, has been transferred recently to Beauceville, Que. He is a graduate of the Ecole Polytechnique in the class of 1936.

**Gerald N. Martin**, Jr.E.I.C., who has been on loan to the Aluminum Company of Canada Limited, Montreal, for the past two years, has now returned to the Dominion Bridge Company Limited, Lachine, Que.

**J. R. Tregget**, Jr.E.I.C., is on leave from the Coca-Cola Limited, Montreal, and has joined the R.C.A.F.

**G. G. Wanless**, Jr.E.I.C., who joined the staff of the National Research Council, at Ottawa, last year, has recently been transferred to the St. Clair Processing Corporation, at Sarnia, Ont.

**Lieutenant R. Bennett**, S.E.I.C., is with the Signals Production Branch in the Department of Munitions and Supply, at Ottawa. He is a graduate in electrical engineering from McGill University in the class of 1942.

**Percy Codd**, S.E.I.C., has joined the R.C.A.F. and is at present training as aircrew at Belleville, Ont. A graduate of the University of Saskatchewan, in chemical engineering, he was employed with the Defence Industries Limited, Valleyfield, Que., before enlisting.

**Flying Officer T. A. Harvey**, S.E.I.C., is now stationed at R.C.A.F. Headquarters, Ottawa, in the office of the director of aeronautical engineering. He had been stationed previously at Macdonald, Man. He is a graduate of McGill University in the class of 1941.

**Sub-Lieutenant G. R. Minty**, S.E.I.C., is at present stationed in Halifax. He graduated from the University of Saskatchewan in the class of 1941.

**Lieutenant E. A. Olafson**, S.E.I.C., is now serving with the Royal Canadian Ordnance Corps overseas. He is a graduate of the University of Saskatchewan in the class of 1941.

**Sub-Lieutenant William Tkacz**, S.E.I.C., has joined the R.C.N.V.R. last February and is at present training at Halifax. He was previously employed with the Ottawa Car and Aircraft Limited, at Ottawa.

**Lieutenant J. A. Webster**, S.E.I.C., is with the Royal Canadian Corps of Signals and is stationed at Ottawa.

**Leon Wigdor**, S.E.I.C., has been employed with Defence Industries Limited, Valleyfield, Que., since April, 1941, when he graduated from McGill University.

**Sub-Lieutenant D. O. D. Ramsdale**, S.E.I.C., who was among the recent naval graduates from King's College, Halifax, passed with the highest marks ever made at the college.

## VISITORS TO HEADQUARTERS

**H. Balmforth**, M.E.I.C., Burnaby, B.C., on March 4th.

**Lt.-Commander Sydney Phillips**, M.E.I.C., H.M.C.S. Fort Ramsay, Gaspé, Que., on March 5th.

**Sarto Plamondon**, M.E.I.C., Ministry of Health, Quebec, Que., on March 13th.

**Major H. A. Gauvin**, M.E.I.C., Supt., A. Bélanger, Limited, Montmagny, Que., on March 13th.

**H. J. Ward**, M.E.I.C., superintendent of property, Shawinigan Water & Power Company, Shawinigan Falls, Que., on March 13th.

**Squadron Leader W. L. Inglis**, Jr.E.I.C. Works and Buildings Branch, R.C.A.F., Ottawa, Ont., on March 10th.

**F/O. C. E. Frost**, M.E.I.C., Royal Canadian Air Force Headquarters, Ottawa, Ont., on March 16th.

**C. D. McAllister**, M.E.I.C., Department of Public Works, Saint John, N.B., on March 15th.

**F. W. Gray**, M.E.I.C., Asst. General Manager, Dominion Steel and Coal Corporation, Sydney, N.S., on March 16th.

**Victor Meek**, M.E.I.C., controller, Dominion Water and Power Bureau, Department of Mines and Resources, Ottawa, Ont., on March 18th.

**H. O. Windler**, Anglo-Newfoundland Development Company, Grand Falls, Nfld., on March 19th.

**C. F. Morrison**, M.E.I.C., assistant professor of civil engineering, University of Toronto, Toronto, Ont., on March 18th.

**G. Ericksen**, M.E.I.C., assistant engineer, City Engineer Department, Port Arthur, Ont., on March 25th.

**C. O. Whitman**, M.E.I.C., field engineer, Beauharnois Light, Heat and Power Company, Valleyfield, Que., on March 27th.

**John Grieve**, M.E.I.C., promotion manager, Imperial Varnish & Colour Company Limited, Toronto, Ont., on March 27th.

**Don Ross**, M.E.I.C., Foundation Company of Canada Limited, Shipshaw, Que., on March 31st.

**F/O. B. P. Scull**, M.E.I.C., Maple Creek, Sask., on April 1st.

**Capt. J. F. Rutherford**, M.E.I.C., R.C.C.S., Camp Borden, Ont., on April 3rd.

## COMING MEETINGS

**Eastern Photoelasticity Conference and Symposium on Experimental Stress Analysis**—The Seventeenth Semi-Annual Meeting. To be held on May 13, 14 and 15, 1943 at the Rackham Memorial Bldg., 100 Farnsworth St. Detroit Michigan. Secretary: Lee R. Baker, Chrysler Institute of Engineering, Highland Park, Michigan.

**American Society of Mechanical Engineers**—1943 Semi-Annual Meeting, Los Angeles, California, June 12-14. Secretary: C. E. Davies, 29th West, 39th Street, New York, N.Y.

**American Water Works Association**—Annual Meeting, to be known as A.W.W.A. Conference on War-Winning Waterworks Operations, at the Carter and Statler Hotels, Cleveland, Ohio, June 14-17. Secretary: Harry E. Jordan, 22 East 40th Street, New York, N.Y.

# Obituaries

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

**John Logie Allison,** M.E.I.C., died at Montreal, on February 10th, 1943. He was born at Toronto, Ont., on October 17th, 1860, and was educated at the School of Practical Science, Toronto. From 1885 to 1889 he was employed on construction work at the Welland Canal. Later he was employed at the Soulanges Canal, for several years.

Mr. Allison had varied experience in civil engineering work during his professional career and he was employed on several large construction projects, successively with W. I. Bishop Limited, Montreal, and H. J. Acres Limited, at Montreal. He had retired from active practice several years ago.

Mr. Allison joined the Institute as an Associate Member in 1887 and he was transferred to Member in 1895.

**John Lyle Harrington,** M.E.I.C., died on May 20th, 1942. Born at Lawrence, Kansas, U.S.A., on December 7th, 1868, he was educated at the University of Kansas where he graduated in 1895. During two summer vacations and from June, 1895, to March, 1896, he worked with the late J. A. L. Waddell, consulting engineer of Kansas. He then held various positions as follows: March to August, 1896, in the drafting room of the Elmira Bridge Company, at Elmira, N.Y.; August, 1896, to July, 1897, with the Pencoyd Iron Works at Philadelphia, Pa., in charge of work in the drafting room; July, 1897, to January, 1898, with the Keystone Bridge Works of the Carnegie Steel Company at Pittsburgh, Pa., in charge of preparation of general and detail plans for numerous bridges, including various bridges and viaducts for the Union Railroad approach to the Pittsburgh and Lake Erie Railroad bridge over the Ohio River; January to September, 1898, with the Cambria Steel Company at Johnstown, Pa., first as assistant superintendent, Structural Department, designing the structural shops, then in charge of engineering, and later in charge of the shop and structural material yards; September, 1898, to March, 1899, with the Bucyrus Company at South Milwaukee, Wis., as assistant chief engineer and assistant superintendent; March to December, 1899, with the Northwestern Elevated Railroad Company in Chicago, Ill., as assistant to the chief engineer, in charge of preparation of shop plans and of inspection of fabrication of steelwork at the shops of the Elmira Bridge Company and Union Bridge Company; December, 1899, to November, 1900, with the Berlin Iron Bridge Company at East Berlin, Conn., as designer; November, 1900, to November, 1901, with the Baltimore and Ohio Railroad Company at Baltimore, Md., as assistant engineer of bridges and buildings; November, 1901, to January, 1905, with the C. W. Hunt Company in New York, N.Y., first in charge of preparation of details, drawings of structural work and of general contract plans for bidding purposes, and later as executive engineer in charge of estimating, contracting, etc.; and January, 1905, to January, 1907, with the Locomotive and Machine Company at Montreal, Que. (a subsidiary of the American Locomotive Company), as chief engineer and general manager, having charge of the building and then the operation of its plant.

In 1907 he entered private practice as a partner in the firm of Waddell and Harrington, consulting engineers, Baltimore. From 1914 to 1928 he was senior partner in the firm of Harrington, Howard and Ash and after 1928 senior partner in the firm of Harrington and Cortelyou, all specializing in the field of bridge engineering.

During his 35 years of consulting practice, Mr. Harrington was associated with the design and construction of several bridges in the United States, Canada and countries abroad. It is interesting to recall that his firm was associated with the construction of the bridge on the Don river at Rostov, Russia. His most outstanding contribution to bridge engineering was in the development of the vertical lift type of movable span. This is witnessed by the numerous patents for the firm's designs and the construction of twenty-seven lift spans.

In August, 1932, Mr. Harrington was called to Washington by President Herbert Hoover, to become a member of the Engineers Advisory Board of the Reconstruction Finance Corporation. He remained with the R.F.C. as chief engineer until 1934.

Mr. Harrington received from McGill University, in Montreal, the degree of Bachelor of Science in 1906 and that of Master of Science in 1908. In 1930 he received the honorary degree of Doctor of Engineering from Case School of Applied Science in Cleveland, Ohio.

Mr. Harrington joined the Institute in 1905 as a Member.

**Chester Waters Larner,** M.E.I.C., died at his home in Philadelphia, Pa., on June 11th, 1942. Born at Elizabeth, N.J., on March 31st, 1881, he was educated at the Baltimore Polytechnic Institute where he graduated in 1887. From 1900 to 1902 he was instructor at the University of Chicago. In 1902 and 1903 he worked as a designer with the New Jersey Bridge Company and from 1903 to 1906 he occupied the same position with I. P. Morris Company, Philadelphia. After having been employed for a few months as a mechanical engineer with International Steam Pump Company at New York, he joined the staff of Wellman-Seaver-Morgan Company of Cleveland, Ohio, as hydraulic engineer, in 1907, and remained in the same position until 1917.

In 1918 he became president of the Larner Johnson Valve and Engineering Company at Philadelphia serving in that capacity until 1922 when he became president of the Larner Engineering Company, a position he occupied at the time of his death. In 1927 he also became president of the Larner Machine Company.

Mr. Larner was the co-inventor of the Larner-Johnson valve. At one time, he was consulting engineer to the Baldwin Locomotive Works, and during the last war he served on the Naval Construction Board of the United States.

Mr. Larner joined the Institute as a Member in 1913.

**Nathan Deane Paine,** M.E.I.C., died at his home in Montreal on March 7th, 1943. Born at Berlin, N.H., on April 19th, 1892, he was educated at the University of New Hampshire where he graduated in electrical engineering, in 1913. Upon graduation, he joined the staff of Northern Ohio Traction and Light Company at Akron, Ohio.

In 1916, Mr. Paine came to Canada to join the staff of Price Brothers & Company Limited at Kenogami, Que., as electrical foreman. In 1922 he became superintendent of electrical operation and in 1925 he was made general electrical superintendent.

A few months ago, Mr. Paine had left Price Brothers to take a position with the Aluminum Company at Montreal where he was employed at the time of his death.

Mr. Paine joined the Institute as an Associate Member in 1927, and he became a Member in 1937.

# News of the Branches

## Activities of the Twenty-five Branches of the Institute and abstracts of papers presented

### HALIFAX BRANCH

S. W. Gray, M.E.I.C. - - *Secretary-Treasurer*
D. C. V. Duff, M.E.I.C. - *Branch News Editor*

The regular monthly joint dinner meeting of the Engineering Institute of Canada, Halifax Branch, and the Association of Professional Engineers of Nova Scotia was held in the Halifax Hotel on Thursday, February 25, 1943. Professor A. E. Flynn, Chairman of the Branch, presided.

The guest speaker for the evening was Mr. H. W. Lea, Director of the Wartime Bureau of Technical Personnel, Ottawa. He was accompanied by Colonel S. W. Beecroft, military advisor to the Bureau.

In his address, Mr. Lea explained how the bureau was organized in 1941. From this beginning in 1941 to date, the total registration of technically trained men had increased to more than 27,000. Mr. Lea stated that they did not expect the register figure to exceed 30,000 maximum, at any future date.

The body of Mr. Lea's address was given to the discussion of the Bureau's purpose, the Policy of Bureau, and its method of operation. The field of operations, he explained, includes all pure and applied science graduates and the field, from time to time, is being enlarged to encompass other groups of technically trained men.

Mr. Lea referred to students now in science courses in Canadian universities and pointed out that, in the event of an "emergency", these students could be called for military service and "the universities go out of business overnight." He stated that such a condition is not very probable, since the demand for technically trained men is steadily increasing and the medically fit students now take military training and have signified their intent to become technical service officers on completion of their courses.

Mr. Lea, after his address, answered several questions and in one instance when questioned "are there sufficient trained men available", replied that the Bureau carries a constant file of from 700 to 800 unfilled applications for trained personnel. These are ultimately filled but often the firm which makes the application must wait six months or more to obtain a man.

A vote of thanks was extended to Mr. Lea for his interesting address and it was evident by the applause that every member present appreciated the opportunity to hear about the regulation and control of all technical personnel throughout the Dominion.

### HAMILTON BRANCH

W. E. Brown, M.E.I.C. - *Secretary-Treasurer*
L. C. Sentance, M.E.I.C. - *Branch News Editor*

Monday, March 1st, was the occasion of the regular branch meeting; T. S. Glover, chairman of the branch, presided.

The speaker of the evening, E. R. Rowzee, Factory Manager of the Canadian Synthetic Rubber Company, dealt in a masterly fashion with numerous aspects of the pertinent subject, **Synthetic Rubber.**

As an effective introduction to the main topic, Mr. Rowzee outlined the history of the development of natural rubber.

Historical mention of rubber begins with Columbus, who brought the first natural rubber to Europe. It was not until 1839, however, that an obscure chemist, named Goodyear, discovered the process of vulcanization, and, thereby, made possible full utilization of this versatile material.

Rubber originally came exclusively from Brazil, and in an effort to maintain this monopoly, the Government placed an embargo on the export of seeds. An enterprising Englishman managed, however, to smuggle a ship load of seed out of the country. This seed was sprouted in England, and seedlings later transported to, and planted in, the Far East.

Intensive cultivation and cross-breeding raised the maximum yield of plantation rubber from 500 pounds per acre per year in 1910 to approximately 1,500 pounds per acre per year in 1939. Such production soon forced the Brazilian rubber off the market, and when the Eastern plantations fell into the hands of the Japanese, between 1,300,000 and and 1,400,000 tons of the world's 1,500,000-ton yearly production was lost to the United Nations.

To replace this lost production, a gigantic industry, unique in history, has come into being. This billion dollar industry, synthetic rubber, started barely two years ago, is already beginning to produce.

The search for a satisfactory synthetic rubber began many years ago. Early destructive distillation had shown that Isoprene was the parent hydro-carbon from which rubber came by synthesis in the rubber tree. The first real step toward synthesis of rubber was taken in 1880, with the discovery that Isoprene could be produced from turpentine. The rubber-like material produced from Isoprene was, however, only a laboratory curiosity, and it has remained so, as no cheap source of isoprene has been found.

In the early 1900's, the advent of the motor car caused the price of rubber to skyrocket, and thereby provided incentive for the search for a suitable synthetic. First patents were issued in 1910, and named Isoprene, or Butadiene as the base, with metallic sodium as a catalyst.

No exploitation of these discoveries took place, and it was not until 1916 that rubber was produced in Germany from dimethyl Butadiene. By 1918 Germany had produced 4,000 tons of this rubber, but the two grades available proved either too hard, or too soft, for the majority of applications.

Interest lagged after the war, and it was not until 1925 that the present investigational work had its beginning.

In the United States, economics have dictated the use of Butanes and Butylenes, cheap by-products of the petroleum industry, as the major contributors of Butadiene. Additional Butadiene will be produced from grain.

In discussing Canada's part in the synthetic rubber programme, the speaker indicated that the Polymer Corporation project is probably the most complete now under construction. Five separate units are coordinated under one head to manufacture the basic ingredients, in addition to the actual synthetic rubber.

Mr. Rowzee ventured the opinion that synthetic rubbers will eventually replace natural rubbers to a large extent. Even at this time, the synthetic rubbers accomplish many tasks which are beyond the capabilities of natural rubber, and the present tremendous stimulation of research will undoubtedly produce even better and cheaper synthetic rubbers.

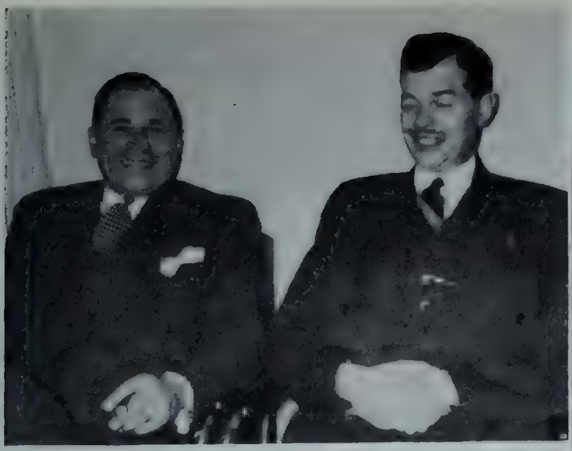
At the present time, the most expensive synthetics, specially rubbers, such as Buna N and Neoprene, are used for gasoline hoses, gaskets, and self-sealing gasoline tanks, which would be out of the question with natural rubber. Buna S, the general purpose rubber, is the chief source of tires. Butyl rubber has been found excellent for footwear, wire insulation, and in the manufacture of mechanical rubber goods.

At the conclusion of his talk, Mr. Rowzee answered many questions, during an animated half-hour discussion period.

Mr. H. A. Cooch extended the thanks of the gathering to the speaker for his excellent address.

Upon adjournment, the eighty members and guests retired to the anteroom for the customary refreshments.

# MONTREAL BRANCH SOCIAL EVENING



O. Biedermann and W. W. Timmins at a not too serious moment.

Branch Secretary L. A. Duchastel and Chairman R. S. Eadie pose with Professor G. J. Dodd.

M. S. Macgillivray listens closely to A. G. Moore.

W. G. Mitchell, G. O. Vogan and H. M. Scott.

G. MacL. Pitts, H. T. Doran and George R. MacLeod.

A group of students chatting with Professor Gaudefroy—left to right: J. Sansfaçon, B. Baribeau, H. Audet, P-E. Salvas, H. Gaudefroy, F. Boulva and L. Scharry.

P. E. Poitras, C. E. Gelinas, R. Matte, W. E. Lauriault and E. Prévost.

## KINGSTON BRANCH

R. A. Low, M.E.I.C. - *Secretary-Treasurer*

A special joint meeting of the Kingston Branch, E.I.C., the Ontario Association of Professional Engineers, and the Engineering Society of Queen's University was held in Convocation Hall, Queen's University on February 3rd to hear Prof. J. A. Van den Broek of the University of Michigan speak on **Theory of Limit Design**.

The meeting was under the chairmanship of K. M. Winslow and a capacity audience welcomed Prof. Van den Broek. The speaker was introduced by Dr. S. D. Lash who outlined the highlights of Prof. Van den Broek's career in an interesting manner.

Prof. Van den Broek outlined his theory of limit design. In 1942 he was awarded the Norman Medal from the American Society of Civil Engineers for this paper, and which has been presented in *The Engineering Journal*

An interesting discussion followed the lecture with student members showing keen interest in this new approach to design.

The speaker was thanked on behalf of the three societies by Prof. C. V. Armour.

C. V. Armour, M.E.I.C.

The regular February meeting of the Kingston Branch of the Institute was held on February 24th in Convocation Hall, Queen's University, with K. M. Winslow in the chair introducing the guest speaker, Dr. P. M. Haenni, Director of Research, Aluminum Laboratories Ltd.

Dr. Haenni surveyed the development of aluminum as a construction metal. He showed that this development was due principally to the discovery of suitable alloys and the introduction of methods of protection against corrosion.

The large increase in production during recent years was almost entirely due to the demands of the aircraft industry led by Germany in pre-war years. Along with the increase in production there has been a substantial reduction in cost of aluminum which is selling now at the lowest price in its history. In allied countries, all aluminum production is now devoted to military purposes. Dr. Haenni pointed out that, curiously, this is not the case in Germany since aluminum has been widely used there as a substitute for other non-ferrous metals. He also pointed out that in Germany it has been found necessary to utilize clay as a raw material in place of bauxite although the process of manufacture from clay is much more expensive.

The appreciation of the meeting was expressed by Col. L. F. Grant.

---

The March meeting of the Kingston Branch, E.I.C., under the chairmanship of K. M. Winslow, was held on March 11th in Convocation Hall, Queen's University, and took the form of a joint meeting with the Engineering Society of Queen's University. The guest speaker of the evening was Mr. Huet Massue of the Shawinigan Water and Power Co., Montreal.

***Left to Right*—R. A. Low, D. S. Ellis, J. D. Lee, Huet Massue, J. R. Carter, K. M. Winslow, S. D. Lash, Major J. P. Carrière, D. M. Jemmett.**

The speaker was welcomed and introduced by Prof. R. A. Low, who pointed out that Mr. Massue was not only an engineer, but an ambassador of goodwill from our sister province, Quebec. He suggested that the programme committee might well arrange a series of similar meetings for branches throughout Canada whereby French and English engineers could fraternize and discuss their common problems.

Mr. Massue spoke on the **Heating of Dwellings with Coal, Gas, Oil and Electricity** and presented a composite picture of the economics of domestic heating, showing average plant installation and operating costs for the various methods and showed estimated power requirements for various Ontario and Quebec cities. Should the use of electricity become general for domestic heating, he emphasized the tremendous investment for plant that would have to be made before it could be put into general use.

The speaker was thanked in French by Mr. P. J. Bourgeois, Sc. '44, on behalf of the Engineering Society of Queen's University and Prof. D. M. Jemmett on behalf of the Kingston Branch.

Dr. L. Austin Wright, the general secretary, spoke briefly on the extensive programme of activities facing the Institute, and clarified the existing situation of the engineering students regarding National Selective Service.

Mr. Massue and Dr. Wright were guests at a courtesy dinner at the LaSalle Hotel given by the executive of the Kingston Branch prior to the meeting.

***Left to Right*—S. N. Graham, R. Hay, D. M. Jemmett, H. Stewart, W. A. Wolfe, S. D. Lash.**

## OTTAWA BRANCH

A. A. Swinnerton, M.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

In honour of Mr. K. M. Cameron of Ottawa, Chief Engineer of the Department of Public Works and newly-elected President of the Engineering Institute of Canada, the Ottawa Branch of the Institute held a luncheon Thursday noon, March 18, at the Chateau Laurier. In the absence through illness of G. H. Ferguson, chairman of the local Branch, N. B. MacRostie, immediate past chairman, presided. Head table guests included the general secretary of the Institute, L. Austin Wright of Montreal; past presidents Dr. C. Camsell and G. J. Desbarats, both of Ottawa; Gordon Pitts of Montreal, president of the Royal Architectural Institute of Canada; W. P. Dobson of Toronto,

*Left to Right:* **Councillor N. B. MacRostie, the Hon. Mr. Fournier, Deputy Minister E. P. Murphy, Past President G. J. Desbarats.**

president of the Dominion Council of Professional Engineers, Commander C. P. Edwards of Ottawa; Hon. Alphonse Fournier, Minister of the Department of Public Works, E. P. Murphy, Deputy Minister, and others.

The luncheon was of an informal nature. The new president was introduced by the chairman. Mr. Cameron then spoke briefly emphasizing the part played by engineers in Canadian life and particularly in the Dominion Government service, with reference also to the cordial relations existing between the Canadian Institute and engineering organizations of United States.

Hon. Mr. Fournier then spoke, suggesting that engineers should take an important part in any post-war reconstruction plans. He also remarked upon the lack in public life generally of engineers and suggested that the country itself would be better off and the public in general would benefit if more of them for instance "were in the House of Commons."

E. P. Murphy, Deputy Minister, also spoke commenting upon the honour which his department had received in having one of its senior officers attain to the high office of President of the Institute.

*Left to Right:* **G. MacL. Pitts, Past President Charles Camsell, President K. M. Cameron, N. B. MacRostie and the Honourable Mr. Fournier.**

## SAINT JOHN BRANCH

G. W. Griffin, M.E.I.C. - *Secretary-Treasurer*

The Saint John Branch held a special meeting in the Admiral Beatty Hotel at 8 p.m. on March 19th. The subject of the meeting was the showing of a sound film in colours produced by the General Electric Co., entitled **The Inside of Arc Welding.** Members brought friends whom they thought would be interested, resulting in an attendance of 67. Notable among the gathering were welders from the Saint John Drydock and Shipbuilding Co., and the Canadian Pacific Railway Co. The film proved most interesting to all and many favourable comments were heard regarding it.

Mr. A. O. Wolff, vice-chairman of the Branch, presided in the absence of Mr. D. R. Smith, Chairman.

## ST. MAURICE VALLEY BRANCH

V. Jepsen, M.E.I.C. - *Acting Secretary-Treasurer*

The annual meeting of the St. Maurice Valley Branch of the Institute was held on March 18th, 1943, at the Cascade Inn, Shawinigan Falls, under the chairmanship of the retiring chairman, Viggo Jepsen, with an attendance of twenty-four.

Regrets were expressed that such a small number were present. This, however, was no doubt largely due to unfavourable weather conditions in the days just previous to the meeting. In opening the meeting the chairman mentioned that he had a little trouble in keeping secretaries during the past year. The first appointee, Jack Sweeney, was a very promising and a very able secretary but joined up last fall with the R.C.A.F. and shortly after Eric Wheatley took over the duties of secretary-treasurer he was called by McGill University to help them to turn out more engineers.

The minutes from the previous year's annual meeting of April 22nd, 1942, were read by C. G. de Tonnancourt and adopted on the motion of Mr. H. G. Timmis and seconded by Mr. Stirling.

The chairman read the report of the branch meetings, as well as the membership reports. There had been five meetings apart from the annual meeting and the membership had increased to seventy-nine from sixty-two a year ago.

The chairman then explained that Headquarters have asked that a committee be set up in each of the four towns in our district and to be known as the Student Guidance Committee. Some of these committees had a little difficulty in getting started, but the Shawinigan Falls sub-committee had done excellent work and in the absence of its chairman, Dr. Heatley, Mr. Dorion gave a short report on the activities there.

The other committee, as asked for by the Headquarters, was the Committee on Engineering Features of Civil Defence. This committee, which consisted of the two members from our branch who attended the Webster Lectures, Messrs. Wyman and Foster, together with Councillor Fregeau and Branch Chairman Jepsen. It had not started to function as yet and consequently no report was available, but hopes were expressed that work would soon be started.

The chairman also mentioned that Mr. Eaton of Shawinigan Falls had been appointed to represent the branch on the Institute Nominating Committee and that Mr. Fregeau had acted in a similar capacity on the committee of Provincial Professional Interests.

At the conclusion of the report from the committees the Chairman thanked all committee members for the work they had performed during the year.

Of new business, it was strongly suggested that the incoming executive set up a small committee to revise the branch by-laws which dates back as far as 1926. It was felt that these by-laws would be a great help to the executives if brought up to date.

The scrutineer's report was read and adopted on a motion by Mr. Timmis and seconded by Mr. Buchanan.

The new chairman was then introduced. Mr. Fregeau thanked the members of the Branch for having done him the honour of electing him chairman and introduced the other members of the executive committee for 1943.

Mr. Fregeau then asked Mr. Jepsen to introduce the guest speaker.

Mr. C. S. Kane, M.E.I.C., P.E.Q., Sales Manager for Dominion Bridge Co. Ltd., and president for the Canadian Institute of Steel Construction, in his talk stated that the public in general and even engineers as well as big industrial firms were inclined to sit back and say that the question of post-war planning and reconstruction was up to the Government. He pointed out the fallacy of such sayings and emphasized that especially engineers should lead the way and point out to the government what plans could be made ahead of the actual winning of the war in order that the peace may also be won.

Mr. Kane went on to explain some of the points in his 19-point programme plan for post-war reconstruction, a copy of which was issued to everybody present.

A lively discussion took place at the close of the address and Mr. Kane was thanked very ably by the incoming vice-chairman, Mr. R. Dorion.

### SASKATCHEWAN BRANCH

Stewart Young, m.e.i.c. - *Acting Secretary-Treasurer*

The Saskatchewan Branch met jointly with the Association of Professional Engineers in the Kitchener Hotel, Regina, on Thursday evening, March 18, 1943. The meeting was preceded by a dinner at 6.30 p.m. The attendance was 30.

A paper on **The Effect of Aerial Bombing,** prepared by Dean I. F. Morrison, Professor of Applied Mechanics, University of Alberta, and illustrated by lantern slides, was read by D. A. R. McCannel in the absence of Professor Morrison who was unable to attend.

The paper, after describing the nature of various types of bombing, dealt briefly with the relative merits of different kinds of shelter—100 per cent no protection in the open, standing up, to almost 100 per cent protection underground. It also explained the theory of explosion. A hearty vote of thanks was accorded Professor Morrison for the very excellent paper and to D. A. R. McCannel for its presentation, on motion of W. O. Longworthy.

In concluding the meeting the Chairman, A. M. Macgillivray, expressed appreciation of the work of the retiring committee in charge of meetings under the leadership of F. C. Dempsey. The new committee will be under the direction of F. E. Estlin.

### SAULT STE-MARIE

O. A. Evans, m.e.i.c. - *Secretary-Treasurer*

The second regular meeting of the Branch for the year 1943 was held in the Grill Room of the Windsor Hotel, on Friday, February 26th, 1943. Forty-seven members and guests sat down to dinner at 6.45 p.m.

Before the dinner commenced, Chairman N. C. Cowie asked the members to rise and drink a toast to the king.

The chairman then called upon D. C. Holgate to introduce the speaker of the evening, D. C. Tennant, of the Dominion Bridge Company, Toronto, Ontario. In his address Mr. Holgate thanked the members for their kindness in allowing the structural class to participate in the meeting, and in introducing the speaker said that Mr. Tennant had a noteworthy career in the structural field and the Branch was fortunate in having a speaker of his calibre to address them.

Mr. D. C. Tennant, Engineer of the Ontario Division of the Dominion Bridge Company, spoke on **Steel Erection at the Algoma Plant.**

To begin with Mr. Tennant showed slides and gave an account of the moving of the travelling Coal Bridge and this has already appeared in the pages of *The Engineering Journal*. Continuing he dealt with the assembling of all necessary erection equipment including small tools and derrick parts from Toronto, other derrick parts and the high erection tower from Montreal, and locomotive cranes and smaller items from the Sault Structural Steel Company. He stressed the fact that most of the 109 foot tower and the derrick used in erecting the Blast Furnace and adjacent high structures such as Stoves, Dust Catcher, Stack, Elevator Shell and Skip Bridge—about 2,000 tons in all —had been taken from Dominion Bridge Company erection stock and had been used many times on different jobs with necessary adaptations.

Some special erection problems were noted such as the setting of derricks or travelers on adjacent high buildings or on top of the steel framing for a new roof where, on account of congestion of routine yard traffic, it would have been impossible to find room for the derrick on the ground. He summed up by pointing out that the successful design and operation of erection equipment depended on foresight and common sense on the part of the designer and a combination of caution, resource and co-operation on the part of the erection forces, than whom there are no finer group of men anywhere.

A few statistics were also given about the 200-ton crane to be installed in No. 2 Openhearth Building. It will be the heaviest crane in Canada although there are some others with greater lifting capacity.

At the conclusion of the address C. Stenbol and L. R. Brown moved a vote of thanks. J. O. Fitzgibbons moved that the meeting be adjourned.

### PETERBOROUGH BRANCH

A. R. Jones, Jr.e.i.c. - *Secretary-Treasurer*
J. F. Osborn, s.e.i.c. - *Branch News Editor*

On February 18th, Mr. R. E. Hayes, Engineer, of the General Supply Company presented a paper before the local branch entitled **Earth Moving Takes Wings.**

Mr. Hayes enlarged on this arresting title by explaining how the technique of moving large masses of earth has speeded up in recent years. Specialized machines have been designed to meet the needs of to-day's vast construction projects. Airports with mile and a half long runways, urgent highway and power projects, each call for a different treatment on an unprecedented scale.

A large versatile machine called the Tourneau-Pull, a combined carrier and excavator came in for particular attention. Other machines of a more familiar type were mentioned and their use outlined. An unusually good talking picture accompanied the paper, illustrating the function of machinery on construction jobs.

The March 4th meeting was addressed by Mr. Wills Maclachlan, Chairman of the Committee on Industrial Relations of the E.I.C. and head of Employee Relations Department, Hydro Electric Power Commission of Ontario. Mr. Maclachlan spoke on **Employee Industrial Relations.**

Mr. Maclachlan stressed the necessity of mutual respect and confidence on the part of employer and employee. He pointed out that the right man can only be selected for a position after analyzing the job and the man's qualifications. Psychological and health examinations can be of great value.

The importance of making a man familiar with his work his surroundings and the general policy of the organization by which he is employed was stressed as was the necessity of adequate training. Wage schedules and the effect on these of various services rendered to the employees such as pensions, sick benefits, insurance, savings schemes, should be carefully explained to a new man. Mr. Maclachlan said that the policy of "equal pay for equal value of work" was now very generally accepted as being a fundamental of Industrial Relations. Great strides are being made toward giving human relations the attention they merit, and this is a process which is bound to continue and accelerate after the war.

Mr. Maclachlan's paper comes at a time when there is particular interest in this topic and was received with close attention by the audience.

### TORONTO BRANCH

S. H. de Jong, m.e.i.c. - *Secretary-Treasurer*
G. L. White, affil.e.i.c. - *Branch News Editor*

At the meeting of the Toronto Branch of the Engineering Institute of Canada, at Hart House, on Thursday, March 4th, Mr. E. L. Durkee, Bethlehem Steel Co., spoke on the **Rainbow Bridge**. The speaker was introduced by Dean C. R. Young, Faculty of Applied Science and Engineering, University of Toronto, who acted as Chairman for the meeting.

In introducing the speaker, Dean Young referred to some of the many engineering achievements in which Mr. Durkee has played an important part. These include the Greater Extensions to the Tata Iron and Steel Company's plant in Tatanagar, India, involving the erection of 31,500 tons of steel mill building; the Outerbridge Crossing between Perth Amboy, N.J., and Tottenville, Staten Island, N.Y., a 750-ft. cantilever span and approaches built for the Port of New York Authority; the Cooper River Bridge in Charleston, S.C., which at the time of building was the fifth longest cantilever span in the world; an all-steel ocean pier 1,530 feet long built for the United Fruit Company, in Panama, in 1935; the Baton Rouge Bridge over the Mississippi River; and most recently, the Rainbow Bridge at Niagara Falls.

The Rainbow Bridge replaces the Falls View or Honeymoon Bridge which was destroyed by an ice jam in January, 1938. In view of what had happened to its predecessor, one of the first considerations in building the Rainbow Bridge was to provide for footings farther back and higher above the river in order to prevent any re-occurrence of the Falls View catastrophe.

The Rainbow Bridge is the longest fixed or hingeless arch span in the world, with a length of 950 feet between abutments. The roadway has a length of 1,200 feet between the vertical walls of the Niagara Gorge. In describing the construction of the bridge, with the aid of slides and excellent motion pictures, Mr. Durkee gave much interesting information on the nature of the design and the construction methods employed.

Successful erection of the arch ribs depended to a great degree on their accurate fabrication in the shops. As sections of the rib were produced in the steel shop, they were assembled three or four at a time, and the form of this assembly was carefully checked to ensure that it would give a proper rise to the section of the arch into which it would be incorporated. The erection of the arch, of course, involved its support from each side of the river until a junction could be effected at the centre. The cables supporting the arch passed over the top of steel bents at the edge of the Gorge and back to suitable anchorage. The cables used were bridge strands which had been employed in the construction of the Golden Gate Bridge and the ill-fated Tacoma Bridge.

Most of the steel used for temporary structures during erection was eventually incorporated into the bridge. One of the most exacting jobs during construction was the adjustment of the cables supporting the arch. An arrangement was used in which two steel plates were mated to three other plates with properly spaced bolt holes. A set of split falls enabled the men to take the weight off the matched plates while any necessary adjustment was made.

The speaker described the method used in shifting the point of cable support outward as the arch progressed. As each part of the arch proceeded toward the middle of the river, modifications were necessary in the methods of getting steel sections to their proper locations.

Where the arches met at the centre, provision had been made for an 11 in. joint to be made by a fabricated keystone piece. The accuracy of the design, production of sections, and erection were shown by the fact that two sections of the arch met with a difference of only about one inch in their horizontal plane.

The completed bridge shows very simple and beautiful lines in keeping with the setting in which it is placed. From the point of view of safety, it is interesting to note that this dangerous piece of work was completed with no fatalities and no serious accidents.

# News of Other Societies

**Items of interest regarding activities of other engineering societies or associations**

## ASSOCIATION OF PROFESSIONAL ENGINEERS OF NEW BRUNSWICK

Professor E. O. Turner, M.E.I.C., professor of civil engineering at the University of New Brunswick, Fredericton, was elected president of the Association of Professional Engineers of New Brunswick at the annual meeting held in the Admiral Beatty Hotel, at Saint John, on January 29th. Born at Harvard, Mass., U.S.A., in 1883, Professor Turner received his engineering education at the Massachusetts Institute of Technology where he graduated in 1914. In 1915 and 1916, he was engaged as a resident engineer with the Massachusetts Highway Commission and from 1916 to 1917 he was instructor of highway engineering at Polytechnic Institute of Brooklyn. In 1917, he enlisted and served as a Second-Lieutenant, Air Service, in the U.S. Army. In 1919 he became professor of civil engineering in charge of that department at the University of New Brunswick.

J. T. Turnbull, M.E.I.C., district highway engineer, Department of Public Works of New Brunswick, of Saint John, is the new vice-president of the Association.

## ASSOCIATION OF PROFESSIONAL ENGINEERS OF ALBERTA

At the annual meeting of the Association held on March 20th, 1943, at Edmonton, Vernon Pearson, M.E.I.C., mechanical superintendent, Department of Public Works of Alberta, was elected president.

Born and educated in England, Mr. Pearson came to Canada in 1910 and was employed with Lethbridge Iron Works until 1914 when he became in charge of electrification of the Canmore Coal Company property at Canmore. In October, 1917, he became assistant chief engineer and a year later was appointed chief engineer. From 1919 to 1923, Mr. Pearson was superintendent of public utilities for the town of Macleod, Alta. In June, 1923, he was appointed

**Vernon Pearson, M.E.I.C.**

mechanical superintendent of the provincial government of Alberta. He resigned in 1928 to become manager of the Edmonton branch of Electrical Engineers Limited. From 1931 to 1934, Mr. Pearson was in private practice under the firm name of Vernon Pearson Company. In 1930, he accepted the appointment of chief engineer and building superintendent of the Royal Alexandra Hospital at Edmonton, a position which he occupied until 1937 when he was appointed to the office which he now holds.

The other officers elected at the same meeting are: Vice-president, J. Garrett, M.E.I.C., general manager, Northwestern Utilities Limited, Edmonton; Councillors, N. W. Macpherson, M.E.I.C., highway commissioner, Department of Public Works, Edmonton; Professor J. W. Porteous, JR. E.I.C., department of electrical engineering, University of Alberta, Edmonton; A. Higgins, M.E.I.C., general mining engineer, Institute of Technology, Calgary, Alta.; J. S. Irwin, M.E.I.C., consulting petroleum geologist, Calgary, Alta.

The remaining councillors to act for one year are: A. Griffin, M.E.I.C., assistant manager, department of natural resources, C.P.R., Calgary, Alta.; P. M. Sauder, director of water resources, provincial government, Edmonton, Alta.; J. McMillan, M.E.I.C., purchasing agent, Calgary Power Company, Calgary, Alta.; E. H. Hunt, M.E.I.C., manager, exploration department, McColl-Frontenac Oil Company, Limited, Calgary, Alta.

## QUEBEC CORPORATION HOLDS ITS ANNUAL MEETING

A. O. Dufresne, M.E.I.C., a mining engineer of great distinction, now deputy-minister of the Department of Mines of Quebec, was elected president of the Corporation of Professional Engineers of Quebec, at the annual meeting held on March 27th, at the headquarters of the Engineering Institute in Montreal.

Born at Montreal, Mr. Dufresne entered the Ecole Polytechnique in 1907 and graduated in mining engineering in 1911. He did post-graduate work at McGill University and obtained a degree of Master of Science from this

**A. O. Dufresne, M.E.I.C.**

institution in 1913. During the early years of his career he was engaged in geological surveys and prospecting work. He later built up a successful practice as a mining engineer, specializing in inspection work, geological examinations and reports on mining properties. In 1929, he was called to head the Quebec Bureau of Mines as director. In 1941, Mr. Dufresne became deputy-minister of the Department of Mines, Province of Quebec.

The other officers elected at the same meeting are C. C. Lindsay, M.E.I.C., consulting engineer and land surveyor of Montreal, vice-president; A. D. Ross, M.E.I.C., manager of Canadian Comstock Company, Montreal, secretary-treasurer. The councillors for the current year are: J. A. McCrory, M.E.I.C., vice-president and chief engineer, Shawinigan Engineering Company, Montreal; Adhémar Laframboise, M.E.I.C., chief engineer, Eastern Canada Steel and Iron Works Limited, Quebec; J. O. Martineau, M.E.I.C., assistant chief engineer, Department of Highways, Quebec; P. E. Poitras, M.E.I.C., mechanical engineer, Steel Company of Canada, Montreal, E. A. Ryan, M.E.I.C., consulting engineer, Montreal.

The report from the Membership Committee showed that the efforts made to induce engineers to join the Corporation were very successful and the indications are that the results should be even more gratifying during the current year.

In his valedictory address, President McCrory stressed the importance of looking at the act establishing the Corporation with a real professional attitude. The purpose of this act was not so much to force engineers to join the Corporation as to assure the public that engineering work be carried on in the province only by those who are properly qualified.

## A.I.E.E. NOMINATIONS

The National Nominating Committee of the American Institute of Electrical Engineers, consisting of members from various parts of the country, has nominated the following official ticket of candidates for the offices becoming vacant August 1, 1943:

*For President:*

Nevin E. Funk, Vice-President in Charge of Engineering, Philadelphia Electric Co., Philadelphia, Pa.

*For Vice-Presidents:*

(Middle Eastern District)—W. E. Wickenden, President, Case School of Applied Science, Cleveland, Ohio.

(Southern District)—C. W. Ricker, Professor and Head of School of Electrical Engineering, Tulane University, New Orleans, La.

(North Central District)—L. A. Bingham, Assistant Professor of Electrical Engineering, University of Nebraska, Lincoln, Neb.

(Pacific District)—J. M. Gaylord, Chief Electrical Engineer, Metropolitan Water District of Southern California, Los Angeles, Calif.

(Canada District)—W. J. Gilson, General Manager, Eastern Power Devices, Ltd., Toronto, Ont., Canada.

*For Directors:*

C. M. Laffoon, Engineering Manager, A.C. Generator Engrg. Dept., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

C. W. Mier, Engineer, Southwestern Bell Telephone Co., Dallas, Texas.

S. H. Mortensen, Chief Electrical Engineer, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

*For National Treasurer:*

W. I. Slichter, Professor Emeritus of Electrical Engineering, Columbia University, New York, N.Y.

These official candidates, together with any independent nominees that may be proposed later in the manner specified by the Constitution and By-laws, will be voted upon by the membership at the coming election this spring.

# Library Notes

## Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**Plumbing Practice and Design:**

*Volume 1 by Svend Plum. N.Y., John Wiley and Sons, Inc. (c. 1943). 6 x 9¼ in. $4.50.*

**Mechanical Handling Yearbook and Manual, 1943:**

*London, Paul Elek (Publishers) Ltd. 5½ x 8½ in. 34/6d, post free.*

**Engineering Law:**

*R. E. Laidlaw and C. R. Young. 2nd edition. Toronto, The University of Toronto Press, 1941. 6 x 9¼ in. $4.00.*

**1942 Book of A.S.T.M. Standards:**

*Including tentative standards. Part 3: Nonmetallic materials—General. Philadelphia, American Society for Testing Materials, 1943.*

### REPORTS

**Canadian Engineering Standards Association:**

*By-Laws to govern the organization and activities of administrative, sectional and working committees. Approved by Executive Committee, March, 1941, and Main Committee, July, 1942. Published December, 1942.*

**American Association of Engineers:**

*Standards on the classification and compensation of professional engineering positions. Edition of 1942.*

**Canada—Department of Labour:**

*Report of the department for the fiscal year ending March, 1942.*

**Edison Electric Institute:**

*Specifications for low and medium-voltage pin-type line-glass insulators approved by Transmission and Distribution Committee, 1942.*

**General Electric Company—Research Laboratory:**

*Electric discharges in vacuum and in gases at low pressures by Dr. Irving Langmuir.*

**Manitoba Electrification Enquiry Commission, 1942:**

*A farm electrification programme. Report of the Commission.*

**Manitoba—Department of Mines and Natural Resources:**

*Thirteenth annual report on mines and minerals for year ending April, 1941.*

**Bell Telephone System—Technical Publications:**

*Monograph B-1352: Poles and pole treatment—B-1353: The use of secondary electron emission for trigger or relay action—B-1354: Some mechanical aspects of telephone apparatus.*

**L'équation de Combustion:**

*Boleslaw Szczeniowski. Montreal, Ecole Polytechnique, 1942.*

**Queen's University—Industrial Relations Section—Bulletins:**

*No. 3: Vacations with pay in Canadian Industry—No. 4: Economic welfare of Canadian employees—No. 5: War-time policy of the Dominion government—No. 6: Trade union agreements in Canadian industry.*

*Proceedings of the sixth Industrial Relations Conference of the Industrial Relations Section, September, 1941.*

### BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters or may be sent direct to the publishers.**

**A.S.T.M. STANDARDS ON PAINT, VARNISH, LACQUER, AND RELATED PRODUCTS**

*Prepared by Committee D-1 on Paint, Varnish, Lacquer, and Related Products; Specifications, Methods of Testing, Definitions of Terms. Dec., 1942. American Society for Testing Materials, Phila., Pa., 1943. 408 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.25.*

This compilation of standards contains in their latest form more than 120 specifications, tests and definitions relating to paint, varnish, lacquer and their constituents. A number of specifications and tests are new.

**APPLIED KINEMATICS for Students and Mechanical Designers**

*By J. H. Billings, 2 ed. D. Van Nostrand Co., New York, 1943. 320 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.25.*

The principles governing motion and the design of machine elements are presented. As far as possible, simple graphical methods are used. The illustrative material and problems are related to engineering practice. Special attention is given to acceleration.

**(THE) ARMY ENGINEERS IN REVIEW**

*By B. W. Leyson. E. P. Dutton & Co., New York, 1943. 202 pp., illus., maps, charts, diagrs., 8½ x 5½ in., cloth, $2.50.*

This book describes the work of the Corps of Engineers of the U.S. Army in peace and in war. It also gives something of its history and tell how it is organized and trained. Young men interested in joining the Corps will find information on the training required and the fields of work.

**BIBLIOGRAPHY OF THE LITERATURE RELATING TO CONSTITUTIONAL DIAGRAMS OF ALLOYS (Institute of Metals Monograph and Report Series No. 2)**

*Compiled by J. L. Haughton. Institute of Metals, 4 Grosvenor Gardens, London, S.W.1, 1942. 163 pp., 8½ x 5½ in., stiff linen, 3s. 6d. net.*

This valuable bibliography contains over six thousand references to publications on the constitution of alloys, arranged by alloys. In addition to the original publications, reference is also made to abstracts that appeared in "Metallurgical Abstracts".

**ECONOMICAL MINERAL DEPOSITS**

*By A. M. Bateman. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 898 pp., illus., diagrs., charts, maps tables, 9½ x 6 in., cloth, $6.50.*

This work is intended primarily as an elementary textbook, but because of its comprehensiveness it will also be useful as a reference book to all those interested in the mineral industry. Part 1, on general principles and processes, describes the formation of mineral deposits and their kinds, and describes briefly the methods of prospecting, exploring and developing them, as well as methods of mining, milling and smelting. Parts 2 and 3 respectively discuss the deposits of metallic and non-metallic minerals. The value of the book is increased by numerous brief lists of carefully selected references.

**ELEMENTARY MATHEMATICS**

*By H. Levy. Ronald Press Co., New York 1942. 216 pp., illus., diagrs., charts, tables, 8 x 5 in., cloth, $1.50.*

This is an interesting British text intended primarily to assist students of aeronautics in obtaining a solid foundation for further study. The explanations are clear and simple, and the range covered is a wide one, extending from whole numbers and fractions to the use of vectors, functions, etc. Students of science generally will find the book helpful.

**ELEMENTS OF SUPERVISION**

*By W. R. Spriegel and E. Schulz. John Wiley & Sons, New York; Chapman & Hall, London, England, 1942. 273 pp., diagrs., tables, 9½ x 6 in., cloth, $2.25.*

Present rapid industrial expansion has created a shortage of trained supervisors and a need for texts which describe the functions of supervisors and methods for training them. The present book meets this need by giving an account of the duties of the position, the problems involved and the ways of meeting them, and of practical methods of training.

**ENGINEERING MECHANICS**

*By G. N. Cox. D. Van Nostrand Co., New York, 1943. 301 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

In preparing this textbook, the author has endeavoured to co-ordinate the desires of our engineering teachers as expressed in the surveys conducted by the Society for the Promotion of Engineering Education. The book is intended for undergraduate students majoring in engineering, and calls for a working knowledge of physics and the calculus.

**(THE) FEDERAL POWER COMMISSION AND STATE UTILITY REGULATION**

*By R. D. Baum. American Council on Public Affairs, Washington, D.C., 1942. 301 pp., 9 x 6 in., paper, $3.00; cloth, $3.75.*

This is a careful study of the relations with the states of the Federal Power Commission. The disputes as to jurisdiction that have arisen, the experience of the Commission in controlling water power, accounting, rates, etc., and the efforts for collaboration are discussed. There is a bibliography.

**FOREMANSHIP AND SAFETY**

*By C. M. MacMillan. John Wiley & Sons, New York; Chapman & Hall, London 1943. 101 pp., illus., tables, 8 x 5½ in., stiff paper, $1.00.*

This little book explains, in clear, simple language, the safety problems that confront the foreman and the way they should be handled. All important phases of everyday industrial accident prevention are discussed.

**FREQUENCY MODULATION**

*By A. Hund. McGraw-Hill Book Co., New York and London, 1942. 375 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

This book is designed to meet the need for an engineering treatment of all phases of frequency modulation from the basic principles to the design of commercial apparatus. The treatment is a critical one, and the text is complete in itself. The book will be of use to the expert as well as to the student.

**GAS WARFARE, the Chemical Weapon, Its Use and Protection Against It**

*By A. H. Waitt. Duell, Sloan & Pearce, New York, 1942. 327 pp., illus., diagrs., tables, 8½ x 5½ in., cloth, $2.75.*

A thorough, readable book of usefulness to both civilian and soldier. The nature of the gases used, their use in battle and methods of protection and first aid are covered. The tactics of chemical warfare are discussed in some detail.

**(A) GUIDE TO CATHODE RAY PATTERNS**

*By M. Bly. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 39 pp., diagrs., paper, loose-leaf binder, $1.50.*

This collection of cathode-ray patterns summarizes in convenient form the types encountered in the usual course of laboratory and test-bench work. Over one hundred forms are shown. These have been collected from many sources and brought together for ready reference.

**HANDBOOK FOR PROSPECTORS AND OPERATORS OF SMALL MINES**

*By M. W. von Bernewitz, revised by H. C. Chellson. 4th ed. McGraw-Hill Book Co., New York and London, 1943. 547 pp., illus., diagrs., charts, tables, 7½ x 5 in., cloth, $4.00.*

This well-known work has again been revised and brought up to date. New tests have been added as well as new chapters on crystals, on ore dressing and treatment and weights and measures, calculations, etc. Details of the United States Mining Law are given. Especially, the data useful to the small-mine owner have been enlarged.

**HANDBOOK OF BRICK MASONRY CONSTRUCTION**

*By J. A. Mulligan. McGraw-Hill Book Co., New York and London, 1942. 526 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

The materials used in bricklaying and brick masonry construction are discussed in a practical way and more comprehensively than in any other book. Much information is provided on strength of masonry, on estimating brickwork, on special types and shapes and on tests. Such topics as underpinning with brickwork, boiler settings, fireplaces and chimneys, paving, swimming pools and timbrel arches are given special notice.

**(THE) HYPERGEOMETRIC AND LEGENDRE FUNCTIONS WITH APPLICATIONS TO INTEGRAL EQUATIONS OF POTENTIAL THEORY**

*By C. Snow. U.S. Bureau of Standards, Washington, D.C., 1942. 319 pp., photo-offset of longhand, diagrs., 11 x 9½ in., paper, $2.00.*

This work has been compiled for workers in applied mathematics and is intermediate between tables of the numerical values of these functions and a treatise on their pure theory. The linear and quadratic transformations and analytic continuations of the ordinary hypergeometric function are derived and written out at length with special space devoted to the associated Legendre functions, and to a smaller extent Heun's generalization of the hypergeometric function. Many applications to potential theory are developed.

**MACHINE DESIGN**

*By P. H. Hyland and J. B. Kommers. 3 ed. McGraw-Hill Book Co., New York and London, 1943. 562 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

This is a carefully illustrated college textbook covering the elements of machine design and containing numerous problems. This edition has been revised throughout, new material replacing old wherever necessary.

**MANUAL OF SHIP CONSTRUCTION**

*By G. C. Manning. D. Van Nostrand Co., New York, 1942. 319 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $2.75.*

The purpose of this book is to explain the fundamental principles of naval architecture to operating officers in the merchant marine and to cadets preparing for that service. The subject is treated as simply as possible, with emphasis upon the portions of most interest to the officer.

**METALLOGRAPHY**

*By C. H. Desch. 5th ed. Longmans, Green & Co., London, New York and Toronto, 1942. 408 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $8.00.*

The new edition of this popular textbook is a reprint of the fourth edition with an appendix which calls attention to certain work done during recent years. The book affords a good introduction to the subject and is especially useful because of its ample references to the literature of metallography.

**NOXIOUS GASES and the Principles of Respiration Influencing Their Action (American Chemical Society Monograph Series No. 35)**

*By Y. Henderson and H. W. Haggard. 2 rev. ed. Reinhold Publishing Corp., New York, 1943. 294 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

In this work two experienced physiologists review the poisonous gases and vapors and discuss their effects and the methods of treatment. The book is designed for chemits, engineers and others engaged in industry, and covers all the noxious gases that occur in industry. The functions of respiration are considered, as well as methods of protection against poisoning.

**PHOTOGRAMMETRY**

*By H. O. Sharp. 3 ed. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1943. 129 pp., illus., diagrs., charts, tables, 11½ x 8½ in., cloth, $3.50.*

This book provides an exposition of the fundamental principles involved in both terrestrial and aerial photographic surveying, together with a discussion of the application of these principles to map making. The work is intended for use as a text and for office reference. The cameras, instruments and methods which have proved satisfactory are described. The analytical solution of photogrammetric problems is discussed as is the use of the photograph in land surveying. Map reproduction is treated in some detail.

**PLASTICS, Problems and Processes**

*By D. E. Mansperger and C. W. Pepper. 2 ed., edited by W. H. Varnum. International Textbook Co., Scranton, Pa., 1942. 350 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

This manual is intended for students of industrial art, home craftsmen and others interested in working plastics on a small scale. The materials available, tools needed and methods of working are described, and designs and instructions given for many useful or ornamental articles. Lists of suppliers of materials and equipment are given. The information is practical and well presented.

**(THE) PRINCIPLES OF METALLOGRAPHIC LABORATORY PRACTICE**

*By G. L. Kehl. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 453 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

This textbook presents the principles of physical metallurgy which underlie effective laboratory practice, and is intended to bridge the gap between theoretical physical metallurgy and its practical application in the laboratory. The new edition follows the plan of the previous one, but has been revised to include recent advances.

**QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book III —AUXILIARIES**

*"Marine Engineering and Shipping Review" published by Simmons-Boardman Publishing Corp., New York, 1943. 139 pp. diagrs., tables, 8 x 5 in., paper, $1.00.*

This little manual contains material selected from the Questions and Answers department of "Marine Engineering and Shipping Review". The questions refer to practical difficulties encountered in operating pumps, condensers, refrigerating equipment, evaporators and other auxiliary equipment of ships.

**RAILWAY ENGINEERING AND MAINTENANCE CYCLOPEDIA, 5th ed. 1942**

*Edited by E. T. Howson and others. Simmons-Boardman Publishing Corp., Chicago, Ill., and New York, N.Y. 1,224 pp., illus., diagrs., charts, maps, tables, 12 x 8 in., fabrikoid, $5.00.*

The Encyclopedia is designed to cover thoroughly the best practice of American railways with regard to the materials, devices and products used in the construction and maintenance of the fixed properties. Sections are devoted to Track, Bridges, Water Service, Signals and General Topics. Each technical discussion is supplemented by material prepared by manufacturers, discussing their products in detail. The new edition has been thoroughly revised and partly rewritten.

**SHIP STRUCTURE AND BLUEPRINT READING**

*By H. L. Heed. Cornell Maritime Press, New York, 1942. 258 pp., illus., diagrs., charts, tables, 7½ x 5 in., cloth, $2.50.*

Blueprint reading is presented here solely from the point of view of men engaged in building ships. The shapes and structures which the prints represent are described in detail. A glossary of shipbuilding terms is given.

**STRATIGRAPHY OF THE EASTERN AND CENTRAL UNITED STATES**

*By C. Schuchert. John Wiley & Sons, New York, 1943. 1,013 pp., illus., diagrs., charts, maps, tables, 9 x 6 in., cloth, $15.00.*

The main object of the late Dr. Schucherts monumental work on the historical geology of North America is to present the data upon which are built a series of Raps depicting the ancient geographies, and to throw light upon the causes that change the relative levels of land and sea. In this, the second volume of the work, the author discusses the stratigraphy of thirty eastern and central States, including Texas. An enormous mass of data is organized systematically, with references to sources, forming a reference work of permanent usefulness.

**STRUCTURAL GEOLOGY**

*By M. P. Billings. Prentice-Hall, New York, 1942. 473 pp., illus., diagrs., charts, maps, tables, 9½ x 6 in., cloth, $4.50.*

This is an elementary textbook, confined to the study of relatively local structural units, in which the emphasis is on principles, methods and technique. The structure of specific local areas is not discussed, except to illustrate principles. Laboratory exercises and problems are provided.

**TABLE OF ARC TAN X**

*Prepared by the Federal Works Agency, Work Projects Administration for the City of New York, as a Report of Official Project No. 165-2-97-22, Mathematical Tables Project.*

*A. N. Lowan, Technical Director; conducted under the sponsorship and for sale by the National Bureau of Standards, Washington, D.C., 1942. 169 pp., tables, 11 x 8 in., cloth, $2.00.*

This table of the inverse tangent is claimed to be the most comprehensive yet published. The angle is given in radians, and the function is calculated to twelve decimals, calculated over the range of x from 0 to 10,000.

**TELEVISION STANDARDS AND PRACTICE, Selected Papers from the Proceedings of the National Television System Committee and Its Panels**

*Edited by D. G. Fink. McGraw-Hill Book Co., New York and London, 1943. 405 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

This volume has been compiled from the Proceedings of the National Television System Committee, on which are based the standards for television broadcasting in use in this country. The papers chosen for the present book are those that directly underlie the official standards. They comprise a symposium on the engineering problems of the television engineer and the radio industry.

**(THE) THEORY AND PRACTICE OF HEAT ENGINES**

*By D. A. Wrangham. The Macmillan Co., New York; University Press, Cambridge, England, 1942. 756 pp., illus., diagrs., charts, tables, 10 x 7 in., cloth, $10.50.*

This is a general textbook, which provides an introduction to the various sections of this large subject. Air compressors and motors, reciprocating steam engines, steam condensers, steam turbines, gas, gasoline and oil engines, steam boilers, refrigeration, combustion, etc., are discussed with the aid of excellent diagrams.

**(THE) THEORY OF THE PHOTOGRAPHIC PROCESS**

*By C. E. K. Mees. Macmillan Co., New York, 1942. 1,124 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $12.00.*

During the last fifty years a fund of knowledge of the photographic process has been built up, which is scattered through many journals. The present volume is a general handbook of the subject, which provides a guide to the literature and a summary of its conclusions. The author has had the assistance of many specialists. There are bibliographies with each chapter.

**TOOL DESIGN (Rochester Technical Series)**

*By C. Donaldson and G. H. LeCain. Harper & Brothers, New York and London, 1943. 443 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.75.*

This textbook presents the general methods of tool design in a practical way, with many applications of the principles to practical problems. The design of punches, dies, gages, jigs, fixtures and cams is discussed, as well as the tooling of automatic screw machines and turret lathes.

**TOOL DESIGN AND TOOL ENGINEERING**

*By J. G. Jergens. John G. Jergens, 4280 E. 119 St., Cleveland, Ohio, 1942. 106 pp., diagrs., tables, 11½ x 9 in., paper, $2.00.*

A collection of articles, drawings and tables of interest to tool designers and engineers. Includes many examples of clamps, cams, tools, fixtures, etc.

**TRANSIENTS IN LINEAR SYSTEMS, Studied by the Laplace Transformation. Vol. I. Lumped-Constant Systems**

*By M. F. Gardner and J. L. Barnes. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 389 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

This exposition of the subject is intended primarily for graduate students of electrical and mechanical engineering, but can also be used for graduate work in mathematical physics and applied mathematics. Volume one deals with lumped-constant systems. The book contains an extensive bibliography.

**ULTRA-HIGH-FREQUENCY TECHNIQUES**

*By J. G. Brainerd, G. Koehler, H. J. Reich and L. F. Woodruff. D. Van Nostrand Co., New York, 1943. Ninth printing, 570 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

This textbook was compiled to meet the demand for engineers and physicists with training in ultra-high-frequency work aroused by the war. It is based on a syllabus of the course now being given in various colleges, and represents the minimum basis for technical work in its field. In addition to the text, there is an excellent bibliography.

**WEATHER SCIENCE, an Illustrated Outline of**

*By C. W. Barber. Pitman Publishing Corp., New York and Chicago, 1943. 248 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth, $2.50.*

This concise textbook presents the course in meteorology, developed at the U.S. Naval Air Station at Lakehurst for training Naval Air Cadets. The subject is clearly presented, with profuse use of visual aids and with many questions.

**PSYCHOLOGY FOR BUSINESS AND INDUSTRY**

*By H. Moore. 2 ed. McGraw-Hill Book Co., New York and London, 1942. 526 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

This text is devoted especially to those aspects of psychology which have been shown to be of value in the business and industrial worlds. The practical personnel problems of testing applicants for positions, appraising employees, training, promotion, accidents, fatigue, etc., are discussed, together with the psychological factors in selling. The new edition has been carefully revised.

**QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book II—Engines**

*Compiled by H. C. Dinger. Marine Engineering and Shipping Review, Simmons-Boardman Publishing Corp., New York, 1942. 186 pp., diagrs., charts, tables, 8 x 5½ in., paper, $1.00.*

This book, containing a collection of questions and answers which have appeared in "Marine Engineering and Shipping Review", is the second of a series dealing with practical problems that confront marine engineers. This volume is concerned with steam engines. both reciprocating and turbine. The information deals with practically every situation.

**READING AS A VISUAL TASK**

*By M. Luckiesh and F. K. Moss. D. Van Nostrand Co., New York, 1942. 428 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $5.00.*

Describes the work of the authors in endeavouring to make a scientific analysis of the visual task of reading. The criteria of readability which have been developed, and the devices and techniques which can be used to measure readability are discussed, and certain conclusions drawn. The book is a pioneer effort in a relatively unexplored field. There is a bibliography.

**SCIENCE IN PROGRESS**

*By H. Shapley, E. Hubble, H. A. Bethe, V. K. Zworykin, P. W. Bridgman, L. S. Marks, J. Franck, J. G. Kirkwood, P. H. Long and H. Mark; edited by G. A. Baitsell. 3rd series. Yale University Press, New Haven, Conn.; Humphrey Milford, Oxford University Press, London, 1942. 322 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

Contains ten lectures by distinguished scientists who discuss the results of recent research work in various scientific fields. The subjects considered in this volume include: galaxies, the expanding universe, energy production in the stars, image formation by electrons, recent work in high pressures, power generation, photosynthesis, the structure of liquids, sulfanilamide and synthetic rubber.

**The SCIENCE OF MECHANICS**

*By E. Mach, translated from the German by T. J. McCormack. Open Court Publishing Co., La Salle, Ill., and London, 1942. 635 pp., illus., diagrs., tables, 8 x 5½ in., cloth, $3.50.*

The new edition of this classic makes available again a work that has been out of print for more than a decade. It has been revised according to the ninth German edition, and the alterations and additions formerly printed as appendices and in a supplementary volume have been incorporated in the text, with great improvement in readability.

**STRESSES IN FRAMED STRUCTURES**

*Edited by G. A. Hool and W. S. Kinne, revised by R. R. Zipprodt and G. C. Ernst. 2 ed. McGraw-Hill Book Co., New York and London, 1942. 642 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

The first edition of this reference book on the stresses in framed structures appeared twenty years ago and has been widely used. The present edition has been thoroughly revised to correspond with modern practice. The book covers the principles of statics, reactions, moments and shears in beams and trusses, influence lines, methods of computing stresses in roof and bridge trusses, determination of stresses in lateral trusses and portal bracing, etc.

**STRUCTURAL PETROLOGY OF DEFORMED ROCKS**

*By H. W. Fairbairn. Addison-Wesley Press, Kendall Square Bldg., Cambridge, Mass., 1942. 143 pp., illus., diagrs., charts, tables, 11 x 9 in., paper, spiral binding, $5.00.*

The subject of structural petrology has aroused increasing interest during the last decade, and this book is a welcome addition to the small number available. The author presents an up-to-date account of knowledge in this field, with some attempt at interpretation of the facts. The book is intended for experienced geologists and petrographers, not for beginners. There is a full bibliography.

**TOWN PLANNING AND ROAD TRAFFIC**

*By H. A. Tripp, foreword by P. Abercrombie. Edward Arnold & Co., London; Longmans, Green & Co., New York, 1942. 118 pp., diagrs., charts, 9 x 5½ in., cloth, $3.25.*

The author, who is Assistant Commissioner of Police at Scotland Yard, has attempted to "review in outline the whole field of traffic direction, its supervision and control, the making and enforcement of traffic law, and the relevant problems of public opinion and psychology, and of town and country planning."

**DIFFERENTIAL EQUATIONS**

*By R. P. Agnew. McGraw-Hill Book Co., New York and London, 1942. 341 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

Offers a first course in the subject for those with a working knowledge of algebra, trigonometry and elementary calculus. Is intended to give a mastery of the techniques by which differential equations are obtained and solved, and by which the solutions are applied.

**PROCEEDINGS OF THE FIRST SOUTHERN CALIFORNIA MANAGEMENT CONFERENCE**

*"Manning and Managing Our Arsenal," held at California Institute of Technology, Pasadena, (apply), May 2, 1942. 49 pp., tables, 11½ x 9 in., paper, $1.00.*

The papers here presented under the general theme of "Manning and Managing Our Arsenal" discuss such fundamental subjects as inventory and production control, the training of workers, and foremanship. In addition, attention is given to current problems of production, co-operative subcontracting, retooling for war work, and women in war industries.

(*Continued on page 237*)

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

April 1st, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the May meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

## FOR ADMISSION

BEEDHAM—GEORGE HERBERT, of 29 Clowes Ave., Leaside, Ont. Born at Sheffield, England, Sept. 21st, 1894; Educ.: 1908-12, evening classes, dept. of applied science, Sheffield Univ., 1909-13, ap'ticeship in engrg., B. M. Renton Co., Sheffield. Course in metallurgy (lectures only), Ont. Chapter, Amer. Soc. for Metals; 1915-17, journeyman fitter and turner i/c forge repairs, Thos. Firth & Sons, Sheffield; 1917-19, engine room artificer, destroyers and submarines, Royal Navy; 1919-20, tool designer, Lincoln Machine Tool Co., Pawtucket, R.I.; with J. &. J. Taylor, safe works, Toronto, as follows: 1913-15 and 1919 (Apr.-Aug.), dftsman., 1920-29, senior dftsman., design work on numerous bank vault jobs, also safes for radium protection, etc., 1929-36, chief dftsman and vault engr., 1936-37, vault engr., doing technical engrg. in South Africa, Australia, New Zealand, setting up exhibits, etc., 1937-39, design and engrg. on new prison at Hull, Que., etc.; 1939 to date, mech. engr., Lablaw Groceterias Co., Toronto, i/c all mech. equipment in 114 stores and large warehouse and mfg. depts., power plant, refrigeration and air conditioning plant, etc.

References: H. R. Brownell, G. H. Tate, E. G. T. Taylor, T. M. West, S. R. Frost.

BJERRING—KARI HERBERT, of 5616 McLynn Ave., Montreal, Born at Winnipeg, Man., July 15th, 1911. Educ.: B.Sc. (Elec.), Univ. of Man., 1934; 1928-33 (summers), rodman, laborer, tracer, dftsmn. and engr. on ground-testing, and 1935, storekeeper, Manitoba Power Commission; 1936-38, junior assessor, land and bldgs., City of Winnipeg; 1938-39, engr., air conditioning divn., Toronto district, Canadian General Electric, design of ducts, design and layout of hot water, steam, and vapor heating systems; 1939 to date, eng., Defence Industries Ltd., Montreal, design and specifications for compressed air and refrigeration installns., steam and air distribution systems.

References: H. D. Karn, A. G. Moore, J. R. Auld, I. R. Tait, J. M. Crawford.

BRADEN—NORMAN SHORT, of Hamilton, Ont. Born at Indianapolis, Indiana, June 15th, 1869; Educ.: 1884-87, special course, Whitman College, Walla Walla, Wash. R.P.E. of Ont.; 1892-94, test and erection engr., Janney Electic Motor Co., Indianapolis; 1895-98, sales and erection engr., Cleveland, Ohio; 1899-1903, sales engr., Westinghouse Electric & Mfg. Co.; with Canadian Westinghouse Co. Ltd., as follows: 1904-19, mgr. of sales, 1919-25, vice-president, 1925 to date, director, and 1940 to date, vice-chairman of board.

References: T. H. Hogg, J. Morse, H. G. Acres, H. A. Cooch, W. L. McFaul, F. A. Gaby.

CRANE—GEORGE JOSEPH, of Buckingham, Que. Born at London, Eng., April 29, 1917; Eudc.: B.A.Sc., Univ. of B.C., 1941; 1941-42, test course, Canadian General Electric Co.; 1942 to date, elect'l supt., Electric Reduction Co., Buckingham, Que.

References: J. N. Finlayson, C. E. Sisson, G. R. Langley, R. M. Prendergast, W. M. Cruthers, H. J. MacLeod, D. Anderson.

HOLDEN—ALEXANDER HERBERT, of Brownsburg, Que. Born at Toronto, Ont., Aug. 24, 1917; Educ.: B.A.Sc., Univ. of Toronto, 1939; 1937 (summer), control lab., Abitibi Paper Co., Fort William; 1938 (summer), constrn., H.E.P.C. of Ontario, Sudbury; 1939 (summer), plant standards dept., Swift Canadian Co., Toronto; 1939-40, process research, 1940-41, asst. chief chemist, 1941 to date, ballistics engr., Canadian Industries Ltd., Dominion Ammunition Divn., Brownsburg, Que.

References: O. Holden, C. L. Johnson, J. W. Houlden, R. Bruce, C. H. Jackson.

LANGELIER—J. NAPOLEON, of Montreal East, Quebec. Born at L'Islet, Que., March 26, 1885; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1910; R.P.E. Quebec; 1910-15, asst. engr., City of Outremont; 1915-21, chief engr., Town of Pointe-aux-Trembles, Que.; 1922-25, general mgr. and town engr., Town of LaTuque, Que.; 1925-40, general mgr., town engr., Town of Montreal East, Que. 1940 to date, chief engr. of the Montreal Metropolitan Commission; engr. and inspr. of the towns of Montreal North, St. Michel and Pointe-aux-Trembles, under the control of the Montreal Metropolitan Comm.

References: H. Gaudefroy, J-A. Lalonde, H. Massue, A. Circé, A. Cousineau.

MURPHY—BRUNELLE NEIL, of Vancouver, B.C. Born at Fort William, Ont., Nov. 7th, 1907; Educ.: Corres. course; 1927-28, Paradise Mine; 1928-30, constrn. dept., C.P.R.; 1931-32, West Kootenay Light & Power Co., 1932-36, mtce., C.P.R.; 1937-39, supt. and engr. in charge, Reeves MacDonald Mines Ltd., Salmo, B.C.; 1939-41, asst. chief engr. i/c all staff-examination and development work of mines in B.C. for Canadian Exploration Ltd., Vancouver; Engr. i/c military road, Ucluelet-Tofino Airdrome; 1941 to date, office and equipment engr., i/c mtce., repair and purchase of all equipment, Coast Construction Co. Ltd., Vancouver, B.C.

References: C. R. Crysdale, K. Dicosn, J. P. Coates, T. C. MacNabb, T. F. Francis, G. T. Chillcott.

SCARLETT—ARTHUR ALFRED, of Hamilton, Ont. Born at Toronto, Jan. 1st, 1890; Educ.: B.A.Sc., Univ. of Toronto, 1913; R.P.E. Ontario; 1913, Westinghouse Machine Co.; 1913-14, H.E.P.C. of Ontario; 1915-18, shell production; with International Harvester Co., of Hamilton, Ont., as follows: 1919-24, designer, 1924-27, asst. supt. of experiments, 1927-35, asst. chief engr., 1935-to date, chief engineer.

References: N. A. Eager, W. J. W. Reid, W. D. Black, H. A. Cooch, W. McFaul.

SEGSWORTH, R. SIDNEY, of 82 Cliveden Ave., Toronto, Ont. Born at Winchester, Ont., May 23rd, 1910; Educ.: B.A.Sc., Univ. of Toronto, 1935; 1930-32, inspr. on constrn. of trunk sewers and disposal plant for town of Brampton; 1932 (Feb.-Sept.), operated own machine shop; 1933-35, supt., Algoma Summit Mines, prelim. development work, installn. of experimental metallurgical equipment; 1935-36, demonstrator, dept. of mech. engrg., Univ. of Toronto; 1936 to date, development engr., General Engineering Company (Canada) Ltd., Toronto, principally on design and installn. of mining and milling plants; also on specifying, purchasing, design, installn. and testing of equipment for above. At present in charge of development dept.

References: C. F. Morrison, E. A. Allcut, R. W. Angus, E. R. Graydon, R. H. Self.

SMITH—STANLEY EDWIN, of 95 Windsor Ave., London, Ont. Born at Dargaville, New Zealand, Feb. 21st, 1905; Educ.: 1924-31, Auckland University College (5 years part time study). B.A., Queen's Univ., 1935. Theology Diploma, Knox College, Toronto, 1938. Post-Graduate course in Theology and German, Basle Univ., Switzerland, 1938-39; 1923-24, ap'tice to borough engr., Onehunga Borough Council, Auckland, N.Z., surveys, design, supervn. for constrn. of new roads, sewers and mtce.; 1927-28, part time employment, while a full time student, testing lumber under N.Z. State Forest Service; 1928-31, civil engr., Mount Albert Borough Council, Auckland, N.Z., surveys, design, supervn., estimates, specifications for new roads, sewers, bldgs., parks, etc.; 1932, left New Zeland to study for ministry; 1939-42, minister in charge of churches in Regina and Hamilton; July, 1942, to date, instr'man., mtce. of way, C.N.R., London, Ont.

References: J. Ferguson, E. R. Logie, E. G. Hewson, H. G. Stead, S. B. Wass.

TITUS—OLCUTT, of Toronto, Ont. Born at Weston, Ont., April 24th, 1896; Educ.: B.A.Sc. (Elec.), Univ. of Toronto, 1917. R.P.E. of Ont.; 1913-16 (summers), elec. mtce. and constrn., Toronto Power Co., Niagara Falls, Ont.; 1917-19, Lieut., Can. Engrs., C.E.F.; 1929 to date, with Standard Underground Cable Co. of Canada and Canada Wire & Cable Co. Ltd., 1929-37, elec. engr., 1937-40, chief elec. engr., and 1940 to date, chief engr.

References: J. B. Challies, J. Morse M. J. McHenry, W. P. Dobson, A. H. Hull, O. Holden.

WAINES—RUSSELL TALBOT, of 43 Albertus Ave., Toronto, Ont. Born at Dunnville, Ont., Aug. 31st, 1901; Eudc.: B.A.Sc., Univ. of Toronto, 1925; 1922-23-24 (summers), G. B. Meadows & Hamilton Gear & Machine Co. Ltd.; 1926 (4 mos.), Cleveland Electric Illuminating Co.; 1925-26, 1928 and 1930, mach. design lab., Univ. of Toronto; 1926-27, and 1930-32, engr. on various jobs incl. testing and inspecting controllers and motors, elevator design, etc., Turnbull Elevator Co. Ltd.;

1933-34, Mills Mining Machinery Co. Ltd., i/c dftng. room, also design of ore crushing machy., etc.; 1935-42, estimator, salesman, costs, etc., also acting erection mgr., Turnbull Elevator Co. Ltd.; 1942 to date, mech. engr., Dominion Bridge Co. Ltd., Toronto, Ont.

References: H. S. Irwin, W. H. M. Laughlin, F. E. Wellwood, R. W. Teagle, E. A. Allcut.

VAN WINCKLE—JACK MULLEN, of 2555 Bloor St. West, Toronto. Born at Toronto, April 28, 1915; Educ.: B.A.Sc. (Mech.), Univ. of Toronto, 1940; 1937-38, (summers), Steel Co. of Canada; 1939 (summer), Plibrico Jointless Firebrick Co.; 1940-41, second i/c engrg. dept., 1941 to date, mechanical engr. i/c engrg. dept., responsible for new layout, mtce. and repair of plant, Steel Co. of Canada, Ltd., Swansea Works.

References: R. F. Legget, C. R. Young, E. A. Cross, W. W. Fotheringham, J. J Spence.

WIDDIFIELD—IVAN STEWART, of Toronto, Ontario. Born at Toronto, Aug. 21st, 1911; Educ.: B.Sc., Queen's Univ., 1935; R.P.E. Ontario; 1931, 1934-5, (summers), Hydro Electric Power Commission; 1936-41, asst. to plant engr., Norton Co., Chippawa, Ontario; 1941 (6 mos.), supervising elect'l. engr., on design and constrn. of Allied War Supplies Corp. project, Scarboro, for Ontario Electrical Construction Co.; at present elect'l. supt., General Engineering Co. (Canada) Ltd., on A.W.S.C. project, Scarboro.

References: W. D. Bracken, G. Morrison, C. G. Cline, R. H. Self, R. C. McMordie, E. A. Cross.

WILCOCK—WALTER, of 521 McDougal St., Windsor, Ont. Born in Lancashire, England, June 6th, 1903; Educ.: 1917-24, Wigan Technical College; 1917-24, ap'ticeship, workshops and drawing office, Richard Evans & Co. Ltd., St. Helens, Lancs., England; 1924-25, with Cross, Eccles & Co., gen. engrs.; 1925-27, misc. work in Canada; 1927-28, outside service foreman, and from 1928 to date, i/c of engrg. consisting of all constrn., mtce., pipe line, locations and office records, Windsor division, Union Gas Co. of Canada Ltd., Windsor, Ont.

References: C. G. R. Armstrong, J. E. Daubney, W. J. Fletcher, J. C. Keith, G. E. Medlar.

**FOR TRANSFER FROM JUNIOR**

BARNHOUSE—FRANK WILLIAM, of 9 Caldow Road, Toronto. Born at Edmonton, Alta., May 19, 1909; Educ.: B.Sc. (Elec.), Univ. of Alta., 1934; R.P.E. of Ontario; 1929-30 and 1931-32 (summers), electrician with Fred Davies, elect'l contractor, Edmonton; 1932-33 (summers) constr'n of elect'l substations, Calgary Power Co., Edmonton; 1933-34, i/c elect'l install'ns on electric gold dredge, McLeod River Gold Mining Co.; with Canadian General Electric Co. as follows: 1934-35, test course, Peterborough; 1935, student engr., Toronto; 1936-39, wire and cable sales engr., Toronto; 1939-40, i/c of application engrg. work in regard to sale of elect'l wires and cables; 1940 to date, asst. mgr. of Wire & Cable Dept., Toronto. (St. 1933, Jr. 1938).

References: H. J. MacLeod, W. E. Cornish, J. L. Balleny, W. T. Holgate, J. Cameron.

BLACK—FRANK LESLIE, of 41 Maple Ave., Shawinigan Falls, Que. Born at Moncton, N.B., Sept. 14, 1909; Educ.: B.Sc. (Elec.), N.S. Tech. Coll., 1931; 1929 (summer), survey party, Geological Survey, 1930 (summer) electrician, Shawinigan Engrg. Co.; 1931 (winter) radio serviceman, Maritime Accessories, Ltd.; 1932-35, instructor, Engrg. Dept., Mount Allison Univ.; 1935-37, junior engr. on line constrn., and 1937-40, asst. engr. on elect'l design, N.B. Electric Power Commission; 1940-41, asst. elect. supt., and 1941 to date, electr. supt., Belgo Division Consolidated Paper Corp., Shawinigan Falls. (St. 1930, Jr. 1934).

References: H. W. McKiel, G. A. Vandervoort, J. P. Mooney, E. B. Wardle, W. A. E. McLeish, E. R. McMullen, L. B. Stirling.

DUNNE—CHARLES VINCENT, of Sydney, N.S. Born at Ottawa, Ont., Dec. 11, 1907; Educ.: B.Eng. (Civil), McGill Univ., 1935; 1929 (summer) dftsmn. and 1930 (summer), rodman, Boston & Maine RR., Boston, Mass.; 1935 (summer), asst. party chief, Geological survey, Kapuskasing; 1936-38, constrn. engr., i/c new digester and blowpit bldgs., New Beach plant, E. B. Eddy Co.; 1938-39, chief engr. for contractor on Mont Laurier-Senneterre Highway; 1939 (summer), engr., road constrn., Noranda; 1939-40, constrn. engr., Masonite Corp., Gatineau Mills, Que.; 1940, junior engr., Dept. Public Works, Ottawa; 1941 to date, res. engr., i/c of naval constrn., Works & Bldgs. Branch, Naval Service, Sydney, N.S. (Jr. 1937).

References: K. M. Cameron, R. DeL. French, A. N. Ball, D. G. Kilburn, R. E. Jamieson, F. Alport.

FRANCIS—JOHN BARTEN, of 4835 Grosvenor Ave., Montreal. Born at Saint John, N.B., May 2, 1909; Educ.: B.Sc. (Elec.), McGill Univ., 1930; Summers, 1928, material checker, 1929-30, asst. to supt., distribution dept., Shawinigan Water & Power Co.; 1930-32, testing electl. apparatus, General Electric Co., Schenectady, N.Y.; 1933-34, blueprints and dfting., Imperial Oil Refineries, Montreal; 1934-35, junior engr., Windsor, Ont., 1935-39, junior engr., asst. to supervising power engr., design of boiler plants, steam distribution, compressed air, refrigerating systems, etc., Canadian Industries, Ltd., Montreal; 1939-41 C.I.L. and D.I.L., Montreal, design engr., i/c design of steam distribution systems, etc.; 1941-43, project engr., i/c designing and equipping small arms ammunition plants, Defence Industries Ltd., Montreal. (St. 1928, Jr. 1937).

References: A. B. McEwen, I. R. Tait, H. C. Karn, C. H. Jackson, E. B. Jubien, C. V. Christie, R. H. Mathew.

INGLIS—WILLIAM LEISHMAN, of 375 Mayfair Ave., Ottawa. Born at Glasgow, Scotland, Dec. 23, 1912; Educ.: B.A.Sc., (Civil), Univ. of B.C., 1934; 1930 (summer), engrg. asst. on constrn. of south fork dam, Nanaimo, B.C.; 1933-34 (summers), mineral claim and road surveys in Cariboo and Bridge River, B.C.; 1934-35, dftsmn. and instr'mn., B.C. Elec. Rly. Co., Vancouver; 1935-37, and 1938-39, design, estimating and detailing struc'l. steel, Hamilton Bridge Co. (Western Ltd.) Vancouver; 1937-38, asst. engr. on design and constrn. of factories, incl. roads sewers and water works, Sir Alex. Gibb and partner, London, England; 1938 (4 mos.), asst. res. engr., British Air Ministry, at Carlisle and Shrewsbury, England; 1939 (3 mos.), inspr., Boeing Aircraft Co., Vancouver; 1939-40, asst. designer and estimator on proposed pulp and paper mill, Bloedel, Stewart & Welch, Ltd., Vancouver; April 1940 to date, constrn. officer, R.C.A.F. Headquarters, Ottawa, with rank of Squadron Leader. (Jr. 1939).

References: R. R. Collard, J. P. MacKenzie, J. B. Stirling, P. H. Buchan, A. Peebles.

SILLITOE—SYDNEY, of Montreal, Que. Born at Edmonton, Alta., Dec. 15, 1908; Educ.: B.Sc. (Elec.) 1931, M.Sc., 1933, Univ. of Alta.; 1928-30, (summers), various surveys; 1931, electric light dept., City of Edmonton; with Northern Electric Co., Montreal, as follows: 1934-41, radio engr., on development, 1941-42, assigned to Dept. Munitions & Supply for 9-week trip to England and production of No. 19 set, 1942 to date, technical engr., production planning. (St. 1930, Jr. 1936).

References: C. A. Peachey, A. B. Hunt, H. J. Vennes, H. J. MacLeod, W. E. Cornish, R. S. L. Wilson.

**FOR TRANSFER FROM STUDENT**

CLEVELAND—COURTNEY ERNEST, of Vancouver, B.C. Born at Vancouver, Feb. 22, 1910; Educ.: B.A.Sc., Univ. of B.C., 1934; M.Sc., 1938, Ph.D., 1940, McGill University; R.P.E. of British Columbia; Summers—1926-27, rodman, Hydro Electric Power and Railroad service; 1929, assayer, Premier Gold Mines, Ltd., 1930, concrete inspr. Burrard St. Bridge, 1931-34, geological mapping, Geological Survey of Canada; 1934-41, with Bralorne Mines, Ltd., B.C., as follows: 1934-35, surveyer's helper, 1935-38, mine geologist, 1938-39 (summers) and 1940-41, examination engineer; 1941-42, development engr., Canbrae Expl. Co.; 1942-43, development engr., and at present geologist and engr. at Takla Mercury Mine (Bralorne Mines Ltd.). Also in full charge of camp constrn. and diamond drill programme. (St. 1937).

References: E. A. Cleveland, W. H. Powell, F. G. Smith, J. N. Finlayson, J. B. Challies.

HOAR—CHARLES RICHARD, of 12210-109 A Ave., Edmonton. Born at Woodleigh, N. Devon, England, Dec. 25, 1917; Educ.: B.Sc. (Elec.) Univ. of Alta., 1940; 1940-41, junior engr., Calgary Power Co. Ltd.; at present senior A.I.D. Inspector, Br. Commonwealth Air Training Scheme, Edmonton. (St. 1940).

References: E. G. Cullwick, H. B. LeBourveau, W. E. Cornish, H. Randle, T. D. Stanley.

OSBORNE—JOHN FOLLETT, of 554 Reid St., Peterborough. Born at Montmartre, Sask., Aug. 21, 1914; Educ.: B.Sc. (Elec.), Univ. of Man., 1936; R.P.E. Ontario; with Canadian General Electric Co., Peterborough, as follows: 1937-38, test dept., 1938-40, foreman, test dept., 1939-43, asst. engr., Industrial Control Engrg. Dept. (St. 1936).

References: J. Cameron, W. T. Fanjoy, D. V. Canning, A. L. Malby, R. L. Dobbin.

ROSS—OAKLAND KENNETH, of 204 Cote St. Antoine Rd., Montreal. Born at Montreal, Sept. 29, 1911; Educ.: B.Eng. (Mech.), McGill Univ., 1934. With Continental Can Co., Montreal, as follows: 1934-35, general foreman, 1935-38, asst. factory mgr., 1938 to date, factory mgr. (St. 1934).

References: E. A. Hankin, P. B. French, A. R. Roberts, E. Brown, R. DeL. French, C. M. McKergow.

---

# LIBRARY NOTES

*(Continued from page 235)*

## REFRACTORIES

*By F. H. Norton, 2 ed. McGraw-Hill Book Co., New York and London, 1942. 798 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth, $7.50.*

Since the publication of this treatise, ten years ago, much new information has accumulated, and has called for complete revision. To this edition there have also been added a chapter on Fundamental concepts of matter in the solid state and five chapters on the selection and use of refractories in furnace construction in various industries. The work provides a good account of the fundamental processes involved in manufacturing and using refractories, and of the process in current use in the United States.

## REPORT OF THE COMMITTEE ON SEDIMENTATION 1940-41, with charts for the Determination of Detrital Minerals.

*National Research Council, Division of Geology and Geography, Washington, D.C., March, 1942. 110 pp., Charts, tables 11 x 8½ in., paper, $1.00 (separate copies of Charts, 50c.).*

This pamphlet includes the general report of the chairman, and also ten supplementary reports upon special investigations in the field of sedimentation. Among these are "Tables for the determination of detrital minerals," prepared by R. Dana Russell.

## SIMPLIFIED DEFINITIONS AND NOMENCLATURE FOR AERONAUTICS, 1942 illustrated edition, a Modern Aeronautical Dictionary

*By L. Thorpe. Aviation Press, San Francisco, Calif., no pagination, alphabetical arrangement, illus., diagrs., charts, tables, 9½ x 7 in., paper, $2.00.*

This glossary of aeronautical terms contains about fifteen hundred definitions and explanations of words and phrases, accompanied by numerous drawings illustrating them. It is based on the nomenclature report of the National Advisory Committee for Aeronautics, supplemented by terms from other sources.

## THE STONE THAT BURNS, the Story of the American Sulphur Industry

*By W. Haynes. D. Van Nostrand Co., New York, 1942. 345 pp., illus., diagrs., maps, tables, 8½ x 5½ in., cloth, $3.75.*

The story of the American sulphur industry is told at length, beginning with the first unsuccessful attempts to mine it in Louisiana. The growth of the industry following the successful introduction of the Frasch process is carried up to the present time, with some remarks on its future. The book is well documentated and includes considerable statistical material.

## TABLE OF SINE AND COSINE INTEGRALS from 10 to 100

*Prepared by the Federal Works Agency, Work Projects Administration for the City of New York, conducted under the sponsorship of and for sale by the National Bureau of Standards, Washington, D.C., 1942. 185 pp., charts, tables, 11 x 8 in., cloth, $2.00.*

This volume supplements the two previous volumes of "Sine, cosine and exponential integrals" by providing sine and cosine integrals, calculated to ten decimal places, for the range of x between 10 and 100, at intervals of 0.01. These integrals are encountered in many branches of physics and electrical engineering, and the volume is expected to meet the needs of workers in these fields.

# Employment Service Bureau

The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

(a) **unemployed;**
(b) **engaged in work other than of an engineering or scientific nature;**
(c) **has given notice as of a definite date; or**
(d) **has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

MECHANICAL ENGINEER. Either capable of making mechanical repairs to power shovels, tractors, etc., or willing to learn. Tropical assignment. Apply to Box No. 2619-V.

EXPERIENCED TRANSITMAN for railway engineering work. Apply to Box No. 2629-V.

CIVIL ENGINEER, must be capable of supervising plant and small town house construction. Tropical assignment. Apply to Box No. 2630-V.

### SITUATIONS WANTED

CIVIL ENGINEER, 38, experienced in all types of building construction and in industrial layout work. Wants permanent or temporary position in charge of design or construction. Present location, Montreal. Apply to Box No. 576-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., 17 years experience as production manager and factory organizer in metal and various other industries, military exempt, available on short notice. Apply to Box No. 1730-W.

### SURVEYING INSTRUMENTS FOR SALE

SIMPLE THEODOLITE, Stackpole and Bros.
Telescope, 10″ long, 1¼″ dia. O.S.
Compass, 5¼″ dia.
Table, 7¼″ dia.
Scale, 6¼″ dia.
Height of C.C. of telescope above levelling table, 10½″.
Spirit levels, 3¼″ long x ½″ dia.
Levelling screws, 4.
Condition of instrument and lenses—excellent.
Complete with tripod and plumbob in wooden case.

Y LEVEL, Watts (bright brass).
Telescope, 10½″ long, 1¼″ dia. O.S.
Height of C.C. of telescope above levelling table, 5½″.
Levelling screws—4.
Base plate, 3½″ dia.
Complete in wooden case, with tripod.
Condition of instrument and lenses, good; one indexed lense appears to require cleaning.

SURVEYOR ARROWS, one set (11), $\frac{3}{16}$″ sq. x 14″ long. Condition, new.

STADIA ROD, 12 ft. (7 ft. closed). Condition, new.

LEVELLING ROD, 16 ft. (6 ft. closed). Condition, excellent.

PICKETS, iron-shod, 2-5 ft. Condition, good.

STEEL TAPE, 66 ft., ½″, Chesterman, on reel. Condition, good.

STEEL TAPE, 66 ft., $\frac{5}{16}$″, on fibre reel. Condition, good.

STEEL TAPE, 100 ft., ¼″ on reel. Condition, good.

STEEL TAPE, 200 ft., ¼″ on reel. Condition very good.

STEEL TAPE, 100 ft., ⅜″ (ft. and 10ths.). Leather case. Condition, very good.

MINER'S DIP COMPASS, W. S. Darley, in case. Like new.

SET OF 65 RAILROAD CURVES, in wooden case. Like new.

C.C. Moler-Line loss and voltage drop slide rule. Like new.

Full leather map-case, 5½″ dia. x 40″ long. Condition, good.

Matthews Teleaheight Level, in leather case. Condition, good.

*Offers will be considered.* Apply to Box No. 48-S.

## REQUIRED IMMEDIATELY

Chemical, Civil, Mechanical
and
Metallurgical Engineers
For Production Supervision

**DOMESTIC AND FOREIGN ASSIGNMENTS**
**ESSENTIAL WAR WORK**

Apply to Box No. 2622-V
The Employment Service Bureau
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

### FOR SALE

Transits, theodolites, compasses, levels, clinometers, hand-levels, pickets, tapes, rods (10′, 15′ and 20′ slab), other accessories. Draughting boards and instruments; planimeters, electric-motored erasers, plan-binders, scales, etc. Apply to Ralph Kendall, M.E.I.C., 93 Maynard Street, Halifax, N.S. Telephone 4-2849.

### FOR SALE

Thacher Calculating Rule in mahogany case, good condition. Apply to Box No. 49-S.

## ELECTRICAL OFFICERS FOR R.C.N.V.R.

**A limited number of vacancies exist in the Royal Canadian Naval Volunteer Reserve for young graduates in electrical engineering possessing suitable personal qualities and engineering experience.**

**Applicants should complete an "Offer of Service" form, which may be obtained from the nearest R.C.N.V.R. Barracks, and should attach to it a detailed account of educational qualifications and engineering experience, together with copies of properly attested testimonials.**

**Successful applicants will be entered as Probationary Electrical Sub-Lieutenants or, in the case of exceptional qualifications, as Electrical Sub-Lieutenants. Their duties after a period of training will consist of electrical engineering work in connection with any of the following: Design and Manufacture; Ship Installations; Testing and Trials; and Base Maintenance. Applicants must be prepared to go to sea. Completed forms should be returned to the Deputy Secretary, Naval Board, Department of National Defence, Ottawa, Ont.**

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 — MONTREAL, MAY 1943 — NUMBER 5

**"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."**

★ ★ ★

# CONTENTS



*Colour plates for Canadian coat of arms on cover, courtesy The House of Seagram*

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que.

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**PAPERS**
L. F. GRANT, *Chairman*

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PUBLICATION**
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**PROFESSIONAL INTERESTS**
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

**STUDENTS' AND JUNIORS' PRIZES**

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING JOURNAL

VOLUME 26 | MAY 1943 | NUMBER 5

**"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."**

---

## ANNIVERSARY

### A FOREWORD BY THE PRESIDENT

TWENTY-FIVE years is a long time in the life of a person or an institution, and yet it seems but a short time since *The Engineering Journal* made its first appearance. In May nineteen hundred and eighteen, with the inauguration of the *Journal*, the Institute took a long step forward—a step that has been well justified by the contribution made not only to the Institute but to the profession of engineering in Canada. With this number the *Journal* starts out on its next cycle of service.

There is a great responsibility in circulating to the public, printed word of any kind. The Institute accepted this responsibility twenty-five years ago, and has steadily maintained standards of quality and progress that have been fitting to a professional society; that have brought knowledge and gratification to the membership. The *Journal* has been the chief repository for the story of engineering progress and accomplishment throughout Canada.

The early ambition of the founders of this Institute, that all engineers in civilian occupations should be given a chance to join together in one society, has been a sound one. No one speaks more approvingly of this feature of the Institute than do members of the profession in the United States. On every occasion they express their admiration of our set-up and continually admonish us to remain "free of the curse of extensive segregation by specialization." The *Journal* has had an important part in maintaining this broad policy, and will continue to aid the cause of the entire profession rather than any one section of it.

I am sure that in acknowledging the attainments of the *Journal* I am speaking for all members of the Institute. Some persons have more opportunity to read the *Journal* than have others; not all members are able to contribute papers, but I do believe the membership generally appreciate the good work done by the *Journal* in establishing itself in a difficult field, and in steadily reaching new levels of attainment in numbers of papers published, circulation, advertising and reader interest.

It is appropriate that for such an occasion there should be a review of events in those fields where the engineer has taken a prominent part in the development of technique and the shaping of policy. The following pages tell in brief but interesting form the story of twenty-five years progress in Canadian industry and science. They also bring greetings from prominent members, officials and sister societies.

For the future it is impossible to prophesy, but we may face it with the hope that good shall conquer evil, and that shortly man's fertile mind may be relieved from the accomplishment of destruction and restored to the contemplation of the way of enduring peace and prosperity, with freedom. In all this *The Engineering Journal* will continue to take its share of responsibility and will maintain its interest in the welfare of the country and of the profession.

K. M. CAMERON, *President.*

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY A. H. PASK
A. H. MACQUARRIE
*(Ex-Officio),* G. E. MEDLAR
H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY,
1614 Ontario Street,
Walkerville, Ont.

**CALGARY**
*Chairman,* J. G. MACGREGOR
*Executive,* F. A. BROWNIE
H. R. HAYES
A. HIGGINS
W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS
G. P. F. BOESE
H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL,
803-17th Ave. N.W.,
Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN,
60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN
J. W. JUDGE
E. D. ROBERTSON
J. D. A. MACDONALD
I. F. MORRISON
H. W. TYE
*(Ex-Officio),* D. HUTCHISON
E. NELSON
*Sec.-Treas.,* F. R. BURFIELD,
Water Resources Office,
Provincial Government,
Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE D. C. V. DUFF
G. J. CURRIE L. E. MITCHELL
J. D. FRASER P. A. LOVETT
J. W. MACDONALD
G. T. MEDFORTH
J. E. CLARKE
R. B STEWART
K. L. DAWSON
*(Ex-Officio),* J. R. KAYE S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY,
Wartime Bureau of Technical
Personnel, 84 Hollis Street,
Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON
R. J. G. SCHOFIELD
NORMAN EAGER
A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID
STANLEY SHUPE
A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN,
427 Concession Street,
Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN
J. R. CARTER
J. D. LEE
*(Ex-Officio),* T. A. McGINNIS
L. F. GRANT A. JACKSON
*Sec. Treas.,* R. A. LOW,
Dept. of Civil Engineering,
Queen's University,
Kingston, Ont.

**LAKEHEAD**
*Chairman,* MISS E. M. G. MACGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL
R. B. CHANDLER
S. E. FLOOK
O. J. KOREEN
S. T. McCAVOUR
W. H. SMALL
E. A. KELLY
J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER
H. G. O'LEARY
*Sec. Treas.,* W. C. BYERS,
c/o C. D. Howe Co. Ltd.,
Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON G. S. BROWN
N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE,
McKenzie Electric Ltd.,
706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT
W. C. MILLER
F. T. TAYLOR
F. C. BALL
V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN
J. A. VANCE
*Sec. Treas.,* H. G. STEAD,
60 Alexandra Street,
London, Ont.

**MONCTON**
*Chairman,* H. J. CRUDGE
*Vice-Chair.,* J. A. GODFREY
*Executive,* A. S. DONALD
E. R. EVANS E. B. MARTIN
H. W. HOLE G. C. TORRENS
*(Ex-Officio),* G. L. DICKSON
*Sec. Treas.,* V. C. BLACKETT
Engrg. Dept., C.N.R.,
Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE
R. C. FLITTON
G. D. HULME
G. E. GELINAS
K. G. CAMERON
G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD
J. E. ARMSTRONG
R. E. HEARTZ
W. G. HUNT
J. A. LALONDE
G. MacL. PITTS
E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL,
40 Kelvin Avenue,
Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* C. G. CLINE
*Vice-Chair.,* G. E. GRIFFITHS
*Executive,* A. G. HERR
R. T. SAWLE
G. F. VOLLMER
W. D. BRACKEN
J. W. BROOKS
J. H. TUCK
D. S. SCRYMGEOUR
*(Ex-Officio),* A. L. McPHAIL
A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS
1870 Ferry Street,
Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY
G. A. LINDSAY
R. YUILL
W. H. B. BEVAN
J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY
K. M. CAMERON
N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON
Dept. of Mines & Resources,
Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* D. J. EMERY
*Executive,* C. R. WHITTEMORE F. R. POPE
I. F. McRAE R. L. DOBBIN
A. J. GIRDWOOD
*(Ex-Officio),* J. CAMERON
H. R. SILLS
*Sec.-Treas.,* A. R. JONES,
5, Anne Street,
Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD G. ST-JACQUES
L. GAGNON A. E. PARÉ
G. W. WADDINGTON Y. R. TASSÉ
*(Ex-Officio),* H. CIMON
R. B. McDUNNOUGH
P. MÉTHÉ
L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT,
Colonization Department,
Room 333-A, Parliament Bldgs.,
Quebec, Que.

**SAGUENAY**
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER
J. FRISCH
B. BAUMAN
G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS
N. F. McCAGHEY
J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS,
P.O. Box 33,
Arvida, Que.

**SAINT JOHN**
*Chairman,* D. R. SMITH
*Vice-Chair.,* A. O. WOLFF
*Executive,* H. P. LINGLEY
C. D. McALLISTER
C. C. KIRBY
*(Ex-Officio),* F. A. PATRIQUEN
V. S. CHESNUT
J. P. MOONEY
G. G. MURDOCH
*Sec.-Treas.,* G. W. GRIFFIN
P.O. Box 220,
Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vive-Chair.,* R. DORION
*Executive,* G. B. BAXTER
E. BUTLER
A. G. JACQUES
R. D. PACKARD M. EATON
E. T. BUCHANAN J. JOYAL
W. E. A. McLEISH H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN
H. J. WARD
*Acting Sec. Treas.,* VIGGO JEPSEN,
Consolidated Paper Corporation
Grand'Mère, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN
E. K. PHILLIPS
J. I. STRONG
F. C. DEMPSEY
N. B. HUTCHEON
J. G. SCHAEFFER
R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG,
P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK
C. R. MURDOCK
G. W. MacLEOD
K. G. ROSS
H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG
A. E. PICKERING
L. R. BROWN
*Sec. Treas.,* O. A. EVANS,
159 Upton Road.
Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR R. F. LEGGET
E. G. HEWSON A. H. HULL
C. F. MORRISON E. A. CROSS
*(Ex-Officio),* E. H. BRANDON W. S. WILSON
T. H. HOGG C. R. YOUNG
N. MACNICOL
*Sec.-Treas.,* S. H. DEJONG,
Dept. of Civil Engineering,
University of Toronto,
Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER H. P. ARCHIBALD
R. E. POTTER I. C. BARLTROP
E. S. JONES H. J. MACLEOD
*(Ex-Officio),* W. O. SCOTT
C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN,
2099 Beach Avenue,
Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD
A. N. ANDERSON
F. C. GREEN
J. H. BLAKE
*(Ex-Officio),* E. W. IZARD
A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING,
41 Gorge Road West,
Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING
N. M. HALL
B. B. HOGARTH
R. H. ROBINSON
R. A. SARA
*(Ex-Officio),* W. P. BRERETON
J. W. SANGER
D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY,
55 Princess Street,
Winnipeg, Man.

# MESSAGES

### W. L. MACKENZIE KING
***Prime Minister of Canada***

On the occasion of the 25th anniversary of *The Engineering Journal*, in May of this year, I should like to extend my warmest congratulations and best wishes both to *The Engineering Journal* itself, and through it, to the officers and members of The Engineering Institute of Canada.

I should like to express appreciation of the value of the many contributions made by members of the engineering profession in building up our country and improving its industrial life, both in peace and in war. I should also like to acknowledge with thanks the helpful manner in which The Engineering Institute, through its various special committees, has co-operated with government agencies in dealing with such important matters as Civil Defence, Industrial Relations and Post-War problems.

The engineering profession is in an exceptional position to aid in the nation's war effort. It is gratifying to know that the engineers of Canada are fully cognizant of the value of their highly specialized skills, and are so zealously devoting their endeavours towards victory.

★

### LIEUT.-GENERAL A. G. L. McNAUGHTON
***G. O. C.-in-C. First Canadian Army***

I welcome this opportunity of sending a short acknowledgment of the 25th Anniversary of *The Engineering Journal.*

In this war of highly-mechanized, fast-moving armoured forces, engineering plays a greater part than ever before. Ours is a citizen army in which the vast majority of officers are civilians and, in the technical arms, it is their engineering experience in civil life that has enabled them to handle their very diversified military jobs efficiently.

Highly trained and experienced engineers are required for commissions, not only in the R.C.E., but also in the R.C.A., the R.C.C.S., the R.C.O.C., and the R.C.A.S.C. Such men are to be found in The Engineering Institute and in the provincial associations. I thank you for your past help and in supplying this demand and bespeak even greater efforts for the future.

Looking back 25 years to the birth of your *Journal*, brings us to the spring of 1918, the fourth year of the last war. This, your 25th Anniversary, is the spring of the fourth year of this war. May 1943 also end, as did 1918, with the unconditional surrender of the enemy.

### THE AMERICAN SOCIETY OF CIVIL ENGINEERS
**George T. Seabury, *Secretary***

Upon instruction by the Board of Direction of the American Society of Civil Engineers, I am to extend to the officers and members of The Engineering Institute of Canada congratulations upon the birthday of one of the important activities of the Institute.

Your *Engineering Journal* has a secure place in the field of technical literature. This it has attained through adherence to the high ideals of your organization. Mere extent of service is perhaps not so important as its quality. Nevertheless, it must be a sincere satisfaction to you to contemplate the completion of a full quarter century.

Our best wish for the *Journal* at this anniversary is that it may continue to add to its scope and usefulness. May the spirit that prompted its initiation twenty-five years ago and that has guided it continually since then continue to burn brightly and to produce increasing results of value to the engineers of Canada—and incidentally, to those of the United States.

These good wishes to your Council, and to the entire membership of the Institute express the sentiments of our Society through its Board of Direction. Again our congratulations upon this significant event in the life of *The Engineering Journal.*

★

### THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
**Harold V. Coes, *President***

On behalf of The American Society of Mechanical Engineers may I take this opportunity of congratulating The Engineering Institute of Canada on the twenty-fifth anniversary of *The Engineering Journal.* The Engineering Institute of Canada serves the entire engineering profession of the Dominion and hence the task of holding together the widely diversified interests of engineers falls heavily upon *The Engineering Journal.*

The American Society of Mechanical Engineers has taken great satisfaction in the much closer ties which have developed between it and The Engineering Institute of Canada during the last few years. We look forward to greater co-operation when the ending of the war should make it possible for the engineers of the two countries to devote their energies to reconstruction and peaceful developments.

# MILITARY ENGINEERING

MAJOR-GENERAL C. S. L. HERTZBERG, M.E.I.C.
*Chief Engineer, First Canadian Army, Overseas.*

### General

Before attempting a detailed discussion of the effect the past twenty-five years have had on the activities of engineers in war, consideration should be given, very briefly, to the factors that have brought about the resulting changes.

The year 1916 saw the advent of tanks and, by 1918, the range and carrying capacity of the aeroplane had increased enormously. The possibilities and advantages of complete mechanization were becoming evident. In Germany, during the ensuing 21 years, plans and preparations were made to wage war to the utmost on the lines that were indicated in 1918—the dawn of mechanized, scientific war of a ruthlessness never before dreamed of. The war in Spain provided the opportunity of testing the effectiveness of the new technique.

**A new type bridge is under construction in Sussex. This is the first time the "derrick and preventor" method of launching has been carried out. Two double truss girders, each weighing 27 tons, and 140 ft. in length form the main part of the bridge. A derrick is erected to pull, by winch, the girders across the river. A cable and winch is secured to the opposite end to prevent the girder toppling when past point of balance. The first girder almost across. This is the most critical stage of the operation.**

Mechanization has resulted in an enormous increase in the speed, density and loads of vehicles.

Long range air bombing necessitates road and bridge maintenance in areas far removed from the actual battle.

Improvement in artillery, with the increased range and armour-piercing performance of projectiles, has led to heavier armour and so to heavier bridges over which the armour must pass.

These new offensive weapons have been developed by engineers and their fellow scientists and, to the engineer also falls the task of producing their antidotes.

### Bridging

In Europe during the last war, except for the rare occasions when armies measured a day's advance in miles rather than in yards, bridging equipment was kept in storage in the back areas. Existing bridges on lines of communication were not likely to be destroyed by aerial bombardment, and enemy sappers, with explosives, could not be landed in gliders or dropped by parachute to deal with them. To-day, in a country where rivers abound, bridging equipment capable of carrying the heaviest military loads must be available, on wheels, well up in an advancing column. In addition to this, an adequate supply of equipment must be kept on hand to repair or rebuild bridges that may be destroyed by long range aerial bombing.

As operational bridges cannot be lifted and re-used further forward until after rear formations have had time to replace them by more permanent structures, a never-ending flow of equipment must be maintained from the base to the van of the army. Sappers must be available, all along the line, to use this equipment to enable the army to advance and to maintain the supply routes that make the advance possible.

In the last war, existing civilian bridges were nearly always strong enough to carry the heaviest military loads. To-day this is not the case and it is an engineer's responsibility to investigate—either from existing records or from reconnaissance—the capacities of all existing bridges in the theatre of operations.

### Roads

Road construction and maintenance have been effected in the same way. The surprising way in which English roads have stood up to the severest military traffic may prove to be misleading when we operate in other countries. Existing road surfaces must be maintained and, in some cases, widened.

Enemy action, both from aerial bombs and deliberately placed demolitions, cause extensive damage at far distant points, and sapper parties, with the most modern equipment, must be available to make repairs. The pick and shovel have given place to bull-dozers, auto-patrol graders, and other modern mechanical equipment.

The rapid building of temporary road diversions presents many problems. Approaches to military bridges, as well as roads to by-pass obstacles, may be required to carry thousands of heavy vehicles, both tracked and wheeled, over soft ground. Continuous maintenance is required on such roads and materials must be readily available.

The provision of tracks across beaches for assault landings, such as that at Dieppe, must be made by sappers, under heavy fire, after they have cleared the beach obstacles.

### Air Landing Fields

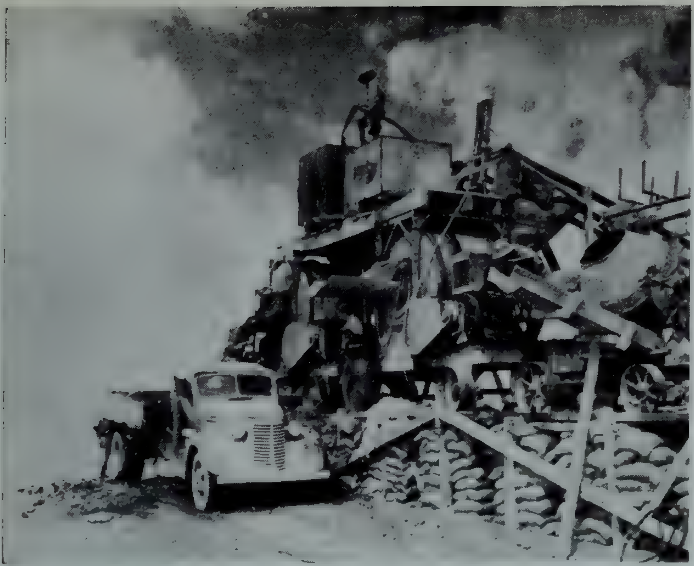
Air support is essential to the operation of armies, and the rapid construction of landing fields must follow closely in the wake of an advance. Maps and aerial photographs provide an indication of where suitable fields may be expected, but the sites must be carefully reconnoitred by sappers moving with the foremost formations. As soon as a site has been chosen, the sappers move forward with plant and material to prepare the field for use.

The site may be an abandoned enemy air field, in which case it will probably have been so demolished that a virgin site is preferable. In any case, the sappers must be prepared to do a considerable amount of grading and removal of trees before they can start preparing the surface. This work must be done in a matter of days—sometimes hours—if the advance is to go forward on schedule.

### Demolitions

Since the last war, great strides have been made in explosives and in the technique of demolishing obstacles of all kinds. All sappers must be trained to decide on the most efficient type of charge and to calculate the amount required for each demolition. They must also be skilled in placing the charges and in connecting them up for firing.

Obstacles may consist of extensive mine fields, concrete road blocks, wire entanglements, concrete pill boxes, etc., all of which are well covered by enemy fire. The removal of each type of obstacle requires a particular kind of demolition.



**A huge cement-mixing plant is part of the equipment of the army engineers for erecting defence structures.**

Minefields, sometimes of great depth and generously provided with booby-traps, must be carefully reconnoitred before it is possible to clear a path through them.

In beach-landing operations, engineers must clear a path through beach-mines, wire and, in most cases, heavy reinforced concrete walls, before vehicles can be landed. They must also prepare tracks across the beach for all types of transport.

All such work requires a high standard of courage and skill, and the maximum amount of protection possible must be provided to bring the engineers and their equipment forward.

### Field Defences

In the last war, field defences consisted of long lines of infantry trenches with occasional strong-points in rear. These were protected against infantry by wire entanglements. Against modern armies such lines are useless. This was demonstrated when the first slow moving tanks successfully cruised across the enemy trenches at Courcelette in 1916.

The "tempo" of a modern battle and the ability of modern armour to penetrate far behind the enemy lines calls not for linear defence, but for strongly defended localities so placed that the enemy can be dealt with in locations and under conditions most favourable to us. As the enemy armour may have penetrated well into our area before it is convenient to destroy him, our defended localities must be capable of withstanding attack from any direction.

All arms are trained to provide their own local defences but their construction will usually be supervised by sappers, and the engineers are responsible for the charting of mine fields and for advising the commander on their disposition.

### Bomb Disposal

Delay-action aerial bombs have provided engineers with the difficult and dangerous job of removing them or of rendering them innocuous *in situ*. These are dropped from great heights and some are extremely heavy. They penetrate to great depths and, as they follow a curved path through the soil, they are very difficult to locate. The time of delay cannot be foretold and work on them must be as rapid as possible. A minimum number of men, consistent with speed, are exposed to the danger of detonation. Much work has been done on methods of locating such bombs and of making them harmless.

### General

I have dealt only with a part of the work done by the Corps of Royal Canadian Engineers and have said nothing of the field survey unit; the tunnelling companies who have done such good work at Gibraltar and throughout this island from Land's End to John o'Groats and even further north in the Shetland Islands; the construction of permanent workshops, hospitals, airfields, roads and many other structures. Nor have I mentioned water supply, the lighting of the different headquarters in the field, the construction of docks, the demolition and repair of industrial plants and

**A bull-dozer tractor, levelling out rough ground.**

countless other activities that are undertaken by engineers during active operations.

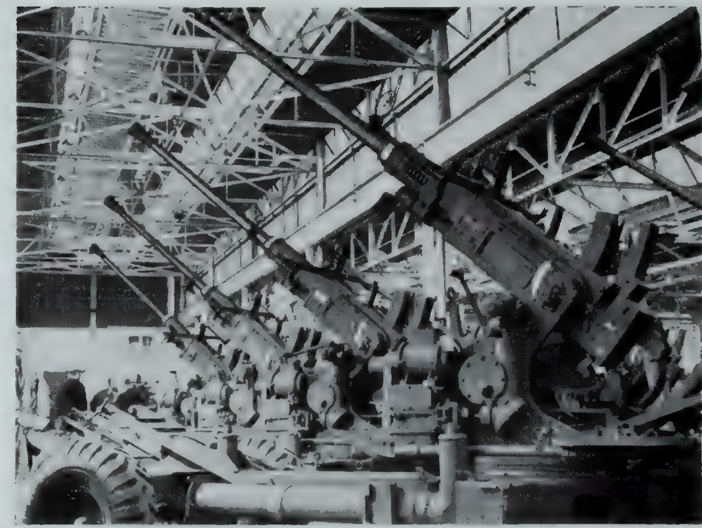
Engineering in the army has kept pace with the profession in civil life. In fact, the average military engineer officer is nothing more—or less—than a civilian engineer, trained as a soldier and engaged in the application of engineering knowledge to war. To our brothers in civil life we look for assistance in the development of ideas and the production of the weapons and equipment so necessary to win the war.

# CANADA AND THE TOOLS OF WAR

C. D. HOWE, HON. M.E.I.C.
*Minister of Munitions and Supply, Ottawa.*

Few nations have had less experience than Canada in making armaments and weapons of war. Until the present conflict came upon us the craft was unknown, the tradition non-existent.

Even in 1914-18 we established no munitions industry of major consequence. We made explosives, we manufactured shells, we turned out army rifles, we equipped our troops with boots and uniforms. But for twenty years thereafter our industrial resources were tuned to the arts and crafts of peace; we made nothing more deadly than commercial explosives, hunting knives, and sportsmen's ammunition. The armaments business was left to the great European specialists—to Vickers, Skoda, Schneider-Creusot, and Krupp, with their huge plants, their trained workmen, their own secrets and traditions developed by years of experience in making tools of war.



**Bofors 40mm. anti-aircraft guns. An Ontario factory turns these out by the dozen.**

It can be said, therefore, that when we turned to the production of weapons at the outbreak of the present conflict we started from scratch. The lack of an established armaments industry was a handicap. Great Britain, France, Russia, and Germany had strong foundations upon which to build and expand. We had to depend on conversion, improvisation, and building from the grass roots. And after Dunkerque, when swift replacement of Britain's lost equipment was necessary and when there was even a possibility that Canada might be a last-ditch arsenal of democracy, we were suddenly called upon for munitions output on a scale regarded as improbable if not impossible.

But, from some aspects, the lack of an established armaments industry was no handicap. There were no shackles of tradition. We were able to adapt the best tools and the best production methods of the New World to concentration on the most modern types of equipment. It was some time before our aircraft plants—busy turning out trainer planes for the Combined Training Establishment—had expanded to the stage where they could contribute substantially to the making of combat craft. But, when that stage was reached, the industry was capable of producing the latest and best.

We are now producing service planes which, in their respective fields, are unsurpassed by any other type of aircraft.

The production of weapons of war follows an established pattern: a better offensive weapon is countered by a better defensive weapon. An improvement in defence demands an improvement in offense. The result is a rapid obsolescence of equipment. The armoured tank gave birth to the anti-tank gun and the land mine technique. The anti-tank gun and the land mine resulted in improved designs and stronger armament for tanks. Stronger tanks meant bigger anti-tank guns, more devastating mines. This contest has been going on since man first waged war, and in time of war it accelerates so rapidly that the secret and invincible weapon of to-day is the obsolete and discarded weapon of to-morrow.

In this race, we have been fortunate in being able to build new plants, equipped with new machines, manned by workers trained in new techniques. These plants, safe from enemy attack, are close to supplies of power and raw materials. They are fed by components and parts made in established industrial factories converted to wartime output. Under forced draught, as it were, we have managed to turn this country into an arsenal producing close to ten million dollars worth of war equipment every day. These weapons and supplies cover a wide range, from anti-aircraft guns to training rifles, from corvettes to dinghys, from 25-pounder artillery to bomb-throwers, from aerial bombs to grenades, from Ram tanks to motorcycles.

Because of our lack of tradition and experience in the making of the tools of war we have few standards with which to compare the quality and quantity of our output, although they are being created quickly even in the span of the present war, so constant is the pressure for improvement. In the last war we produced shells, which were shipped overseas to be filled. Our shell programme in the present war goes a good deal farther. We not only produce a greater variety of shells, ranging in size from the small 37 mm. armour piercing shot to the heavy shells, but they are filled with Canadian-made explosives and are shipped together with their cartridge cases and components as completely filled rounds of ammunition.

This means that our ammunition industry is immensely greater than in 1914-18. It involved the establishment of a number of major filling plants and scores of smaller plants in all parts of Canada, for the manufacture of propellent and explosive charges required for gun ammunition of all kinds, as well as for depth charges, land mines, aerial bombs, smokes bombs, fuses, primers, and small arms ammunition. This huge industry, employing 50,000 people, was created at a cost of $150 million. Our chemical and explosives plants alone cover an area equivalent to the area of the city of Montreal. In safety and sufficiency they are equal to the best in the world. Production techniques are such that untrained workers can soon become adept at tasks in an industry where the novice was once regarded as a potential danger.

While there have been many difficulties in converting this nation's industrial capacity to a war production programme of the vastness upon which we are now engaged, there have been pleasant surprises. Gun steel was never previously made in this country. Armour plate had never been made in Canada. High quality alloy steel, so vital to many types of modern weapons, had not been made in sufficient quantity "to fill one's hat," in the words of one steel expert. The fact that our steel industry has successfully increased production of basic open hearth steel and is producing great quantities of steels indispensable to a wide range of weapons and armaments is one of the major reasons for our ability to produce tools of war on our present scale.

There were two factors mitigating against production of heavy guns. Lack of gun steel capacity and a complete lack of industrial experience in the manufacture of these complicated weapons. A modern anti-aircraft gun will consist of as many as four thousand separate parts, all machined and assembled with extreme tolerance down to a ten-thousandth of an inch. Some parts demand precision work of the accuracy that goes into the making of a fine watch.

In spite of lack of experience, lack of skilled labour, incomplete drawings and specifications, Canadian manufacturers undertook the task—revolutionary to this country—of making heavy guns. The steel industry made gun steel. Industrial plants once devoted to peacetime products accepted contracts for parts. And just recently our 15,000th heavy gun was turned over to the army ordnance authorities—a Bofors anti-aircraft gun of the most complex type, completely mounted, equipped with instruments for remote fire control, ready for action, made by Canadian hands in Canadian factories.

We are making field guns and naval guns, tank and anti-tank guns of the most modern types but we are particularly proud of the fact that Canadian workmen have mastered this art so quickly and so well that we are delivering the British 3.7 anti-aircraft gun, which fires a 28-pounder shell eight miles in the air at the rate of 15 shells a minute. One part of this gun is so meticulously finished that it requires three months of machining. This type of weapon, of course, was unknown in the last war. It is a miracle of engineering design, being equipped with instruments which automatically locate the target, set the fuse, aim and fire the gun.

In the instrument field, not only in the manufacture of intricate fire control apparatus for artillery but in the production of communications equipment vitally essential to modern land, air and sea warfare, we have established an industry which keeps apace with the latest in scientific discovery. Indeed it often sets the pace.

In twenty-five years, radio has revolutionized communication methods. Paralleling the revolution in transportation that has taken place in the same period it has helped shrink the world in size. Naturally it has had a pronounced effect on methods of warfare. Fast tanks and automotive transport, swift combat aircraft and naval combat craft have added speed and mobility to modern attack far beyond anything imaginable in the last war, but these advantages might be nullified if it were not for corresponding advances in the science of communication.

It is possible now to shift forces swiftly, to marshal defences rapidly, to launch combined attacks with great speed and accuracy of timing by organization based on two-way radio communication. Delays in conveying information can be fatal in battle at any time; modern battles are fought at such speed that instant communication between various elements of aerial, naval, or land forces is of first importance. In the manufacture of this equipment Canada has become a major source of supply. This year we will build $250,000,000 worth of communications equipment for the United Nations.

The great, obvious difference between the present war and the conflict of 1914-18 is that mechanization has made this a war of movement as against the stabilized type of trench warfare. Transport has become of greater importance than ever before. Here we had a solid foundation upon which to build and expand. Our contribution in this respect has been heavy.

Even in peacetime, the introduction of a new passenger car model demands weeks of planning, redesign, and retooling. In abandoning commercial output, our automotive factories took on the task of making no less than 115 types of automotive transport never before made in this country.

A good deal of planning and foresight went into this. From 1933 to the outbreak of the war, collaboration had been in progress between the automotive industry and Canadian and British army authorities. Primary development in army design came from the British authorities who recognized that the ordinary commercial vehicle would be unsuitable for duty in the event of another war, owing to its poor cross-country performance. Army design benefited the automotive industry when the time came for conversion; on the other hand, mass production techniques, the resourcefulness and experience of the automotive men have been of inestimable value to the army in turning those designs into sturdy, reliable, economically built vehicles equal to the best in the world.

A fundamental difference between wartime and peacetime automotive production is that front wheel action drive is considered a necessity for military requirements. Improvements based on lessons learned under service conditions are constantly being incorporated. Two of our automotive companies have technical staffs in Cairo, acting as liaison officers between military authorities in the Middle East and production officials in Canada.

Essentially, there are no new weapons. There are only improvements and variations of the old. But the *Mosquito* bomber, made of plywood, capable of great speed and manoeuvrability, is a technical miracle compared to the "stick and string" training planes we made in the last war. The Sten carbine is a handier infantry weapon than anything our soldiers had in the last war, just as our No. 4 rifle is lighter and more accurate and our Bren machine guns and Browning aircraft machine guns are more reliable and have far more devastating fire power than the machine guns of twenty-five years ago. The Ram tank is a swifter, more mobile, heavier armoured, more deadly tank than anything in service at the beginning of the present war. Our twenty-five pounder field gun is one of the most effective pieces of artillery in the world and our naval guns and anti-aircraft guns are models of accuracy, power, and precision. Our Canadian-built army trucks will bring troops and supplies into action more rapidly and in greater numbers than ever before in military history. Our armoured cars and universal carriers enable battles to be fought at speeds undreamed of in other wars. Our communications equipment knits fighting forces together to a degree never before realized. Our corvettes are equipped with devices that rob the submarine of secrecy of approach. We are not only making a far greater variety of weapons than ever thought possible in this country. We are making them in quantities and of qualities equal to the best on earth, for we have never permitted the second-rate or the expedient as a standard.

The obstacles that stood in the way of Canadian industry's conversion to modern war production have been numerous. The making of modern tools of war is a highly specialized division of industrial science, not to be easily or quickly mastered. With neither tradition nor experience in these crafts, however, Canadian industry has met the challenge. The problems have been complicated by shortages of raw materials, by the complex difficulties of adjusting civilian economy to a war basis, by the manpower adjustments inevitable to any programme of enlisting armed forces and producing not only weapons to equip those forces but the forces of our Allies. Industry has shown remarkable ingenuity and resource in solving its problems of production and supply. The Canadian people have adjusted their lives from peacetime to wartime standards with a free willingness that is the best augury of democracy's ability to beat the Axis in the very field where it deemed itself supreme.

---

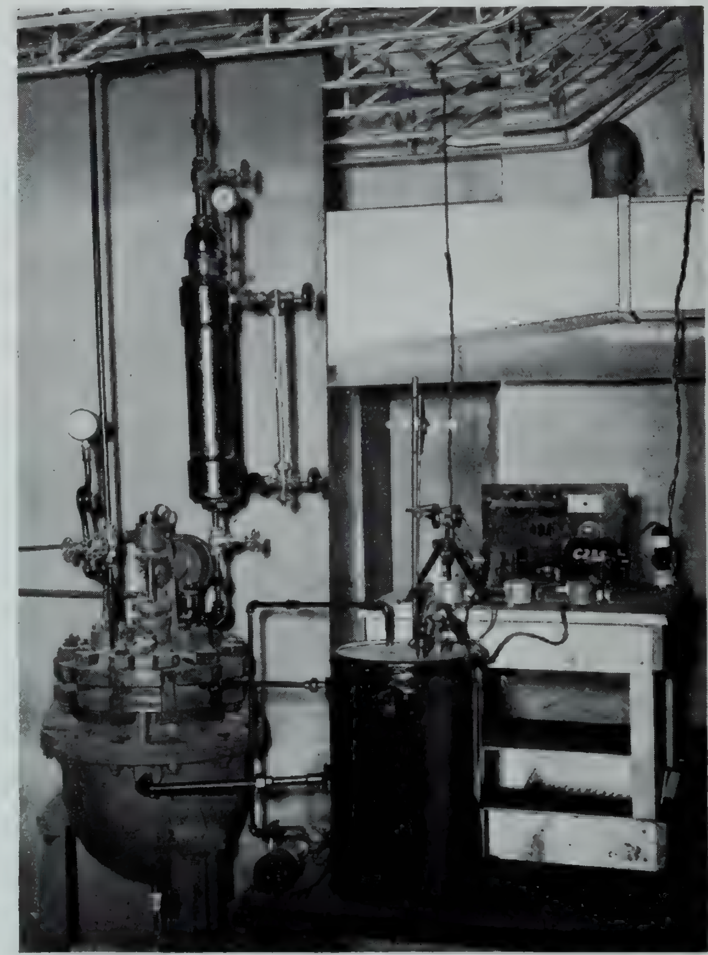
# NATIONAL SCIENTIFIC RESEARCH

C. J. MACKENZIE, M.E.I.C.
*Acting President, National Research Council, Ottawa*

Pasteur once said that chance favours those who are prepared. Research development in Canada during the last quarter-century provided a degree of preparedness for the present conflict far in advance of that which this Dominion possessed in 1914.

Science, technical mechanics and engineering have become such great and fundamental factors in the present world-wide struggle, that it is difficult to realize their implications and to appreciate the value of the work done by the relatively few scientists and engineers who, in the years from 1916 onwards, quietly developed the machines and equipment which to-day are contributing so largely to the success of our arms in the field.

It was under the stress of World War I, that the call went out throughout the British Empire for highly qualified research men. It was then discovered that there were more trained scientists in a few of the great German industries than could be found in the whole British Empire. However, if the British are slow to change and to adopt new ideas which disturb traditional procedure, it is equally true that once awakened to the necessity for action, Great Britain moves effectively and very surely.



**Experimental apparatus in the National Research Council rubber laboratory for making Buna S synthetic rubber by copolymerization of butadiene and styrene.**

The Committee of the Privy Council for Scientific and Industrial Research was created in Great Britain in 1915 to enlarge and organize the scientific resources of the country. This was the first time in the national history that an organized attempt had been made to equip scientific research in an adequate manner. It was clearly realized that such action was essential if the industrial fabric of the Empire were to be built up and maintained on a sound basis.

Under the Committee of the Privy Council, the Government of Great Britain appointed an Advisory Council for Scientific and Industrial Research. Furthermore, a dispatch was sent to each of the Dominions requesting them to establish similar organizations for the purpose of developing scientific and industrial research within their own borders.

The Government of Canada, acting on this suggestion from the Government of Great Britain, established, late in 1916, the Honorary Advisory Council for Scientific and Industrial Research, now known under the short title—"National Research Council."

One of the first activities of the Council was to take, in 1917, a research inventory of Canada. This inventory disclosed two outstanding facts: first, that industrial research was at that time practically non-existent in Canada, and secondly, that the supply of research men, with such postgraduate training as to enable them to undertake independent investigation, was entirely inadequate to permit of any general application of scientific research to Canadian industrial problems.

Pending the provision of such laboratory facilities as would make it possible to serve Canadian industry on an adequate scale, the National Research Council directed its activities along three main lines:

(a) The co-ordination of research and the organization of co-operative investigations through competent and representative Committees;

(b) The postgraduate training, through scholarships, of students selected for their aptitude in scientific research;

(c) The encouragement of graduate research through financial grants to heads of science departments in Canadian universities.

This programme was and is a matter of some importance because in the absence of similar offers at home many graduates continue to be attracted to institutions in other countries where scholarships are available. Too often it happens, as a consequence, that those who leave Canada under foreign scholarships find profitable appointments elsewhere with industrial concerns whose products may even be competitive with those produced in this Dominion. The fallacy of training men in Canadian institutions and then allowing them to be absorbed by foreign industries while Canadian manufacturers lag behind for lack of scientific guidance should not need to be emphasized, but before the war, it is feared that many persons failed to realize the national value of these postgraduate scholarships and regarded them only as evidence of paternalism on the part of a benevolent government organization.

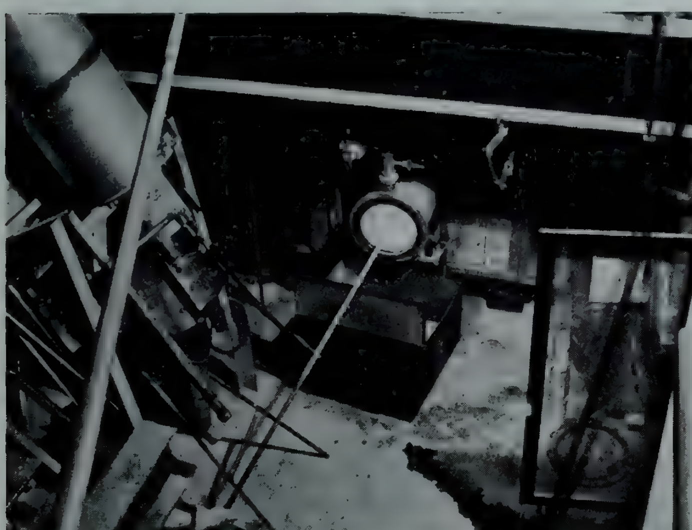
Efficiency of industry is a matter of vital concern to everyone. A national research organization should seek to promote this efficiency in every way; to assist in turning every national resource and facility to account; to improve processes and to cheapen products so as to better the competitive position of its country in the markets of the world, and particularly to be ready to suggest new articles of manufacture when the fashion for the old diminishes or they stand in danger of being displaced. It is to these activities in aid of Canadian industry that the National Research Council is dedicated.

During the last half century or so the industries of the world have been modified and built up on the basis of scientific knowledge. The mechanical industries derive from Newton's laws of motion; the electrical industries are based on the early scientific work of Henry, Faraday, Maxwell, Ampère, and down the years through Kelvin, Edison and a multitude of others; aviation is the outgrowth of hydrodynamics and aerodynamics; the chemical and metallurgical industries make use of knowledge accumulated since the days of the alchemists.

Most of this fundamental information, which has made modern industry possible, was built up slowly in the universities of the world. It was not acquired for any utilitarian purpose, it came as a by-product in the search for truth. This form of research has in consequence come to be called "pure science," and it continues to hold a most important place in the scheme of things as they are.

Until towards the end of the last century only a relatively small fraction of the fundamental knowledge that had been acquired and stored up by the universities had been assimilated by industry and new knowledge was accumulating perhaps faster than it could be applied.

In this period, industry sought to exploit existing stores of information and often succeeded, but even for this task trained minds were needed. A demand arose for men who could understand the facts and apply them to every-day problems, and experience showed that men who had been trained in the universities in the fundamentals of mathematics, chemistry, physics, etc., were particularly useful. First, in the larger manufacturing establishments and later extending in ever-widening circles, there began to grow up organizations for what was called "applied research."



**Discharging retort of magnesium furnace in pilot plant of the National Research Council.**

Applied research was something that most business men of that day could understand. It was immensely profitable. In contrast "pure research" was deemed academic and the men who engaged in it were thought of as people who were not practical. Business was quite content to leave to the universities the pursuit of knowledge for its own sake.

At the beginning of this century, some forward-looking leaders of industry recognized that industrial application had nearly overtaken the capacity of the universities to produce new facts to work on, and out of this idea "industrial research" was born.

The development of the National Research Council in the era of peace between the first Great War and the present conflict followed a line of slow but definite progress. The Research Council Act was passed in 1924. Laboratories were established in temporary quarters and construction of the present spacious National Research Building was commenced in 1930. The buildings were completed and occupied in 1932.

Immediately prior to the war, additional provision for laboratory space was made through the purchase of a site just outside of Ottawa. Plans were laid for a group of buildings but the advent of the war made it necessary to limit construction to those which would be wholly used for war purposes. The aeronautical laboratories with their shop equipment, the hydrodynamic laboratory and the explosives laboratory are now installed.

The demands of the war have made it necessary greatly to increase staff as well as laboratory accommodation. Radio field stations have been constructed and every available inch of space in existing laboratories has been utilized. University facilities have been used to advantage for the conduct of special investigations of a kind that can be decentralized.

Appointment of the National Research Council as the official research station of the Navy, Army and Air Force opened up new avenues of service and brought, to the Council, the advice of the operational staffs in respect of scientific problems presented for solution.

The enormous advantages of this arrangement, both to the laboratories and to the Armed Services, need not be stressed. The co-ordination of effort thus made possible has greatly accelerated both the study of problems in the laboratories and the application of the results in the field.

This procedure is in line with the generally accepted policy that the scientific method must pervade all stages of production and of the use of the product; the scientific worker must live with the maker and the user. He is an essential "third party," understanding the points of view of both.

It is the moral responsibility of the scientific workers to see to it, by all means in their power, that those responsible for the formulation of policy give full weight to the scientific and technical factors involved. The extent to which policy must be based on scientific and technical considerations tends to increase rather than otherwise.

In the twenty-odd years between the end of the last and the beginning of the present war, Canada had built up, from almost nothing, creditable scientific research facilities. In 1919, the total expenditure on research in Government departments, in universities and in industry amounted to not more than $500,000 while in 1939 the peacetime budget of the National Research Council alone was about $1,000,000 and probably as much more was spent in the research laboratories of the Departments of Mines and Resources, Agriculture, and Pensions and National Health, and in the universities. In addition, industry probably was spending something like $20,000,000 a year and the number of scientific research workers available had increased in comparable proportions.

On the other hand, the budget of the Department of National Defence had been cut so drastically in the post-war period that no moneys were available in Canada for development of new weapons and devices or for other strictly military research, and the relatively small amount of scientific work that it was financially possible to do was carried out by the National Research Council in co-operation with Service officers and departments. This co-operation became more intimate when Lieutenant-General A. G. L. McNaughton became president of the National Research Council in 1935.

The outbreak of the war intensified the need for scientific work on war problems, and, since then, the co-operation between the National Research Council and Services has developed steadily in a most effective and cordial manner. To-day, the Council's work is almost entirely on war projects; the staff of less than 300 in 1939 has grown to over 1,200; the direct war budget has increased in like proportion. Expenditures on equipment designed and projects directed by the Council's scientific staff now amount to many millions of dollars annually.

The fundamental problem facing Canada, to-day, is the simple and obvious task of providing equipment superior to that of the enemy and in adequate quantities for the military personnel trained in its tactical use. For the first time this Dominion has been called upon to produce complicated scientific equipment on a mass production basis, for use in the war.

When the ordinary man on the street thinks of mass production, he probably visualizes production on assembly lines with the machines or equipment coming off at a continuous and rapid rate. He probably does not realize that before such production is possible several other time-consuming phases have preceded it. There is the research phase when the equipment or the machine must be conceived in its general outline, its detailed features worked out scientifically, the various components tested and often even special materials developed. Then the laboratory model must be placed in the hands of development and designing engineers whose job it is to work out not a tailored article, but one that is capable of being manufactured by mass production methods. After this is done, the factory layout must be made, the necessary machines and tools obtained and a plant constructed to carry out the process. Not until all these steps have been taken can we obtain equipment in mass quantities. It has generally been assumed that, in peacetime, these steps take at least three years. Moreover, in peacetime, changes in models from year to year are kept to a minimum in order to ensure adequate production.

What of war ? In war, the problem is met from a different, and for us on this continent, a doubly different, angle owing to the fact that up until the outbreak of war there were few if any scientists and engineers in industrial organizations who had ever thought in terms of weapons of war and who, consequently, had done no thinking or active work on the research and development phase.

In order to produce materials in mass quantities, it is necessary to go through the various phases. The research phase is the period during which the prototype is being worked out. The length of this period if unpredictable but on the work in this stage will depend whether our equipment will be inferior, or equal, or superior to that of the enemy, and all this takes time.

When the prototype has been produced, the factory specifications for its manufacture have to be worked out, the necessary plant layout has to be designed and buildings erected or remodelled, staff must be assembled and trained and the necessary tooling-up process completed before construction can be commenced. And then, when the finished product becomes available, its tactical use depends on a long and arduous training of the military personnel for whom it was developed. Mass production even in peacetime bristles with difficulties.

**Apparatus for measuring permeability of fabrics by poison gases.**

In war problems, all mass production becomes aggravated; war is not a static affair, it is rapidly moving; changes come quickly and war is not only a contest between armies in the field but a contest based on the industrial resources of the countries involved. The enemy is constantly changing his equipment and improving and devising new instruments and we must do likewise or else we will perish.

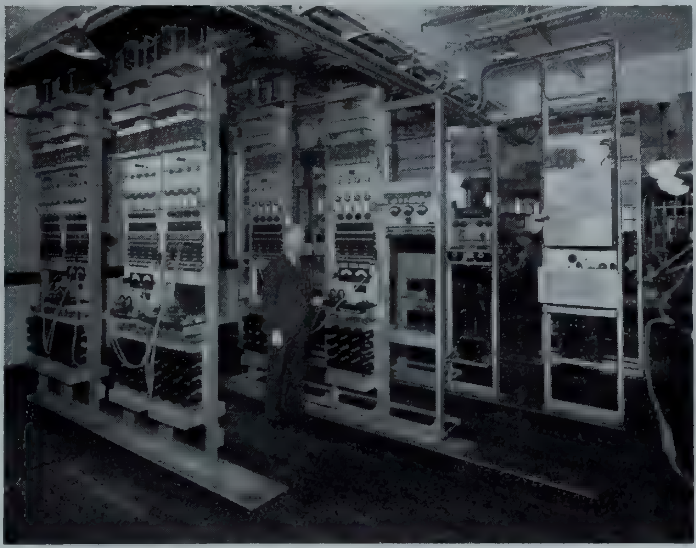
The situation now is that we must keep our production at top speed from existing designs and, at the same time, we must push forward development work on these designs in order continuously to improve our weapons and machines of war. War more than any other of man's activities puts a premium on being in the lead.

In this endeavour, the scientist and the engineer work hand in hand. The National Research Council, through its laboratory facilities and personnel, through co-operation with government departments, and by correlation of research in the universities, and through its close affiliation with the Armed Services as their official research establishment, is playing a not unimportant part in the application of science to the Nation's war needs.

# TELEGRAPH COMMUNICATIONS

L. A. W. EAST
*Chief Engineer, Department of Communications, Canadian Pacific Railway Company, Montreal*

Like its younger brothers telephony and radio, telegraph communication brought forth many improvements and underwent much expansion in the period following the last world war. From its first use in Canada in 1846 until this period, telegraph transmission had been limited almost exclusively to single wire ground return circuits employing direct current and, for the most part, Morse signals. Manual relaying of messages was general and uninterrupted transcontinental service was difficult to maintain, frequently being impossible during periods of aurora borealis. However, with the introduction of carrier systems and improvements in telegraph equipment during the twenties, these difficulties were rapidly overcome. Much of this improvement may be attributed to developments in magnetic materials and metal alloys, particularly in mechanical parts. In 1918, automatic telegraph equipment was practically limited to a multiplex system enabling simultaneous transmission of four messages in each direction over one wire, and relatively few teletypewriter machines located in central offices. To-day, thousands of teletypewriter machines, usually called teletypes, located in branch and individual subscribers' offices provide speedy and direct communication at sixty words per minute throughout Canada. Contrasted to the equipment of twenty-five years ago, these modern machines can be operated for months at a time without other maintenance than occasional oiling of mechanical parts. Manual retyping and relaying of messages can now be eliminated by the modern reperforator, whereby received signals are recorded on punched tape by means of which the same signals can be automatically retransmitted as required. A printer reperforator is also available which prints the letters as well as recording the signal impulses on tape.



**Modern carrier telegraph equipment.**

### Carrier Current Systems

The development of carrier telephone and telegraph systems may be considered as having its inception in the application of the vacuum tube and electric wave filter for the generation, detection and selection of alternating currents. The first carrier telegraph systems were installed in Canada in 1927. These provided ten telegraph and one long distance telephone channel on one pair of copper wires, using frequencies up to about 11 kc. Due to convenient association of carrier telephone and telegraph systems, the utility of a single pair of wires was soon increased. In the latest carrier telegraph systems now in operation in Canada, some 42 telegraph and a long distance telephone or broadcast transmission circuit are derived from a single pair of wires. This permits 42 messages to be transmitted simultaneously in each direction at 60 words per minute.

A system having still higher message capacity has already been developed commercially. Using carrier frequencies up to about 140 kc., it provides 15 carrier telephone channels on each of which 14 voice frequency carrier telegraph channels may be superimposed. However, at present, service requirements in Canada are being adequately and economically provided by the 30 kc. systems. The advantages and economy of carrier over physical operation on trunk circuits are well established. Incorporating many vacuum tube and circuit inventions, tremendous improvements have been made in the stability and efficiency of over-all circuit performance and reduction of operating maintenance. One or two tubes now perform the functions previously requiring six or eight tubes. Application of the negative feed-back circuit has made possible highly stabilized repeaters whose over-all amplification may be held practically constant over wide ranges of power supply voltages. Much simplicity and economy of operation have been made possible by use of the copper oxide varistor for modulation and demodulation purposes in place of vacuum tubes. In general, the per channel cost of carrier telegraph operation has been reduced because of these developments.

### Outside Plant

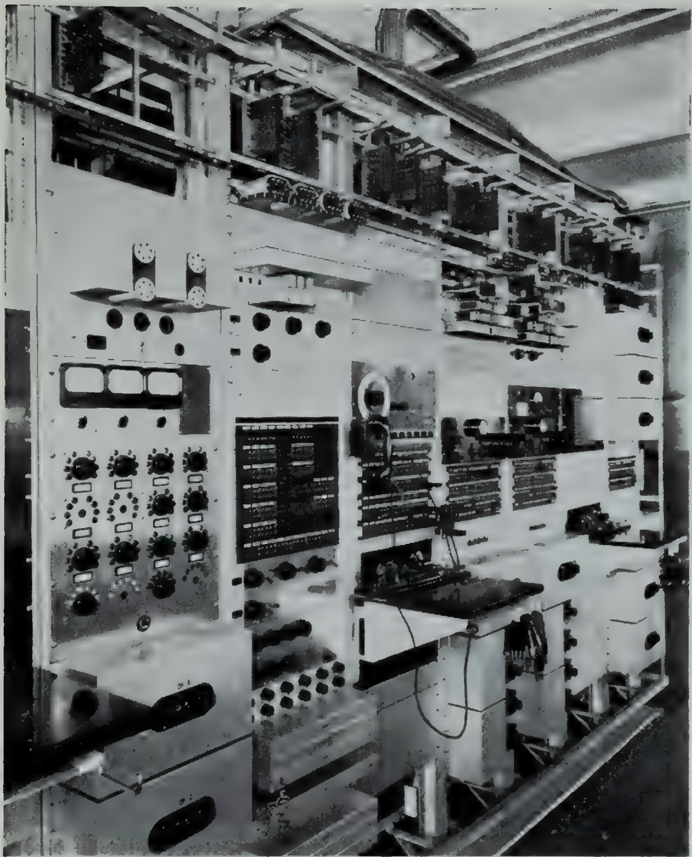
In sharp contrast to the relatively simple construction of 1918, involved engineering of practically all details of line construction is now required to enable simultaneous operation of a multiplicity of carrier telegraph, telephone and broadcast services without interference. Precise arrangement of wires in pairs and location of poles are matters of extreme importance. High efficiency loaded cables have replaced the simple rubber insulated types of earlier days. Wide application of improvements in protection against inductive interference and electrical hazards have contributed greatly to the reliability of service despite the growth in power lines throughout the country. Developments in wood preservatives and treatment of poles, galvanizing of hardware parts, glass insulation capable of withstanding extreme temperature changes, low resistance compression type wire joints and many others have greatly improved the life, efficiency and maintenance required in outside plant.

### Broadcast Networks and Specialized Facilities

Since 1932 the two major telegraph systems in Canada have been providing coast-to-coast programme network facilities for the Canadian Broadcasting Corporation. Some 10,000 circuit miles are operated on a regular schedule of sixteen hours per day. This network links all of the principal broadcasting stations throughout Canada. Quick switching of programme pickups between points thousands of miles apart is, to-day, a matter of ordinary routine. Private long distance telephone facilities are operated for the two transcontinental railway systems. Long distance telephone lines are also furnished to the various telephone systems. A large section of the trans-Canada telephone system is operated over lines of one of the major telegraph companies.

### Leased Telegraph and Teletype Facilities

In addition to public telegraph service, the Canadian telegraph systems furnish many leased wire facilities for varied services. An elaborate teletype network linking most of the airports throughout Canada and operating twenty-four hours per day is maintained for the Meteorological



**Programme transmission equipment.**

Branch of the Department of Transport. Nationwide teletype networks are also furnished for the exclusive use of the principal news gathering agencies. Transcontinental land line facilities are operated in conjunction with the trans-oceanic cable and wireless companies in the chain of Empire communications. Improvements in repeater and automatic equipment in recent years have greatly reduced the amount of manual relaying on such circuits.

### Wartime Operations

At the outbreak of war, telegraph communications in Canada were eminently better equipped than in 1914 to meet the needs of the armed services and various governmental departments. Many private teletype circuits have been furnished on short notice for the Department of Munitions and Supply, and the Department of Transport. Extensive facilities for the Army, Navy and Air Force in connection with defence communications have also been provided. With new equipment extremely difficult, if not impossible, to obtain, these have been furnished for the most part by transfer of carrier and other equipment from one point to another. Many improvisations have been effected in the re-use of old equipment parts and salvaged materials. Use of additional copper wire has been avoided except where carrier systems are not feasible or not obtainable. Emergency cars containing portable repeater and terminal equipment have been set up and held in readiness in the event of damage in coastal areas. A number of long distance telephone facilities have been made available to the telephone systems to take care of increased traffic in highly industrialized areas.

### Post-War Developments

In the light of developments at the outbreak of war many new innovations may be anticipated. For use when general service may require it, automatic teletype switching equipment has been perfected whereby teletype subscribers at local or distant points may be inter-connected quickly. Means have also been developed whereby a single telegraph channel may be shared simultaneously by a number of subscribers when service requirements permit, and, it is not economically feasible for any one subscriber to lease an exclusive channel. Automatic telegraph means, employing facsimile transmission, has been developed practically. With this it is only necessary for the subscriber to drop a hand or typewritten message into a slot and push a button. The message is automatically transmitted to the central telegraph office there to be retransmitted to the distant point. A facsimile reproduction of the original message is produced and released at the receiving subscriber's machine. Facsimile and telephoto equipment has been developed to transmit graphic and pictorial material. During the occasion of the Royal Visit to Canada of the King and Queen in 1939, some 250 to 300 pictures were transmitted for the various news agencies by portable equipment using programme transmission facilities of the telegraph companies. The feasibility of operating some 240 telephone channels simultaneously over two pairs of concentric conductors contained within a single lead sheathed cable has already been demonstrated. Considering that some 14 telegraph channels can be superimposed on each of these voice frequency channels, some idea of the present state of the art, insofar as the number of messages which can be handled over a single metallic

**Modern telegraph operating room.**

circuit, can be obtained. Employing conventional multiplex equipment this number is at once doubled so that some 6,720 teletype circuits could be operated over a single pair of such coaxial conductors. The electronic and photographic principles of television suggest even greater possibilities. Perhaps it may not be too much to suppose that, when technical development can again be turned to peacetime pursuits, recorded messages may be transmitted instantly.

# TELEPHONE COMMUNICATIONS

## PEACETIME RESEARCH MEETS WARTIME CRISIS IN TELEPHONY

H. G. OWEN
*Bell Telephone Company of Canada, Montreal*

**The latest method of providing storm-proof long distance telephone facilities is by burying cable directly in the ground by means of special plough drawn by powerful tractors. This type of cable is being laid in 1943 to link Ottawa, Montreal and Toronto.**

Continuous improvement through unremitting research—that is the story of telephone development since *The Engineering Journal* made its first appearance 25 years ago, and it is this research which explains the readiness with which the telephone system has met the tremendous wartime expansion of the past four years.

In 1918, as in 1943, all the resources of telephone science were being concentrated upon war problems. Bell System engineers were busy devising methods of ensuring secrecy in military communications, circuits for firing mines by remote control, and electrical ears for detecting enemy gun emplacements, submarines, and airplanes from afar. Telephone manufacturers were turning out shock-proof field telephones and gas masks equipped with telephones for the land forces, helmets equipped with telephones for the air force, radio sets for the tank corps, and electrical stethoscopes and probes for the medical corps.

With the armistice, all this activity was directed upon the problems of telephone expansion created by the boom of the 1920's. The fruits of this intensive study can be most readily seen in a comparison of telephone service in 1918 with that in 1943, and in a brief review of its by-products which have appeared in almost every field of modern science.

First, consider the telephone set itself. In 1918, the most modern type was the desk stand set. The telephone user of 1943 is still familiar with the outward appearance of this instrument, and may become increasingly so as wartime shortages compel the reconditioning and re-use of all telephones in stock.

Despite this outward similarity, there is no comparison between the desk stand set of 1918 and that of 1943. The modern transmitter is eight times more efficient over a wider range of tones than that of 1918. The modern receiver unit weighs only three ounces, compared with ten for that of the old desk stand, yet its efficiency is even greater. Finally, the circuit of the modern set is specially designed to reduce the effect of room noise picked up by the transmitter and reproduced by the receiver of the same set.

In 1918, there were no dial exchanges in the Bell System. The Bell Telephone Company of Canada opened its first dial exchange in Toronto in 1924. Beginning in 1933, dial service was also extended to small-town exchanges, and at the present time, 72 per cent of all the company's telephones are dial-operated.

In 1918, a caller often had time to go out and play a game of golf between the times of asking for a long distance connection and obtaining it. By 1939, the average time for establishing an out-of-town connection had been reduced to 78 seconds. Under war conditions, that figure has risen again slightly, to 102 seconds, but 90 per cent of all long distance calls are still completed while the caller remains at the telephone.

In 1918, the Bell of Canada had no inter-city cables and no carrier systems in service. The company's first long cable was erected between Toronto and Hamilton in 1924, and the first carrier systems were installed in 1928. The use of cable ensures greater protection from storms than open-wire lines afford, while carrier permits several conversations to be carried on over the same wire circuit at the same time. The conversations no more interfere with one another than a broadcast from one radio station interferes with a programme from another station which is operating at a different point on your radio dial.

The loading coil of to-day is one sixth the size of the 1918 coil, yet the use of the permalloy core instead of the old iron one renders the coil far more efficient. The modern telephone repeater lasts ten times as long as the vacuum tube of 1918, and gives many times greater amplification for the same amount of current. The effect of these developments is indicated by the world-wide extension of the service during this period.

In 1918, long distance service of The Bell Telephone Company was available only to other communities in the provinces of Ontario and Quebec, and those in the United States within the radius of a thousand miles. It was not until the following year that regular commercial service was established to the Maritimes and not until 1920 that a Canadian telephone user could call anywhere in Canada and the United States. Even then, service between the Maritimes and Quebec, between Ontario and the Prairies, and between the Prairies and British Columbia was provided only over lines in the United States.

It was not until 1932 that the Trans-Canada Telephone System was officially inaugurated. It is jointly owned and operated by the seven major telephone systems of the Dominion. These systems include the Maritime Telegraph and Telephone Company in Nova Scotia, the New Brunswick Telephone Company, the Bell Telephone Company of Canada in Quebec and Ontario, a government system in each of the three Prairie Provinces, and the British Columbia Telephone Company.

Transatlantic radio-telephone service was introduced in 1927. From then on, overseas connections were extended year by year until at the beginning of the war, any Canadian telephone user could reach any important country in the world except the U.S.S.R. or New Zealand, and could also speak with passengers on ships at sea.

Meanwhile, many by-products had come from telephone research. Bell Telephone Laboratories improved the electrical stethophone, the artificial larynx for those whose vocal cords have been removed, and a variety of aids for the hard-of-hearing. They evolved orthophonic recording, sound motion pictures, magnetic tape recording, and the reproduction of recorded music in auditory perspective, as exemplified in Walt Disney's *Fantasia*. They contributed to the development of two-way radio-telephone for planes in flight, and other devices to promote air safety, and to teletype, telephoto, and television.

Then came the war. As a result of this 25 years of development, the telephone companies and the telephone researchers were ready. With little change in standard practices, they swung easily in the new direction required by the war effort.

First, consider the effect of war upon ordinary telephone service. Between 1939 and 1943, Ottawa, heart of the nation's war effort, has actually doubled its telephone requirements. Twice as big as in 1939 are the government's private branch exchange, which is large enough in itself to serve a small city; the Ottawa-Hull telephone exchange building; and the volume of long distance calls from the capital. Calls between Ottawa and Toronto have increased fourfold since the outbreak of war.

To ensure storm-proof service between the capital and the two largest cities in the Dominion, new cables, ploughed directly into the ground by means of a special tractor-drawn plough, are under construction from Ottawa to Montreal and Toronto. Many circuits in the Montreal-Ottawa section were made available on an emergency basis following the year-end sleet storm.

Additional circuits to the Maritimes and the Prairies have involved the erection of two entire new lines, poles and wires, from Montreal to Edmundston, New Brunswick, and from Ottawa to North Bay. Direct circuits have had to be provided from Ottawa to Halifax, Winnipeg, and Washington.

These are only the major projects. All over the two provinces served by The Bell Telephone Company, military, naval, and air force centres, government, industrial, and war service organizations have called for telephones, public telephones, teletypewriters, private branch exchanges, and other installations of many different kinds—some involving unusual engineering problems.

The part the Trans-Canada Telephone System is playing in the nation's war effort is revealed by the rapid increase in the number of messages handled since the outbreak of war. The annual calling volume has leapt from 87,000 in 1939 to 121,000 in 1940, 200,000 in 1941, and 276,000 in 1942.

In 1940, the longest direct circuit in the British Empire was placed in service between Toronto and Vancouver, a distance of over 3,000 miles. With the direct circuit opened between Halifax and Toronto in 1941, connections can be established from Halifax to Vancouver with but a single switch—at Toronto.

Despite these undeniable wartime requirements, the telephone industry must still effect economies in its use of vital materials. The Northern Electric Company makes 90 per cent of all telephone equipment manufactured in Canada. Over 80 per cent of this great plant is now directly devoted to war production. The manufacture of new telephone equipment is confined to high-priority jobs only.

In such new installations as are still required, a number of substitutions have been adopted for telephone materials which are also war materials. It is estimated that the Dominion's telephone systems are saving enough aluminum annually by such substitutions to build more than 16 fighters or half as many bombers.

Here is a specific example of how the company has been able to fall back upon peacetime researches to meet a wartime crisis.

When the wires in a telephone cable have been spliced, the bunched joints are enclosed in a lead sleeve with a short length of lead sheath at each end, and a wiped solder joint is made to seal the sleeve to the sheath. Since the seizure of Malaya, source of 80 per cent of the world's tin, the metals controller has successively limited the proportion of tin used in solder from 40 per cent to 38 per cent, then to 30 per cent, and finally to 20 per cent. From studies made by Bell Telephone Laboratories long before a war emergency was ever thought of, solder formulae had to be selected which contained the requisite proportion of tin, but compensated for the reduction in the tin content by the addition of other metals such as cadmium or bismuth. With the introduction of each new type of solder, the entire cable-splicing force had to be trained in its use.

Not only did the company reduce the tin content of its solder, but it also introduced the "Victory Joint," which effected a 50 per cent saving in the amount of wiping solder used in 1942.

There is another metal telephone companies are even more anxious to save. That is copper. A machine gun in action for four minutes uses as much copper as a mile and a half of telephone wire. The average 10,000-ton merchant vessel requires nearly enough copper to erect a telephone circuit from Montreal to London, Ontario.

Copper is being saved by the installation wherever possible of carrier systems instead of the erection of new wires. Through a more intensive use of carrier than ever before, applied to one long distance line alone, The Bell Telephone Company obtained several badly-needed circuits which would otherwise have required the erection of 500 tons of copper wire in 1942. The new Ottawa-Montreal-Toronto cable is designed for the ultimate provision of 20 12-channel carrier systems, in addition to the regular wire circuits.

Eventually, it may be necessary to get along with substitutes which cannot altogether replace the materials which were evolved only after years of research. For example, to economize the use of nickel, iron has replaced a nickel alloy in the core of the telephone ringer magnet. Iron-core ringers are less satisfactory, especially when they are located at the end of long lines, where only a small amount of current may reach them.

It is possible that further restrictions in civilian telephone service may be necessary before the final victory is won. Some companies are trying to console their customers for present wants by promises of future miracles. Traditionally conservative, the telephone system prefers to state merely that the policy of seeking constant improvement will be pursued even more diligently than in the past.

The plastic telephone set is already with us, and coloured plastic housings were under study when the war began. A limited number of combined, or bell-in-base sets released before 1940 indicates a trend toward more compact, streamlined design.

Dial operation is being extended to long distance service, so that an operator in Montreal can dial a number in Toronto directly, without having to pass on the number to the Toronto operator, this speeding up inter-city connections. Although the prospect of nation-wide dial service is very far distant indeed, it opens up immense possibilities to the imagination.

Coaxial cable, that "wire in a tube" which permits the transmission of frequency bands a million cycles wide, and methods of reducing the band of frequencies required for a single voice channel without distorting the speech, may permit an almost limitless multiplication of inter-city-telephone circuits in the future. The American Telephone and Telegraph Company is considering the feasibility of laying a transatlantic coaxial cable after the war to supplement the existing radio channels. It would involve the use of repeater tubes designed to operate unattended for more than 20 years on the bed of the ocean.

Since the coaxial cable is also capable of accommodating the very wide range of frequencies required for television, it is possible that the post-war telephone user will not only talk to his girl in London, but also see her—and all over the same wire!

Thus, at the conclusion of our review of 25 years in the history of telephony, we find ourselves upon the threshold of another 25 years packed with staggering potentialities.

# RADIO COMMUNICATIONS

GORDON W. OLIVE
*Chief Engineer, Canadian Broadcasting Corporation, Montreal*

Perhaps the outstanding advance, to date, in the art of conducting warfare in World War II is in radio communication. It is significant that, through the use of radio location, the secret weapon which Britain had perfected prior to the outbreak of the Second World War, R.A.F. fighter planes were used to best advantage to repel the Luftwaffe and eventually control the air and win the air battle of Britain in 1940.

Twenty-five years ago, radio was referred to as wireless communication but, with the conclusion of the First World War, and with all wartime bans on radio operation removed, vacuum tube oscillators, developed for wartime use, rapidly replaced so-called spark transmitters. With the advent of the vacuum tube, the first practical use of radio communication was made for voice transmission.

### International Problems and Conventions

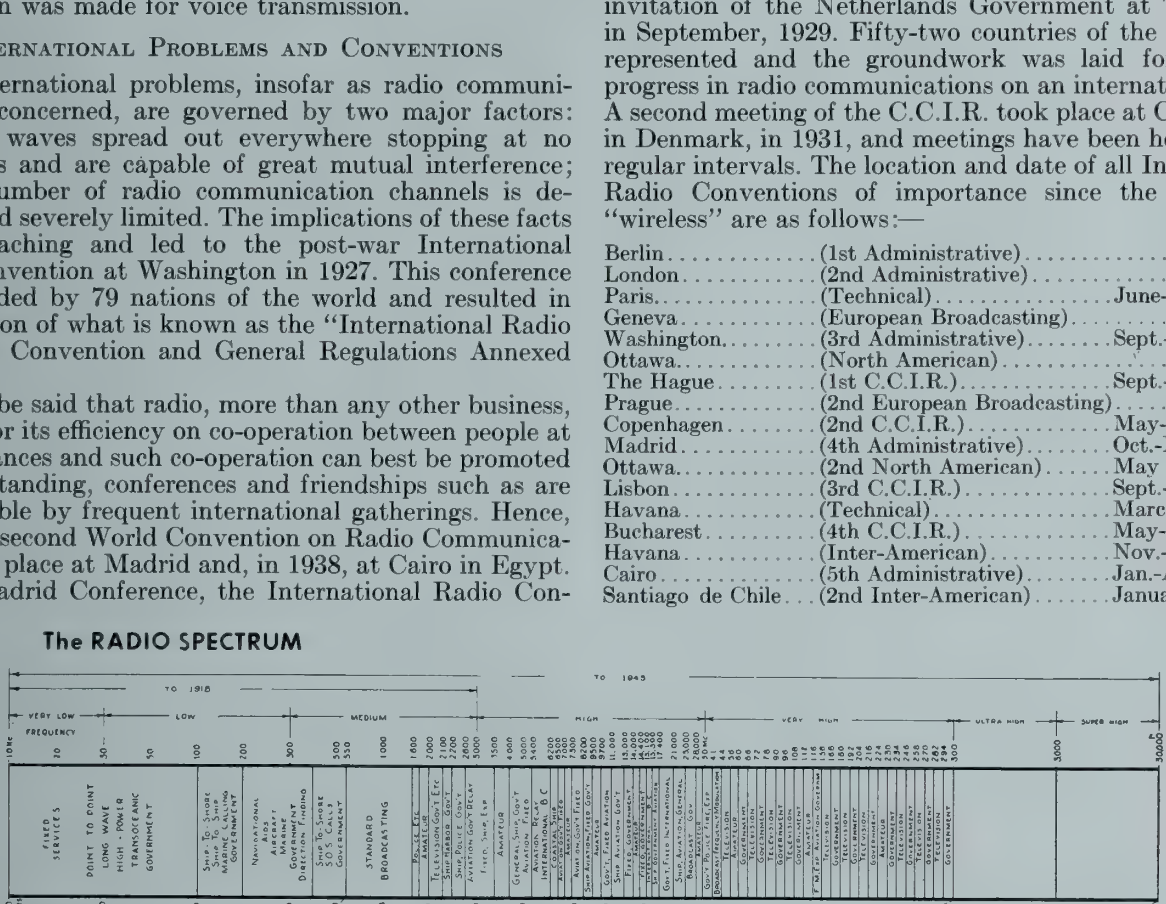
The international problems, insofar as radio communication is concerned, are governed by two major factors: (1) radio waves spread out everywhere stopping at no boundaries and are capable of great mutual interference; (2) the number of radio communication channels is definitely and severely limited. The implications of these facts are far-reaching and led to the post-war International Radio Convention at Washington in 1927. This conference was attended by 79 nations of the world and resulted in the adoption of what is known as the "International Radio Telegraph Convention and General Regulations Annexed Thereto."

It may be said that radio, more than any other business, depends for its efficiency on co-operation between people at great distances and such co-operation can best be promoted by understanding, conferences and friendships such as are only possible by frequent international gatherings. Hence, in 1932, a second World Convention on Radio Communications took place at Madrid and, in 1938, at Cairo in Egypt. At the Madrid Conference, the International Radio Convention Regulations were completely revised. These conventions are arranged through the Bureau of International Telecommunications' Union at Berne, Switzerland.

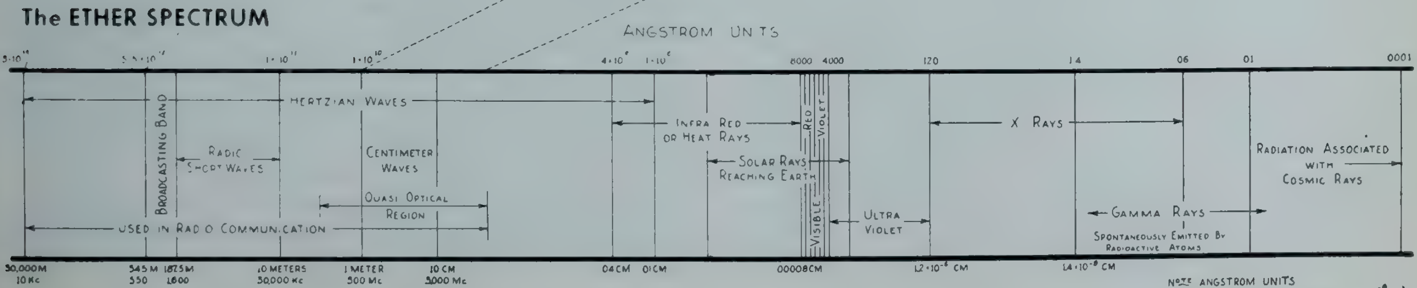
In order to keep up to date with the technical progress that was being made in radio, the 1927 International Convention provided for the establishment of a technical committee known as the International Technical Consulting Committee on Radio Communications, or the C.C.I.R. (Comité Consultatif International des Radiocommunications), to meet every two years to consider technical recommendations which would be consistent with technical progress made since the holding of the last world conference. This committee, which was organized following the Washington Conference in 1927, held its first meeting at the invitation of the Netherlands Government at The Hague in September, 1929. Fifty-two countries of the world were represented and the groundwork was laid for technical progress in radio communications on an international basis. A second meeting of the C.C.I.R. took place at Copenhagen in Denmark, in 1931, and meetings have been held since at regular intervals. The location and date of all International Radio Conventions of importance since the advent of "wireless" are as follows:—

| | | | |
|---|---|---|---|
| Berlin | (1st Administrative) | | 1906 |
| London | (2nd Administrative) | | 1912 |
| Paris | (Technical) | June-August | 1921 |
| Geneva | (European Broadcasting) | | 1927 |
| Washington | (3rd Administrative) | Sept.-Nov. | 1927 |
| Ottawa | (North American) | | 1929 |
| The Hague | (1st C.C.I.R.) | Sept.-Oct. | 1929 |
| Prague | (2nd European Broadcasting) | | 1929 |
| Copenhagen | (2nd C.C.I.R.) | May-June | 1931 |
| Madrid | (4th Administrative) | Oct.-Dec. | 1932 |
| Ottawa | (2nd North American) | May | 1934 |
| Lisbon | (3rd C.C.I.R.) | Sept.-Oct. | 1934 |
| Havana | (Technical) | March | 1937 |
| Bucharest | (4th C.C.I.R.) | May-June | 1937 |
| Havana | (Inter-American) | Nov.-Dec. | 1937 |
| Cairo | (5th Administrative) | Jan.-April | 1938 |
| Santiago de Chile | (2nd Inter-American) | January | 1940 |

**The RADIO SPECTRUM**




**The ETHER SPECTRUM**



It will be observed that of the 17 international meetings on radio from 1906, all but two of these have taken place since 1921.

The London Conference of 1912 was the effective international document until the Washington Convention of 1927. The long interval between these conventions was, of course, due to the First World War but the London Convention remained internationally effective during the whole period from 1912 to 1927.

### Canada and Great Britain

The history of radio communication in Canada is really the history of the development from the time of Marconi, for Canadians were keenly aware of the successful attempt to span the Atlantic made in 1901 between Poldhu in Cornwall, England, and St. John's, Newfoundland.

Quoting from a periodical of that time, we find the following prophetic comment in connection with Marconi's triumph:

> "When gas was introduced into the House of Parliament in London, members of the Parliament touched the pipes gingerly and marvelled that they were not hot.
>
> "When Morse sent his first telegraph message over the wire between Washington and Baltimore, people thought it incredible and were almost convinced that the final wonder was come.
>
> "The people of to-day are looking on an achievement as wonderful and perhaps as epoch-making as the discovery of gas or the discovery that electricity could be sent through wires for communication at a distance.
>
> "Marconi has proved electrical telegraphy not impossible without wires. This apparently cuts the practice of telegraphy from all its earthly bounds. The imagination can hardly conceive of the possibilities in store."

One of the earliest experimenters in radio communication was Sir Ernest Rutherford. In the year 1902, Ernest Rutherford, then a professor of physics at McGill University, Montreal, carried out successfully the transmission of signals by wireless to a moving train on the Grand Trunk Railway system between Montreal and Toronto. Nothing was done to adapt the science to transportation uses at that time. However, it seemed fitting that in the year 1923, the Canadian National Railways, of which the Grand Trunk was an important component, broadcast on December 31st of that year what was probably the first commercial network radio programme in the world, employing a radio network made up of Station CHYC owned by the Northern Electric Company in Montreal and Station OA in Ottawa, owned by the Ottawa Radio Association, using transmission facilities of the Bell Telephone Company of Canada.

Radio communication is a very wide field for it covers not only that which the layman is perhaps most familiar with—broadcasting for entertainment purposes—but also all other forms of electrical communication without the use of inter-connecting wires. During the past twenty-five years, radio communication has been supervised in Canada by the Radio Branch, Department of Marine and, in more recent years, by the same branch under a new Minister, i.e., the Department of Transport. In the United States, the same function is carried out by the Federal Communications Commission except that this body, since 1934, has supervised for the Government the operation of all communication facilities, radio and land line.

The Postmaster-General is the licensing authority for all radio transmitting and receiving stations in Great Britain and Northern Ireland. The principal services operated by the British Post Office may be classified under the following headings:

Ship-to-shore radio telegraphy.
Long-wave radio service.
Point-to-point radio telegraphy.
Point-to-point radio telephone services.
Radio telephone to ships.

In addition to these services, as the statutory authority for the control of radio telegraphy in Great Britain, the British Post Office has a close interest in broadcasting, the control and issue of licenses for radio transmitting and receiving, the investigation of complaints of interferences, etc. The B.B.C. like the Canadian Broadcasting Corporation with respect to the Radio Branch, Department of Transport, is separate from the Post Office and is governed by a Board appointed by the Government, and derives its revenue from broadcast license fees collected by the Post Office and from the sale of its B.B.C. periodicals.

In Canada, the Department of Transport, Radio Branch, besides acting as the controlling and licensing authority on behalf of the Government over radio communication, itself operates coastal and inland radio stations for direction finding and point-to-point communication. Other organizations in the Dominion which it licenses to operate radio facilities, both trasmitting and receiving, are the C.B.C. and private broadcasting stations, the Canadian Marconi Company, (which established a beam service from Canada to England in 1926 and to Australia in 1928), the various branches of the military forces, the municipal and provincial police and the Royal Canadian Mounted Police, the various transportation companies, railway, air and water, the radio broadcasting listeners and, in peace time, the radio amateurs. To accommodate all these radio communication services, the radio spectrum, i.e., the frequency bands from 10 kc. to 3000 megacycles or from 30,000 metres to 10 cm. is now divided as indicated in the figure on page 255.

It will be observed that the part of the ether spectrum occupied by the radio spectrum is indicated and then the radio spectrum is divided into the main division extending to-day from 10 kc. to 3000 megacycles in frequency or from 30,000 meters to 10 cm. in wavelength. Comparison is also made with the allocation some twenty-five years ago before the advent of voice or music transmission, when practically little commercial use was made of the high frequency end of the radio spectrum.

### Radio Broadcasting in Canada

Perhaps if we trace the development of radio broadcasting in Canada from its modest beginning, we might best indicate the developments in the art generally during the past twenty-five years. The important date to remember in connection with the development of radio broadcasting in Canada, besides the ones already mentioned, is the year 1929 when the Aird Commission had been appointed by the Government of Canada to look into the problem and to recommend how best the development and operation of radio broadcasting should take place in the Dominion. The report of this commission offered the first real attempt at a comprehensive plan to establish radio broadcasting communication on a national basis. It was not until the year 1932 that it was found possible, however, to follow up the recommendations of the Aird Commission by appointing a House of Commons Radio Committee to make recommendations to Parliament, and following the unanimous report of that committee, national control and operation of radio broadcasting were organized in 1933. Later, in 1936, based on the first experience with national ownership, further changes were made in the set-up and the Canadian Broadcasting Corporation came into existence on November 2nd of that year. An important change that took place on that date was the creation of a Board of Governors of the C.B.C. as distinct from management and operations. The board dealt with matters of policy affecting radio broadcasting generally in Canada and management dealt with the particular administration and operational problems of the C.B.C. An increase in the license fees also helped considerably to obtain the additional revenue required for expansion.

### The Royal Visit

Perhaps the most comprehensive test in the use of radio broadcasting facilities to cover an event of world-wide interest was the job assigned to the C.B.C. to cover the

Royal Visit in Canada in May and June, 1939. Many months before Their Majesties were due to arrive at Quebec city and to commence their six weeks' tour of Canada and the United States, preparations were going on so that adequate equipment and facilities would be available when required for all the thirty-three broadcasts that were scheduled to completely cover the historic event. The highlight of the Royal Visit was on Empire Day from Winnipeg, when the whole of the British Empire was linked up with that city for two-way broadcasting in the exchange of greetings around the world. This important event in the history of Canadian radio communication required the co-ordination and the use of the facilities of all the major communication companies of the Dominion and of the British and colonial broadcasting systems. In Canada, facilities of the Bell Telephone Company of Canada, Canadian National Telegraphs and Canadian Pacific Communications and of the Canadian Marconi Company were all employed, and the fact that the complete two-hour programme was carried throughout the world without a hitch was due to the excellent co-operation of all these organizations working with the C.B.C. and also through the excellent co-operation of the British Broadcasting Corporation, without whose valuable help the event would not have been possible. The B.B.C.'s high-powered shortwave transmitters, which had been developed from the modest beginning in 1932, were brought to the peak of efficiency for this event and guaranteed the satisfactory transmission and reception of the programme to all parts of the Empire.

With the intensive development and excellent provision of equipment that was made necessary for the Royal Visit broadcasts, the C.B.C. found itself in a splendid position to carry on its increased responsibilities at the outbreak of the Second World War, September 3rd, 1939. At that time two-thirds of the total power of broadcasting stations in Canada were owned outright by the Corporation and it was operating over forty hours of network broadcasting per day supplying programmes from its principal studios in Montreal, Toronto, Winnipeg, Vancouver and Halifax, and from the B.B.C. through the C.B.C.-owned shortwave receiving station in Ottawa and from the American networks.

### Wartime Operations of the C.B.C.

The wartime technical plans of the C.B.C. include the following major items:—

1. Conservation of equipment by every means possible to prolong the life of such items as vacuum tubes, condensers, transformers, moving parts, etc.
2. Provision of standby antenna and power supply units at vital points to ensure continuity of service.
3. Replacement of technical personnel required for wartime duties elsewhere by training of other temporary personnel not eligible for military service.
4. Help to other organizations such as the Department of Transport, Radio Branch, civilian emergency committees, Free French Forces, etc., in carrying out important wartime assignments.
5. Protection to vital C.B.C. plants against sabotage by provision of protective fences, floodlights, fire protection and the use of armed guards.

Of the actual work to assist in the war effort, apart from the normal technical operations, perhaps the most interesting is the assistance that was given to the Fighting French Forces in the establishment of vital communications overseas. Members of the C.B.C. Engineering Division spent considerable time abroad on initial plans of an important undertaking and the C.B.C. Engineering Division in Montreal was able to render vital assistance in the preparation of engineering plans including actual layout, mechanical and electrical drafting.

Because of its interest in radio interference matters generally, the C.B.C. has been assisting other Government departments in investigating interference with radio reception on tanks and other armoured vehicles as used by the Canadian Army. To protect the broadcasting network in areas that were considered vital and hazardous, radio links were established using frequency modulation transmission so as to by-pass physical circuits which might, in an emergency, not be available to the C.B.C. to carry on its operations. This work is proceeding.

### Post-War Radio Communications

What of the post-war years, when the effect of wartime necessity and secrecy will have been removed and radio communication will once again be mainly concerned with peace time pursuits and civilian needs? Perhaps the greatest change that we can foresee will be brought about by the introduction of frequency modulation transmission for point-to-point radio communication to replace wire lines and, through the use of the same medium, for broadcast entertainment purposes in urban centres.

One of the great difficulties to-day in the use of the medium wave broadcasting channels is that to accommodate all the broadcasting transmitters needed to give service, only 10 kc. separation can be permitted between stations. With the use of frequency modulation transmission for broadcast entertainment purposes, there immediately are opened up new channels in the ultra-high frequency bands which are necessary to accommodate the wide bands required for frequency modulation transmission (i.e., the bands between 30 and 300 megacycles). The very nature of radio transmission on these radio frequencies is such that an optical path is the limit of transmission, i.e., you can transmit as far as the horizon. For instance, a 1 kw. FM transmitter operating in the 40 megacycle band and with an antenna height of about 300 ft., might transmit 70 miles if the surrounding terrain is suitable. Inherent with FM transmission, is high fidelity response and practically no noise or interference. This medium, therefore, offers excellent radio broadcast reception in urban centres of population while, at the same time, the present broadcast band may be employed wholly for the use of high-powered broadcast transmitters of 50 kw. power or greater, each channel separated by 20 kc. instead of 10 kc. as at present to permit high fidelity reception in rural as well as in urban centres. As far as the listener is concerned in the post-war years the radio receiver might be of the push-button type capable of receiving equally well the present amplitude-modulated transmission in the medium-wave broadcast band and the new frequency-modulated transmission in the ultra-high shortwave band. The listener would simply push a button to get a particular station and would not be unudly concerned with just how the transmission was being directed to his receiving set.

With such high fidelity reception there would then be the need for improvement in network transmission. Physical programme circuits linking up broadcast centres across the Dominion would have to be capable of much wider band transmission than at present and in some locations it might be found more economical to operate radio point-to-point links through the use of FM instead of the physical circuits commonly employed to-day. The next step after the introduction of FM transmission would be the use of television applied at first on an experimental basis. In a country like Canada, of great distances and limited population, the one factor in delaying the introduction of television to the whole population will be that of cost. Of the wartime developments and improvements in radio communication, we can only know with certainty that with the coming of victory for the United Nations' cause, will also come the benefits to peaceful pursuits of such important applications as radio location and other radio communication devices now employed by our fighting forces.

One wartime radio communication development for Canada which can be mentioned here is the establishment of a high-powered international shortwave broadcasting centre at Sackville, N.B. It is expected that this new development will be operating sometime in 1944 to carry the radio voice of Canada to the far corners of the world.

# WARTIME TRAFFIC

N. B. WALTON
*Executive Vice-President, in charge of Operation, Maintenance and Construction, Canadian National Railways, Montreal*

While not primarily designed as strategic lines, the routes of the Canadian National Railways system are admirably located to serve the war effort of Canada and the United Nations and they have been doing so since September, 1939. Possessing 23,600 miles of road, the largest rail mileage in North America, serving all deep water ports in Canada, with international connections and many miles of track reaching a score of important industrial centres in the United States, the Canadian National Railways are well located to answer the demands of wartime emergency.

Eastern lines now within the system did a big transport job beginning in August 1914, and continuing until the last of Canadian overseas troops had been returned to the Dominion in 1919. From September 1939 to this date these lines have given similar service on much larger scale. During 1914-1918, from interior points to the seaboard, these eastern lines carried on 1,191 special trains and by regular trains, 813,998 military passengers. These totals have been greatly exceeded—more than twofold—during the forty-three months of the present war.

**The latest type of hospital car in service on Canadian railways can accommodate twenty-eight bed cases.**

To illustrate the war task imposed on the system these figures will serve: in 1938, the pre-war year, 10,289,000 passengers of all categories were carried; in 1942, the total had risen to 30,363,000.

Military passenger traffic is vitally important, and in addition armies need munitions and supplies and civilians in war zones require food. Canada has an imperative duty to manufacture, produce and transport supplies and food. As an example of the growth of wartime freight traffic these figures are presented: in 1938, Canadian National Railways carried 40,577,666 tons of freight; in 1942, the total freight transported amounted to 71,545,000 tons, which constituted an all-time record.

To deal with such an immense tonnage, large fleets of locomotives and freight cars are essential. It may appear surprising to learn that in 1943 the Canadian National Railways have in operation fewer locomotives and less freight cars than in 1938 when a smaller volume of freight was transported. In 1943, the company has in use approximately 2,500 locomotives of all classifications and just over 90,000 freight cars. In 1938, the system employed an additional hundred locomotives and approximately 2,000 more freight cars. The answer to the problem is to be found in the increasing daily mileage made by cars and locomotives in 1943, in the greater tonnage of the average freight train, and in the larger tonnage of freight loaded into the average car. By stepping up the locomotive maintenance programme, the equivalent of 264 additional locomotives was obtained. Similarly, an increase in the serviceability ratio improved the freight car situation by 3,900 units.

The additional passenger traffic was handled by increasing the number of trains, the length of trains, the daily mileage made by cars, and the passenger car load.

In passenger traffic, a new service has been established requiring the daily transportation to and from war plants of well over 20,000 workers, actually an industrial commutation service. To obtain equipment for these special trains a considerable number of units were salvaged and redesigned by mechanical engineers of the Canadian National. By removing the conventional seats and preparing a new interior plan with seating along the sides and a row down the middle, the capacity of these cars was increased to 126 passengers. Some of the units to be reconditioned for this purpose include the mountain observation cars formerly employed between Jasper and Kamloops to allow passengers on the transcontinental main line a clearer view of the Rockies. These cars are in service every day rolling to and from important war plants in Quebec and Ontario.

By far the greater part of present day passenger traffic is due to war work. Quite apart from the large number of military passengers travelling daily, a considerable number of civilians move on business directly concerned with the country's war effort. This includes movements of large groups of workers being sent to special war projects under construction or for the additional manning of plants already in operation. In this connection large numbers of men, military and civilian, employed during the construction of the Alaska-Canada highway were moved from distant centres over the Canadian National Railways. During the same period a very heavy tonnage of machinery and material required for construction work also moved over the National Railways

Much of the freight handled by the system every day is rather of the "secret and confidential" character and may not be particularized. However, there is no special secret in the fact that the company does handle a great deal of interesting war material including tanks, planes, shells, and even light craft built inland and designed for coastal service. Travellers who use important main lines have seen stacks of cases at yards and close observers note that the character of these great piles changes frequently. These are goods assembled along the railway awaiting the gathering of ships for a convoy. When the ships are ready, thousands of tons of these goods begin their journey to the seaboard to be laden on ships for the ocean crossing.

During the pre-war years the roadbed and bridge structures of the system were maintained at a satisfactory standard, and in 1939, when it became evident that a crisis was approaching in Europe, measures were taken to strengthen and expand those sections of the line which experience in 1914-1918 had indicated would be called on to sustain heavier movements. Considerable stretches of passing tracks were lengthened, greatly speeding up movements over lines east of Montreal, and additions were made to yards in Quebec and the Maritimes, signal systems were enlarged, and, at the same time, a large tonnage of heavy rail was relaid in the important traffic areas of Ontario and Quebec. Shop facilities were increased at eastern points, coal docks enlarged and later a system of lighters was established at an eastern port to assist in the quick transfer of cargo between land and ships.

After the outbreak of war, it was necessary to provide spurs and sidings to accommodate war plants and Royal Canadian Air Force fields and stations. To the first quarter of 1943, such additions have required the construction of well over 200 miles of track.

For security reasons it is not permissible to give details of this special work which has a direct bearing on the nation's war effort. To the close of 1941, expenditure on this account amounted to approximately $10,000,000 and since then that sum has been substantially increased.

To deal with the traffic situation imposed by the war, it was necessary for the Canadian National system to design and provide a considerable number of units of special equipment for military passengers. Probably, the most widely known of these special types is the commissary kitchen car used in special troop trains. In the new order of things, quantities of food are carried in these cars and cooked therein, but meals are served to the men of the armed forces in the cars to which they have been assigned. Orderlies come from the troop cars and carry the food to their fellow soldiers, one kitchen car being capable of serving 600 individuals at each meal. Some of the cooking is done by taking steam from the trainline. A type of steamer installed on these kitchen cars can cook at one time all the potatoes required by a train load of troops.

A new type of dining car was also developed for use where smaller numbers of men are travelling. This is a "long table" diner, with two tables running the length of the dining-room, permitting waiters to serve from the centre of the car. These tables seat 54 men, instead of the regular diner capacity of 30 to 36.

War conditions which added considerably to the volume of passenger traffic on many lines, led to the production of a new style of café car, popularly called a coffee-shop on wheels. This car has its kitchen in the centre with a dining room at each end, patrons being seated on settees at the sides of the car, 40 being accommodated at one sitting. The coffee-shop specializes in "plate" meals so that a larger number of passengers may be served in less time than when the standard diner is in use.

For entirely different service, the company has co-operated with the Department of National Defence in the design and fitting out of hospital cars. The first unit of this character was placed in service in July 1940, after inspection by the Royal Canadian Army Medical Corps. In this car, berths were removed to be replaced by hospital cots so that serious cases could be handled conveniently. This type of car was planned to form the medical centre of a train carrying casualties from seaboard to inland points.

In November 1941, the Medical Department of the Canadian National Railways again co-operated with the Royal Canadian Army Medical Corps to design a slightly different type of hospital car accommodating twenty-eight bed cases.

As direct contributions to the country's war effort, two special responsibilities were accepted by the Canadian National Railways. One was the establishment of a plant for the manufacture of munitions; the other the enlargement of an existing dry dock and shipyard to allow for the construction of the type of cargo ships needed for the United Nations sea transport.

The manufacturing plant was organized as National Railways Munitions Limited, a Crown plant operated by the subsidiary company for the manufacture of naval guns and field artillery mounts. A complete new structure was erected on railway property at Montreal, the location being selected to make full use of existing facilities for drainage, steam, water and power, and, at the same time, take advantage of the protection afforded by the enclosures already built for other railway structures. The shop measures 505 by 513 ft. and is laid out in eight longitudinal bays, varying in width from 61 to 66 ft. the design following closely the neighbouring locomotive erection shops. Foundations and walls to a height of 5 ft. above the ground are of reinforced concrete with brick walls above. The frame is of structural steel and the roof of laminated timber construction. Ample light is provided from wall windows, skylights and monitor sash. Glass in the walls measures 33,000 sq. ft., or 25 per cent of the total, the skylight glass measures 64,000 sq. ft., nearly 25 per cent of the total roof area. As the shop will ultimately be used as a car repair shop, the design is in accordance with railway requirements.

The first contract undertaken at the National Railways Munitions plant was for naval guns and when that order was completed the plant received another important order for a naval gun of larger calibre.

Another contract awarded to the plant was for the manufacture of field artillery mounts and at present the workers are busy with guns and mounts.

When the enterprise was started, none of the mechanical staff of the railway had any experience in the classes of work which had been undertaken. A nucleus of trained machinists was obtained from the National Railways locomotive shops at Montreal and Stratford. In turn, they imparted their knowledge to newcomers and in time a complete working staff of one thousand individuals was in active service. A large proportion of these workers are women trained on the premises for the special tasks at which they are employed.

The other unusual enterprise undertaken by the Canadian National Railways was a shipbuilding contract. Long before the outbreak of war, the company operated a drydock on the Pacific Coast and, when war came, the plant immediately gained in national importance. The first work undertaken was the repair and equipment of naval vessels. Then the construction of minesweepers was commenced and, after that, the yard had developed to such an extent that ways were erected to build cargo ships up to 10,000 tons. To date a large amount of tonnage has been launched and is now in service. The Canadian National is the only railway in North America which operates a shipbuilding yard.

Every day finds 100,000 freight cars on the line, those of the Canadian National system and cars which have reached the lines from other railway connections. To keep the freight and passenger trains moving on the Canadian National system requires the services of 94,000 workers—equivalent to six army divisions.

During this winter, Canadian railroaders have been called on to work under unusual conditions, the winter of 1942-1943 being exceptionally severe. For two and a half months, from mid-December to the close of February, the operating forces have faced everything that a so-called "old-fashioned" Canadian winter represents, excessive cold, heavy snow, rain, sleet and high winds. One item alone would paralyze operation if not promptly dealt with, that was the crashing of more than 1,500 poles in the Central Region of the Canadian National with the consequent disruption of thousands of miles of dispatching and commercial wires. Rain and sleet coated poles and wires and high winds came along to finish the job bringing sub-zero temperatures at the same time. That emergency was met. During that same period the snowfall was heavier than for many years previous. This will be appreciated when it is noted that on the Canadian National system, snow plow miles in January 1942 totalled 61,585, and in January 1943 rose to 185,467 miles, an increase of over 200 per cent.

# RAILWAY TRANSPORTATION

J. E. ARMSTRONG, M.E.I.C.
*Chief Engineer, Canadian Pacific Railway Company, Montreal*

The railways of Canada are of relatively recent origin, the oldest having been built little more than 100 years ago. Natural waterways were the original arteries of commerce, and highways were initially tributary or supplementary to them. The first railways were merely advantageous substitutes for highways, and, like the first highways, were tributary or supplementary to waterways.

**Fig. 1. Large freight locomotive of 1939**

The "Company of the Proprietors of the Champlain and St. Lawrence Railroad" was incorporated under the statutes of Lower Canada in 1832 to build a railway from Dorchester (now St. Johns, Que.) on the Richelieu river to a point on the St. Lawrence river opposite the city of Montreal. This railway line, some sixteen miles in length, was the first in Canada, and was opened for traffic in 1836, essentially as a portage link in the water route between New York and the St. Lawrence river.

The locomotive first used on this line, although a primitive engine, was adequate for its purpose.

*The Engineering Journal* commenced publication in 1918, only 82 years after the opening of the Champlain and St. Lawrence Railroad. At that time Canada was in the midst of a World War, and the railways of Canada had advanced far beyond the stage of being ancillary to waterways. They were the major arteries of transportation, and transportation was a vital element in Canada's war effort. Their development prior to the turn of the century had been gradual but persistent, and after the turn of the century had been very rapid.

The Grand Trunk Railway Company of Canada was incorporated in 1852 to build a line from Toronto to Montreal. Prior to 1867, railways had been built in Nova Scotia and New Brunswick under colonial government auspices, but under the British North America Act the Dominion Government acquired all of these lines and assumed responsibility for their extension into an Intercolonial Railway System. The Canadian Pacific Railway Company was incorporated in 1881 to implement the undertaking of the Dominion Government to build a railway connecting the seaboard of British Columbia with the railways of Canada, this being one of the conditions under which British Columbia, in 1871, had agreed to become a part of Canada. The Canadian Northern Railway was incorporated in 1899 as an amalgamation of the Winnipeg Great Northern Railway Company and the Lake Manitoba Railway and Canal Company. From its inception each of these railways continued to grow by construction and by acquisition of other lines.

In 1900, the railways of Canada may be said in broad terms to have consisted of the government-owned Intercolonial Railway, principally in the Maritime Provinces, the privately-owned Grand Trunk Railway in eastern Canada, the privately-owned Canadian Northern Railway in western Canada, and the privately-owned transcontinental Canadian Pacific Railway.

With the turn of the century the success of the Canadian Pacific Railway inspired the other two privately-owned railways each to endeavour to develop itself into a transcontinental railway. Toward this end the Grand Trunk Railway undertook the construction of the Grand Trunk Pacific Railway from Winnipeg to the Pacific Coast, and the Grand Trunk Pacific Railway undertook to lease from the Government the Transcontinental Railway which at the same time was being built by the Government between Moncton and Winnipeg. The development of the Canadian Northern Railway took the form of extensions both to the Pacific Coast and eastward.

The decade of railway construction, which was brought to a close by the depression immediately preceding the war of 1914-18, was a drain upon the finances of the railways which participated in it. This drain, followed by the many months of light traffic and reduced earnings during the pre-war depression and the early part of the war, placed the Canadian Northern Railway and the Grand Trunk Railway in a precarious financial position.

Commencing in 1916, railway traffic arising out of the war developed very rapidly. By 1918, the railways of Canada were handling a record-breaking business which overtaxed their separate capacities, and their operation was being directed, in effect as a single entity, by the Canadian Railway War Board, which had been created to deal with this situation. In 1918, they had a total of approximately 38,900 miles of line and gross operating revenues of over $330,000,000.

In the period between 1836 and 1918, great strides had been made in all matters having to do with railways. 1918 and the immediately preceding and following years were critical ones in Canadian railway history. In 1917, the Canadian Northern had found itself unable to carry on and was taken over by the Dominion Government, which by so doing sought to protect its financial commitments in that railway. The Grand Trunk Pacific Railway had found itself unable to carry out its undertaking to lease the National Transcontinental Railway, and the Dominion Government retained control of that railway. In 1919, the Grand Trunk Pacific Railway notified the Dominion Government that it would be unable to carry on, and in the same year the Grand Trunk Railway, for the same reasons, came to an agreement with the Dominion Government for its acquisition of their property. The Dominion Government decided against permitting these railways to pass into receivership, and as an alternative took over the operation of the Grand Trunk Pacific Railway in 1919, and of the Grand Trunk Railway in 1920. Subsequently, their purchase was completed on terms determined by arbitration.

In 1919, the Canadian National Railway Company was incorporated to operate and manage a national system of railways, including the Canadian Government Railways and the Canadian Northern Railway. In 1923, the Grand Trunk Railway and its subsidiary the Grand Trunk Pacific Railway were amalgamated in the Canadian National Railways. It may therefore be broadly stated that five years after the close of the war of 1914-18 there remained in Canada one privately-owned transcontinental railway, the Canadian Pacific Railway, and one government-owned transcontinental railway, the Canadian National Railways.

Fig. 2. Freight locomotive of 1918

The post-war depression was followed by the boom days of the so-called New Era during which railway improvements and extensions were again accelerated. During this period the extensions were chiefly branch lines to act as feeders for the existing transcontinental lines. Extensive development ended soon after the close of the New Era in 1929, but intensive development was uninterrupted. In 1928, the record year up to that time, the Canadian railways had approximately 40,700 miles of line, and gross operating revenues of almost $564,000,000.

For the Canadian railways the depression which followed the New Era reached its nadir in 1933, at which time they had a total of just under 42,500 miles of line, and gross operating revenues of slightly over $270,000,000. This precipitous decline of more than 50 per cent in revenue from the peak of five years before reduced the revenues to a point substantially below that of 1918. The recovery was slow and somewhat intermittent.

The ten depression years from 1930 to 1939, concurrent with drought conditions in western Canada, severely affected the railways, but throughout that period they maintained and improved their properties and services, and discovered means of doing so for less expenditure of dollars and man-hours than ever before. Had they been unable to accomplish this the record of Canada's war effort during the present war would not have been possible.

In 1939, which may be regarded as the most recent year in which the railways were not affected by war traffic, they had approximately 42,700 miles of line, and their gross operating revenues had recovered to just over $367,000,000, only slightly more than they had been in 1918, and still very much less than they had been in 1928.

The large freight locomotive of 1918, shown in Fig. 2 was a little over 71 ft. long, weighed approximately 438,000 lb., and could exert a tractive effort of 54,000 lb. The large freight locomotive of 1939, shown in Fig. 1 was a little over 98 ft. long, weighed approximately 750,000 lb., and could exert a tractive effort of 77,200 lb. without the help of the booster, and with the booster in operation could exert a tractive effort of 89,200 lb. This improvement in motive power is symbolic of the general improvement of the Canadian railways during that interval of 21 years.

Since 1939, the railways have been progressively more and more restricted in the use of manpower and materials. Locomotives of any new type have been unobtainable, and the few locomotives of existing types which could be purchased have been barely sufficient in number to compensate for retirements. Similar restrictions have operated in regard to all railway materials so that it has been necessary for the railways to carry the enormous increase in traffic due to the war with little if any increase in facilities. By intensive use of existing facilities they have done so in a manner generally satisfactory to their patrons.

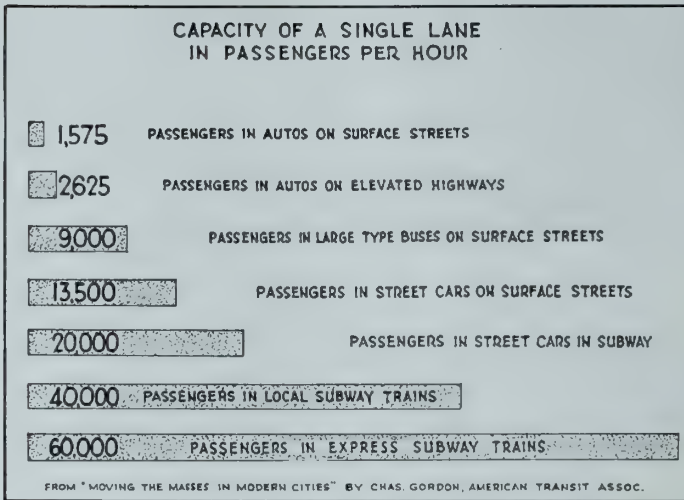
During 1942, with slightly less than 42,600 miles of line, the gross operating revenues of the railways of Canada, with December earnings estimated, amounted to over $650,000,000.

Gross operating revenue as an index of the volume of service rendered is to some substantial extent misleading because of the fact that both passenger fares and freight rates were lower in 1942 than in either 1918 or 1928. While gross earnings indicate an increase in railway business of approximately 100 per cent between 1918 and 1942, and approximately 15 per cent between 1928 and 1942, the actual increase in services rendered by the railways were substantially more than these percentages indicate.

An industry which, after ten years of most serious depression, and without substantial increase in fixed property or equipment, is able to handle in three years an increase of approximately 80 per cent in traffic, and in the third year handle over 15 per cent more than in its previous record year, which came toward the end of a period of prosperity, cannot be regarded as an industry which was unprepared for eventualities when the present war commened in 1939.

# URBAN TRANSPORTATION

A. DUPERRON, M.E.I.C.
*Assistant General Manager, Montreal Tramways Company*
*President, Canadian Transit Association*




In 1937, the author had the privilege of writing an article on urban transportation for the special number of *The Engineering Journal* published on the occasion of the semicentennial anniversary of the Institute. This article covered the development of the industry during the past 50 years. The present article, for the issue commemorating the 25th anniversary of the foundation of *The Engineering Journal* deals with the progress of the last twenty-five years. Discussion will be confined to the general principles of urban transportation, with special reference to wartime conditions. For additional information, the reader may refer to the article published in 1937.

In 1918, there existed but one method of urban surface transportation: the electric railway. To serve municipalities of relatively small population, or outlying districts of large cities where density of traffic was low, many miles of trackwork and electric lines had to be installed, entailing large capital investment and high cost of maintenance for a relatively small amount of traffic. There was therefore a need for a system which would not require the spending of large sums of money in places where the number of passengers did not economically warrant such an expense. The autobus and trolley bus have since filled this very important need.

To-day, three different modes of urban transportation are available on surface lines: the street car, the trolley bus and the autobus. Each has a definite place, depending upon the density of traffic and local conditions.

In large cities the street railways are still the backbone of transportation. Due to their large carrying capacity, street cars can move more passengers with less street occupancy than any other type of vehicles. To replace one street car it is necessary to use 1½ autobuses of the larger type or two of medium capacity. In main arteries of large cities, tramways are operated on headways as low as 25 seconds. Most of these streets can accommodate only four lanes of traffic, two in each direction, and are now taxed to capacity. The remedy to the acute problem of traffic cannot be found, as is sometimes proposed, in the substitution of buses for street cars, because the former take up much more of the street space which is already too small.

One thing has not changed during the last twenty-five years: the width of existing streets in the central districts of large cities. Most streets were built over fifty years ago, when transportation was furnished by horse-drawn vehicles. It is not necessary to describe the conditions of to-day's traffic, as they are well known to every one. Cities have grown to giant proportions, but the old streets have still to be used.

It is interesting to note that on the American Continent, in all cities having a population of 500,000 and over, 70 per cent of the passengers are carried by street cars. In fact, in all of its large cities where there is no subway, e.g., Chicago, Los Angeles, Montreal, Toronto, Cleveland, Baltimore, Pittsburgh, St. Louis, the proportion of passengers carried by street cars varies from 75 to 90 per cent. New York is often cited as an example of successful replacement of street cars by buses, but it must be noted that 66 per cent of the passengers are carried by the subway system. If New York did not have subways, there could be no question of carrying its people in buses only.

There is a special difficulty which public transportation companies have to face in Canada, and that is conditions in winter. It is a well established fact that, during heavy snow storms, street railway service is not interrupted, when autobuses often have to suspend operation. This is due to the fact that transit companies, with their plows and sweepers moving on rails, keep the tracks free of snow. There are also days in winter when, on account of rain, the streets become so slippery that autobuses cannot operate. Due consideration has to be given to these facts in deciding upon the different modes of transportation serving large cities.

Apart from the above, one must also take the economic point of view. Evidently, the density of traffic must be high enough to justify the capital cost of the construction and maintenance of tracks, trolley lines, feeders and substations for street cars. When this condition is not fulfilled, as a general rule, trolley buses or autobuses should be used.

Modern trolley buses were first used in Canada in 1937. The body and chassis of a trolley bus is that of an ordinary gasoline bus, but the vehicle is driven by an electric motor taking its current from a positive trolley wire like that of a street car. As there are no rails to serve as a return conductor, there must be a second trolley wire, and consequently trolley buses are equipped with two trolley poles. Such a bus can move freely right and left to a distance of about 12 ft. each side of the trolley wires, and on streets of ordinary width it can, therefore, move as freely as an ordinary gasoline bus and draw to the curb to load and unload passengers.

These vehicles are economical when headways are sufficiently short to distribute the cost of the trolley line, feeders and substations over a large number of bus miles. They have their place for medium traffic in streets where there is no objection to the erection of poles and trolley wires. The disadvantage of the trolley bus is that its route cannot be altered. In this respect, the gasoline bus has a decided advantage.

Certainly the most important change in urban transportation during the past twenty-five years has been the use of gasoline and Diesel engine buses.

The first autobuses appeared in 1920, but it was not until 1925 that the development of this vehicle had reached a point where it could be used with real advantage. Its growth has been both rapid and remarkable. At first, the motor was placed in the front as in automobiles. As the capacity of the buses increased, the engine became quite large and it was realized that the space it occupied was wasted as far as floor area was concerned. A radical change was then effected when the body and chassis were built integral as one unit, and the engine located underneath the floor or transversely at the rear of the bus. Buses of larger carrying capacity could then be built and the street occupancy per passenger reduced accordingly. It has been found, however, that for economic and structural reasons, the size of buses is limited to approximately 40-seat capacity.

The great advantage of autobus service is that it only requires the purchase of the vehicle and the construction of the garage for storage and repairs. However, the average life of an autobus is much shorter than that of a street car and its maintenance and operation more costly.

As mentioned previously, autobuses are used where the density of traffic does not justify the capital expense required by tramways. In large cities, they are used as feeder lines to the main tramway system. They are especially suitable for use in less populated sections, in residential areas and in newly developed districts.

A well-balanced surface transportation system in a large city therefore includes street cars and trolley buses or autobuses, each fulfilling its proper function, due weight being given to climatic and topographical conditions. Complete change-over from street cars to buses cannot usually be made at one time without causing a waste of money; on the contrary, it should be gradual and spread over a number of years. Each route so changed should be the subject of a special economic study.

During the last fifteen years, many small and medium sized cities have entirely substituted buses for street cars where the population and local conditions did not justify the continuance of street car service. In a number of these cases, tramway tracks and street cars had not been properly maintained and the property was in such a state that the change had to be made in one operation. It is not possible to state a definite figure of population below which a tramway service cannot be justified economically. Each city has its own special problems in this respect.

### Rapid Transit

It may be of interest to say a few words about rapid transit. When a city has become so large that surface transportation can no longer meet the needs of the population, it becomes necessary to resort to some form of rapid transit, which in the central district usually takes the form of subways. The construction of subways, however, is so expensive that it cannot be financed by private enterprise alone, because the fare required to meet the fixed charges on capital investment plus the cost of operation would be so high as to be prohibitive. I do not know of any subway that pays its cost of operation and fixed charges with the fares collected, so the deficit has to be met by general taxation. It would be totally unfair to place the full burden of the cost of underground rapid transit on the passengers alone. By putting mass transportation underground, the streets are relieved for the balance of traffic, thereby benefitting the public as a whole. Subways provide additional street space without widening the streets in areas where land values and existing structures prevent street widening.

On the North American continent only New York, Chicago, Philadelphia and Boston have subways. In Chicago, in spite of its four million population, the first subway was built only recently, (its operation was commenced in March of this year), and it was built partly with money loaned by the Government.

In Canada, there are as yet no subways, although studies have been made for Montreal and Toronto. Can they be built as post-war works? It would be very desirable, for the congestion of traffic in the central districts of these two large cities has reached a point where relief is urgently needed.

### Fares

If we examine the fares in force since 1918, it is seen that they increased from 1918 to 1922 but since then have remained practically at the same level. Street car transportation is therefore one of the few commodities which has not become more expensive during the last twenty years. This is in spite of the fact that the cost of labour, material and equipment of all sorts has considerably increased. It must also be noted that during the last twenty-five years, large cities have grown very rapidly and their population has moved toward the outlying districts; many suburban municipalities have also been developed. Transit passengers to-day must travel far greater distances to go to and from their work than they did before, with the result that the cost of transportation per person has risen.

### Wartime Transportation

To-day, transit companies have to face tremendous difficulties due to wartime conditions. War started in 1939, following a very severe business depression. The industrial war effort of our country, taking into account its population, is surpassed by none. As mass transportation is a true barometer of the trend of business activities, the number of passengers has increased accordingly. The following table shows the number of revenue passengers carried in typical Canadian cities in 1939 and in 1942:

| | 1939 | 1942 | Percentage of Increase |
|---|---|---|---|
| Vancouver, B.C. | 62,048,000 | 89,355,000 | 44% |
| Hamilton, Ont. | 15,565,000 | 29,675,000 | 91% |
| London, Ont. | 8,909,000 | 14,750,000 | 65% |
| Montreal, P.Q. | 208,928,000 | 319,398,000 | 53% |
| Halifax, N.S. | 9,627,000 | 24,396,000 | 153% |
| Ottawa, Ont | 21,138,000 | 42,294,000 | 100% |
| Quebec, P.Q. | 16,980,000 | 28,936,000 | 70% |
| Toronto, Ont. | 154,090,000 | 238,992,000 | 55% |
| Winnipeg, Man. | 41,640,000 | 61,696,000 | 48% |

The following methods are available to meet these abnormal increases:

1. By adding to the rolling equipment.
2. By increasing the speed of operation.
3. By staggering the hours of work.

With regard to additional rolling stock, orders for street cars and buses were placed by transit companies immediately following the outbreak of war. Most of such equipment had to be obtained from the United States and paid for in American funds. The Canadian Government at that time had great difficulty in maintaining the exchange at a reasonable level and was very reluctant to transfer large sums of money to the United States. The result was that only a limited amount of equipment was obtained.

Conditions became worse when the United States declared war, as the number of transit vehicles manufactured was gradually reduced until now it is practically nil. The few buses and street cars now built are under the exclusive control of the United States Government, which allots the vehicles as it sees fit. The few vehicles Canadian companies can get from the United States Government are obtained through the Transit Controller for Canada, who, in turn, distributes them as he deems advisable.

A limited number of small buses manufactured in Canada were also obtained. While helping to relieve the situation, these cannot solve the problem.

One unforeseen development of the war was the shortage of rubber and gasoline. In compliance with a request of the Transit Controller, the use of autobus equipment was reduced to strictly essential services. Few changes were made during rush hours as all pieces of equipment were required at that time, but, outside of these hours, a number of bus lines operating within walking distance of street car lines were discontinued. In certain cases, abandoned street car lines, replaced before the war by bus lines, were resumed. It was fortunate that the bulk of passengers in large cities could be carried by street cars.

The speed of service was also increased. With a fixed number of vehicles, more people can be carried if these vehicles move faster. Numerous stops for loading and unloading passengers were abolished, and this policy is still being extended. Also, men were stationed at heavy transfer points to hasten the loading of passengers. Strict enforcement of no-parking regulations on main arteries of traffic was also applied. City authorities and transit companies were in many instances fortunate in having the support of newspapers, social clubs and public bodies, who urged the strict observance of traffic by-laws.

In addition to these measures, further steps were needed

*(Continued on page 316)*

# AIR TRANSPORTATION

J. A. WILSON, M.E.I.C.
*Director of Air Services, Department of Transport, Ottawa.*

The story of the gradual development of aviation in Canada from the earliest days to the end of 1936 was recorded in the special number of *The Engineering Journal* published in June, 1937, to celebrate the semi-centennial anniversary of the Institute. It is fitting that this story should be continued and brought up to date in this issue of the *Journal* which marks the celebration of its twenty-fifth anniversary. Progress in all phases of aeronautical activity was rapid but on normal lines during 1937, 1938 and 1939. The outbreak of war forced an immense expansion in every field; training, manufacturing, aerodrome and building construction, air transport operations, radio and other communications, meteorology, alike shared the new impetus. Aviation will emerge from the war immensely strengthened in all respects and at its conclusion Canada will be the fourth ranking air power in the world.


*Photo Trans-Canada Airlines*

**Administration building at the new Montreal Airport, Dorval, Que.**

A new chapter in the development of air transport opened towards the close of 1936 with the coming into force of the Department of Transport Act (November 2, 1936). This Act brought together, for the first time under one Minister of the Crown, all services in Canada having jurisdiction over transportation and communications. As air transportation develops, its dependence on radio aids to air navigation and meteorology increases each year. Under the new Department of Transport an "Air Services Branch" was formed to unite, under one Director, these three closely allied activities. Since its formation, the Air Services Branch has very fortunately remained under the able and energetic direction of the Honourable C. D. Howe, M.E.I.C., to whose vision and foresight Canada owes much of its progress in aviation, during his tenure of office, first as Minister of Transport and then as Minister of Munitions and Supply, retaining jurisdiction over the Air Services Branch.

### Air Legislation

Mr. Howe introduced, and passed through Parliament, the Department of Transport Act in the session of 1936, the Trans-Canada Air Lines Act in 1937, and the Transport Act 1938. These three Acts have placed air transport on a firm foundation for all time. The first provides a suitable organization in the Department of Transport for the administration of all phases of civil aeronautics. The second creates a national instrument for the operation of main line air transport services in Canada and international main line connections to other countries. The third provides, through the Board of Transport Commissioners, an independent judicial body to deal with air route licensing including adjudication on necessity and convenience, tariffs and other related matters, leaving regulation of the technical and safety factors to the Air Services Branch.

### Construction of the Trans-Canada Airway

In 1937, the tempo of construction on the airway, which had been proceeding intermittently for ten years, was stepped up and measures were taken to hasten its completion from coast to coast by providing, for the first time, funds adequate for a project of this magnitude. By the end of January 1938, the construction of the aerodromes between Winnipeg and Vancouver, radio ranges, field lighting and installation of other necessary facilities was sufficiently advanced to permit Trans-Canada Air Lines to begin their training programme. Regular air mail services were inaugurated over this section on March 6th, 1938, and, on April 1st, the complete services for mail, passengers and express were started.

Meanwhile the completion of the airway facilities on the long section of the airway between Winnipeg, Toronto and Montreal, through the rough and unsettled terrain of northern Ontario were being pressed so that a regular service connecting for the first time eastern and western Canada by air might be possible. Training and familiarization flights over this section commenced on September 7th, 1938. These were followed by mail and express services and finally on April 1st, 1939, the passenger service over the whole system west of Montreal was placed in regular operation.

On the section east of Montreal, the time-table was: January 1st, 1940, air mail service established between Montreal and Moncton; passenger service, February 15th, 1940. This service was extended to Halifax on April 16th, 1941, and to St. John's, Newfoundland, on May 1st, 1942.

This construction programme involved the enlargement, paving and lighting of all the principal airports. There are now 19 principal airports at which regular stops are made, 24 intermediate fields with ranges, and 42 emergency fields on the airway. Almost all of these are now in active use as part of the Joint Air Training Plan or for other defence purposes.

### Construction of the Northwest Airway

The possibilities of an airway connecting with the Trans-Canada system at Edmonton to give access to all parts of northwestern Canada and Alaska had long been realized. In 1935, a survey to determine the best route was made. The route over valleys of the Peace, Liard and Yukon rivers offered the best solution and, in 1937, a contract was let for a weekly airmail service, on skis in winter and floats in summer, from Edmonton to Whitehorse, Y.T., via Fort St. John, Fort Nelson and Lower Post so as to gain further knowledge of flying conditions at all seasons of the year. The results were so favourable that an airway survey of the route was authorized in the spring of 1939 to locate aerodromes and radio range sites at intervals of one hundred miles according to standard airway practice. The construction of an airway based on these surveys was recommended by the Joint Canadian-United States Board on Defence in November 1940. This recommendation was accepted and the Canadian Government authorized the Department of Transport to proceed with the construction on February 8th, 1941. Construction was far enough advanced by September 1, 1941, to permit of its being flown in daylight and good visibility, and by the end of 1941 the main bases and radio ranges were completed up to standard requirements. Since the entry of the United States into the war, this route has become of vital importance to the war effort of the United Nations, and its facilities have been greatly augmented. It gives direct access from the airway systems of Canada and of the United States by the shortest route through northern British Columbia and the Yukon to Fairbanks in the heart of Alaska. Its importance in the post-war period as the shortest route between the North American Continent and the Orient and Asia can readily be seen.

### Aerodrome Construction for the Commonwealth Training Plan

A detailed account of the co-operation between the Departments of National Defence for Air and Transport and the results of the first year's work on this programme will be found in *The Engineering Journal,* November 1940 issue. The Air Services Branch has continued and extended its work for the Department of National Defence for Air and is now authorized to construct on its behalf all aerodromes and allied facilities required, not only for the Air Training Plan but for all defence purposes. This has meant a great increase in work and responsibility. These activities are now Dominion wide (and include Newfoundland and Labrador as well). The projects number more than 200 and the cost of the programme now exceeds $150,000,000 and still increases. The Air Services Branch is responsible not only for the planning and construction of these aerodromes but for the selection of suitable sites, their purchase and survey, power and water supplies, radio range stations where necessary, telephone and teletype installations, highway connections, and all related work.

### Airport and Airway Control Systems

Increasing congestion on major airports due to war activities has made necessary the installations, in 1940, of a system for the efficient control of all air traffic within a radius of 20 miles of the principal airports. This was followed in 1942 by a similar demand for "airway" traffic control, to ensure the safety of the numerous aircraft en route over the system especially under conditions of poor visibility and at night. This links up with a similar control system in force in the United States. These control systems have necessitated the formation of a school for the training of traffic control officers and assistants for both classes of work. This school trains not only the civil staff but members of the R.C.A.F., including the Women's Division, as well. Fully manned airport traffic control towers, giving service 24 hours a day, are now installed at all major airports and the necessary land line phone connections are now being installed to give direct through connections between the airway traffic centres, with connections as necessary across the international boundary.

### Radio Aids to Air Navigation

The importance of radio in the operation of air transport services increases continually. The air administrations of Canada and the United States have followed a common policy in this, as in other airway facilities, such as airport planning, zoning, lighting, control systems, etc., so that there may be as far as is physically possible one system universally used throughout North America.

A chain of radio range stations now guides pilots from coast to coast. These stations are spaced at intervals of approximately 100 miles along the airway and give pilots a true indication of the proper course at all times and, in addition, a means by which he can bring his aircraft down through an overcast ceiling to a safe landing on an airport. For added safety, marker beacons and cone of silence markers have been added where necessary to afford the pilot additional assurance of his exact location on his course relative to an adjacent airport or radio range when he is flying "on instruments" in conditions of poor visibility. There are now 48 range stations on the trans-continental system and 15 serving other airways, while 17 more are projected.

All range stations are also weather observing stations and are interconnected by teletype. Each range transmits for the information of pilots the weather conditions at his station and the same information from other adjacent stations at 60 minute intervals. The major airline operators all have their own radio communication stations at the principal airports with frequencies allotted for their special use. Itinerant aircraft are also allotted special frequencies which are guarded at the main airports by Department of Transport operators. Congestion of the radio services had forced the introduction of land line connections for the transmission of weather, traffic and administration messages. In some districts, however, it has not been possible to extend these land lines and the whole burden of communications for all purposes rests on the radio service. Under such circumstances, the Department provides communication sets on long and short wave for intercommunication between airports, radio ranges and aircraft.

Airport traffic control is exercised by radio-phone. Special sets are installed in all control towers for this purpose to enable the control operator to communicate direct with the pilot. On the other hand, airway traffic is controlled by landline interphone between stations and the necessary information is relayed to pilots through the airport control radio. The modern airway communication set up is a complicated but closely integrated system using radio and land lines, voice and key each in its most efficient field.


**Map showing the routes of T.C.A. and other air lines.**

### Meteorological Services

Flying has revolutionized meteorological science. New methods of forecasting have been introduced and the collection and dissemination of weather information has been speeded up to a remarkable degree. Weather recognizes no political or physical frontiers. The ebb and flow of the atmosphere is world wide and the modern meteorologist must of necessity have a world outlook. Under existing war conditions, the free interchange of meteorological information has been greatly restricted. Canada fortunately is not so adversely affected as many other countries since weather reports are still available from all points on the North American Continent, the Aleutian and Arctic Islands, and for trans-Atlantic operations from Greenland, Iceland and the British Isles, which, together with a few reports from ships at sea on the Atlantic Ocean, provide a very large area from which regular reports are received. The prompt collection and dissemination of meteorological data over such a wide area requires skillful organization. Radio, teletype, phone and telegraph are all used in the work.

Scheduled airline operations call for a most intensive weather organization capable of accurate forecasting of the weather for all points on the airway system. Hourly sequence reports, giving the temperature, pressure, humidity, ceiling, visibility, wind strength and direction, are made by all main airports and radio range stations. These are made available to all aircraft operators. In addition, regular forecasts are issued at six-hour intervals by seven forecasting stations based on observations not only on the airways but from numerous stations established all over the Dominion. Many of these are quite inaccessible and stores, food and replacement personnel can only be supplied once a year. In such locations the weather reports must of necessity be made by radio.

To cope with war-time responsibilities, the Meteorological Service has trained a very large number of men and women for special work. These duties range all the way from those of highly trained physicists for forecasting work to the relatively simple duties of weather observing. This war work has included the organization of special forecast centres on both coasts for the Air Force and the Navy; the manning of all Air Force stations with a specially trained meteorological staff; the preparation of all text books on meteorology for the Joint Air Training Plan and the supply of personnel qualified to lecture on this subject; the establishment of radiosonde stations for the measurement of the pressure, temperature and humidity of the upper atmosphere up to very great heights which greatly improve the accuracy of forecasting.

The establishment of the R.C.A.F., R.A.F., and U.S.A. A.F. Ferry Commands has thrown extra burdens on this staff which is wholly responsible for all Canadian and trans-Atlantic forecasts. The staff has increased from 195 on September 30th, 1939, to 672 on January 31st, 1943, and the appropriations from three quarters of a million dollars in the fiscal year 1939-40 to nearly three million dollars in 1943-44.

The Meteorological Service of Canada is second to none and its rapid expansion to meet war-time requirements was only possible because its directing staff realized in advance the demands which would be made on it and took measures to meet the situation by training a number of scientists for its special requirements.

### Commercial Flying

The accompanying table illustrates clearly the steady growth of commercial air operations which still continue. Air mails increased from 1,450,473 lb. in 1937 to 5,415,117 in 1942, with a corresponding growth of revenue not only to the air operator but to the Post Office Department as well. Commercial freight fell from 24,317,610 to 12,224,028 lb. This decrease shows the lessening of mining and prospecting activity in northern Canada due to the war. This was the mainstay of many "bush" operators in peace time. It has been more than compensated for by the immense increase in freighting by air for military services, for which figures cannot yet be released. Passenger traffic rose from 141,158 to 235,860 and aircraft mileage from 10,755,524 to 12,986,590. The figures for licensed personnel show a corresponding increase; pilots, 1937, 1157; 1942, 1276; air engineers, 1937, 595; 1942, 944. The largest factor in this steady growth is Trans-Canada Air Lines.

### Trans-Canada Air Lines

The national system began its commercial operations in September, 1937, over the Vancouver-Seattle route, 122 miles long. About the same time it initiated its staff training programme. In January, 1938, T.C.A. had 71 employees and owned five Lockheed "Electra" planes, each carrying 10 passengers, pilot and co-pilot. At the close of 1942, the employees numbered 1,662. The company owns 12 Lockheed "14" and 12 "Lodestar" planes, each fitted with two 1200 hp. Pratt & Whitney "Twin-row Wasp" engines, which fly 22,670 miles a day or 8,250,000 miles a year.

The war has affected T.C.A.'s operations in many directions. Some of its most experienced employees have been released for military service and deferrment has only been requested from the National Selective Service Board for such employees as are essential to maintain the safe operation of the air line. To-day more than 30 per cent of the employees are women who are employed in many capacities.

The release of experienced personnel and the continued expansion of the company's operations has necessitated a large training programme for new entries. Classes for the training of pilots, dispatchers, stewardesses, radio operators, passenger agents and shop workers of all classes are in continuous operation. A large pilot training programme has been carried out for the R.C.A.F.; for the Department of Munitions and Supply a new engine and propeller overhaul plant has been built and is now operating on a three-shift basis; the instrument shop is working 24 hours a day chiefly on R.C.A.F. work; the company's facilities across Canada have been extensively used for the servicing of military aircraft; at Montreal about 300 skilled mechanics are continuously employed on maintenance and overhaul of the trans-Atlantic aircraft operated by British Overseas Airways Corporation; T.C.A. flight crews have been assigned to B.O.A.C. for overseas work; radio coverage, dispatch and station service are furnished to the R.C.A.F. Communications Squadron by arrangement with the Department of National Defence for Air; the company's engineering and flight staffs have given much assistance to the National Research Council and the R.C.A.F. in the study of icing conditions; in fact the war work of T.C.A. has covered the whole field of aircraft operation and maintenance from coast to coast.

Statistics for Commercial Flying

| Year | Reg'd Aircraft | Licensed Air Engineers | Licensed Pilots | | | | Aircraft mileage | No. of passengers carried | Lbs. of freight carried | Lbs. of mail carried |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Private | Commercial | Ltd. commercial | Transport | | | | |
| 1936 | ... | ... | 559 | 380 | 65 | 42 | 7,100,401 | .... | 22,947,105 | .... |
| 1937 | 604 | 595 | 635 | 320 | 129 | 73 | 10,755,524 | 141,158 | 24,317,610 | 1,450,473 |
| 1938 | 588 | 643 | 734 | 226 | 165 | 130 | 12,294,088 | 139,806 | 19,623,133 | 1,901,711 |
| 1939 | 488 | 722 | 795 | 166 | 191 | 147 | 10,969,271 | 161,503 | 19,379,700 | 1,900,347 |
| 1940 | 486 | 822 | 825 | 128 | 249 | 152 | 11,012,587 | 148,719 | 14,436,571 | 2,710,995 |
| 1941 | 440 | 832 | 760 | 77 | 322 | 158 | 12,481,741 | 205,577 | 16,545,756 | 3,388,634 |
| 1942 | 318 | 944 | 656 | 108 | 324 | 188 | 12,986,590 | 235,860 | 12,224,028 | 5,415,117 |

| Year | Air Mail (lb.) | Air Express (lb.) | Passengers | Miles Flown | Operating Revenue | Net Income |
|---|---|---|---|---|---|---|
| 1938 | 367,734 | 7,806 | 2,086 | 1,122,179 | $ 590,808.35 | $818,025.85 Def. |
| 1939 | 523,906 | 45,819 | 21,569 | 2,760,090 | 2,350,473.97 | 411,656.59 Def. |
| 1940 | 927,037 | 105,788 | 53,180 | 4,770,219 | 4,592,383.39 | 539,263.15 |
| 1941 | 1,389,614 | 173,192 | 85,154 | 6,384,651 | 5,807,794.03 | 302,436.79 |
| 1942 | 2,308,812 | 362,837 | 104,446 | 7,172,130 | 7,337,318.60 | 494,915.03 |

## Canadian Pacific Air Lines

The consolidation of the many independent commercial operators chiefly engaged in servicing the mining industry in northern Canada has been proceeding gradually for the past two years. The Canadian Pacific Air Lines now controls the operation of Canadian Airways Limited, Arrow Airways Limited, Ginger Coote Airways, Prairie Airways, Mackenzie Air Service, Yukon Southern Air Transport Limited, Dominion Skyways Limited, Quebec Airways, Wings Limited, Starratt Airways and Transportation Company.

The traffic statistics of all of these companies are embodied in the tables showing the total traffic for the years 1937-1942. The component companies of C.P.A. in 1942 flew approximately 5,300,000 miles, carried 60,000 passengers and 10,000,000 lb. of freight, express and mail. Their employees number 7,000. Ninety per cent of the company's business is now for war purposes—in the northwest for the important developments in these remote districts arising out of the joint defence programmes of Canada and the United States for the defence of northwestern Canada and Alaska; in the northeast in connection with the construction of plants for war industries and aerodromes. "Bush" services have been maintained in all important areas but the decline in gold mining has materially reduced this activity. This decline has been compensated for by the increased war-time search for essential war minerals.

To meet the increasing traffic, more efficient and larger twin-engined aircraft have been placed in operation on several routes replacing the former ski-float operations. Up to date air navigation facilities, including aerodromes, radio ranges, improved weather and communication services and lighting are also being installed so as to permit of all weather, night and day operation. Every effort is being made to bring such services up to main line standards as rapidly as possible.

The majority of the component operating companies had made contracts with the Department of National Defence for Air in 1940 for the operation of schools under the Combined Training Plan. C.P.A. now operates on a non-profit basis one elementary and six air observers schools under such contracts. The company also manages five aircraft and engine repair plants under contract with the Department of Munitions and Supply.

The Aerial Survey Division has been actively engaged throughout the period under review and, during 1942, 12,000 negatives were handled.

Although many of the principal operating companies have been absorbed by C.P.A., there still remain independent organizations in this field. Typical of these are Maritime Central Air Lines who operate a mail, passenger and express service between Moncton, Saint John, Summerside and Charlottetown, P.E.I.; the M & C Aviation Company who operate a licensed airmail, passenger and express service from Prince Albert to northern Saskatchewan points and, in addition, an engine and overhaul shop under contract with the Department of Munitions and Supply; Leavens Bros., who hold the contract for the winter airmail service to Pelee Island, operate charter services and an air observers school under contract with the Department of National Defence for Air; Northern Airways who operate a mail, passenger and express service under license between Carcross, Y.T., and Atlin, B.C., and charter services from these points; Austin Bros., who operate a charter service in northern Ontario.

The flying school operators who were fully employed up to the end of 1941 have been forced out of business in many cases since then owing to the restriction of the use of gasoline to essential war purposes, shortage of man-power and the concentration of flying training in the hands of the R.C.A.F. through the Combined Training Plan.

## The Flying Clubs

The Flying Clubs started in 1928 with the assistance of the Government to meet the urgent need for pilot training facilities and municipal airports, continued their activities on a constantly increasing scale till 1940.

In June 1939, the Department of National Defence entered into contracts with eight of the strongest clubs for the elementary training of a number of pilots for the R.C.A.F. On the outbreak of war this system was extended to cover all clubs.

In 1940, that Department entered into contracts with elementary training school companies sponsored and organized by the Flying Clubs for the elementary flying instruction of all pupils under the Commonwealth Air Training Plan. This system was subsequently extended to cover elementary flying training for the Royal Air Force schools in Canada. Nineteen such schools are now in operation. In most cases the normal work of the clubs close down with the opening of their sponsored school but in one or two of the larger cities the club activities were carried on to meet the need for pilots for the civil schools, ferry commands, and air operating companies.

In 1942, even these activities ceased with the need for the conservation of gasoline, man-power and equipment and the concentration of training activities for all services in the Combined Training Plan under the direction of the Department of National Defence for Air.

The Canadian Flying Clubs Association has continued to play a useful part in the co-ordination of these activities.

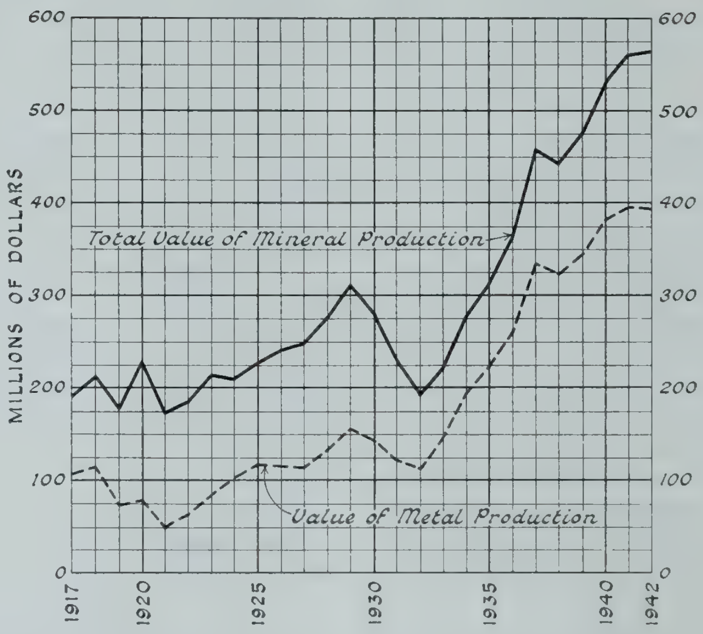
Flying Clubs Statistics

| Year | Membership | Aircraft in Use | Members under Instruction | Hours Flown Hrs. | Min. | Grants awarded for Pilots Private | Commercial | Renewal |
|---|---|---|---|---|---|---|---|---|
| 1936 | 2,492 | 66 | 645 | 17,324 | 01 | 222 | 32 | |
| 1937 | 2,798 | 67 | 608 | 20,943 | 12 | 258 | 69 | |
| 1938 | 2,773 | 66 | 825 | 20,910 | 34 | 231 | 51 | 80 |
| 1939 | 2,884 | 102 | 796 | 31,210 | 11 | 190 | 42 | 93 |
| 1940 | 1,576 | 46 | 389 | 43,519 | 23 | 190 | 59 | 60 |

# MINERAL INDUSTRIES

DR. CHARLES CAMSELL, C.M.G., M.E.I.C.
*Deputy Minister of Mines and Resources, Ottawa.*

The headway that Canada has made in the production of metals and minerals in the past quarter of a century is shown to excellent advantage in the accompanying chart. Commencing with 1917 when the total output reached a value of $190,000,000, it gives in broad outline the production history of the industry over a twenty-five-year period, ending with 1942, when the output reached a record total value of $564,000,000. This represents an increase in per capita production from $23 in 1917 to $49 in 1942, the comparable figures for the United States, the leading producer of minerals, being approximately $49 and $57. In the same period, metal production in Canada increased from an annual value of $106,000,000 to a value of $392,762,000.




The headway can be traced to many factors. It can be traced in part to the wide range of metals and minerals found in the Dominion and to the fact that supplies of most of them are large; to the expansion of other industries, primary and manufacturing, which opened up new markets for the products of the mines, and the growth of which in turn depended largely upon mining; to the availability of cheap hydro-electric energy throughout the country, to the widening use of metals and minerals in industry; and perhaps most important, to the skill and toil of the prospector, the work of the engineer, metallurgist, and geologist, and to the vision and venturesome instincts of men who were prepared to take risks in the belief that the industry had a real future.

A comparison of the status of the industry in 1917 with its present position is necessary to a full appreciation of the progress that has been made. Commencing with the metals, the most impressive comparison is in the production of gold. Output of this metal in 1917 reached a value of $15,273,000 and it came chiefly from a few large mines in the Porcupine and Kirkland Lake areas of Ontario. These mines are still among the leading Canadian producers of the metal but the list now comprises more than one-hundred and forty properties in scattered areas across the Dominion, the total gold output from which in 1942 was valued at $186,000,000, a record of $206,000,000 having been established in 1941. In 1917, the value of gold output was little more than a third of the value of coal output. In 1942, it was appreciably greater than the total for the fuels and the non-metallic minerals and it was $18,500,000 greater than the total for copper, nickel, lead, and zinc. The price of gold in the meantime, of course, had advanced from $20.67 an ounce to the present level of $38.50 an ounce.

Considering the metals as a group, a comparison of exceptional interest is in the distribution of output. In 1917, approximately 85 per cent of the output of metals came from Ontario, British Columbia, and Yukon. There was only a small production from the mines of Quebec, and Manitoba and there was no production of metals from Saskatchewan and the Northwest Territories. Last year, Quebec reported a metal production valued at $61,500,000 and approximately 95 per cent of the output was obtained from deposits in the northwestern part of the province, all of which were discovered since 1917. About the same percentage of the output for Manitoba and all of the output from Saskatchewan was obtained from deposits that were brought into production since 1917. Metal output in the two provinces last year reached a total value of $28,000,000 and that from the Northwest Territories, chiefly radium and gold from deposits discovered since 1930, a value of $5,200,000.

In 1917 as at present, Canada was the leading producer of nickel, but its output of copper, lead, and zinc in that year was relatively small. Most of the larger base metal deposits from which production is being obtained at present were discovered prior to 1917, the chief exception being the copper-gold deposits at Noranda in Quebec, but the huge orebodies had only been partly explored. A few years later, however, an expansion programme was undertaken chiefly with the object of coordinating all stages of operation, from the mining of the ores to the marketing of the finished products. The programme comprised the underground exploration and development of the deposits and the erection of modern smelting units and of huge refining plants. These plants include two copper refineries, one of which is the largest in the British Empire, two zinc refineries, a lead refinery, and a nickel refinery. With these facilities available, all but a small part of the output is refined within the country, whereas in 1917 most of it was exported for refining. The vast programme and extensions to plants that have since been made placed Canada in the forefront as a producer and exporter of non-ferrous base metals. The value of the facilities under present conditions requires no comment.

Other comparisons could be made in reference to the metals but they would only serve to further emphasize the many changes that have taken place since 1917. These changes, in the main, have been featured by marked increases in the production of most of the metals; by the discovery and successful development of gold deposits in areas the possibilities of which were largely unknown in 1917; by the addition from time to time of new metals to the list, recent examples being antimony, mercury, tin, and magnesium metal; and particularly by the greater realization on the part of Canadians of the importance of the industry in the economy of the country as a result of the progress that it has made.

In the case of the fuels, the production of crude petroleum affords the best comparison. Canada's output of this fuel in 1917 amounted to 214,000 barrels, 95 per cent of which came from wells in southwestern Ontario, the annual output from which has shown little change. In 1942, however, 96 per cent of the record output of 10,364,000 barrels came from wells in Alberta, chiefly from the Turner Valley field and that field is also the source of about 70 per cent of Canada's output of natural gas. Crude oil is also obtained from wells in New Brunswick and in the Norman field west of Great Bear lake in the Northwest Territories. Nova Scotia, Alberta and British Columbia continue to be the chief Canadian sources of coal output. Coal production in Canada last year reached a record total of 18,226,000 tons, but this was only 4,000,000 tons higher than in 1917. The Dominion has large supplies of coal but in 1942 as in 1917 it imported a large percentage of its requirements owing to the fact that the important coal fields are hundreds of miles distant from the principal consuming centres.

In 1917, the production of non-metallic minerals, including the clay products and other structural materials, reached a value of $34,512,000 and in 1942 it amounted to $81,139,000. In both years, asbestos and cement were the chief contributors to the output, but the value of output of both minerals in 1942 was more than double that of 1917. Most of the minerals produced in important quantities in 1917 are still being produced but there have been several additions to the list, chief among which are nepheline syenite, rock wool, sodium sulphate, muscovite mica, high grade magnesia, magnetitic dolomite, and peat moss. These additional minerals have a total value of several million dollars a year. Muscovite mica was first produced in important quantities in Canada in 1942 and the output was obtained from deposits discovered in the Mattawa area, Ontario, late in 1941. High grade magnesia was also added to the list in 1942, the source of supply being brucitic limestone deposits in the Wakefield area, Quebec. Peat moss had been produced in small quantities for years, but when supplies from Europe to Canada and the United States were cut off as a result of the war, interest in the Canada deposits was revived and production at present is several times greater than in 1939, with prospects of a further substantial increase.

With some exceptions, chiefly asbestos, gypsum, and barytes, Canada's output of the non-metallic minerals is marketed within the country and, accordingly, production is governed by domestic demand and frequently by localized demand. Transportation costs are an important factor in the marketing of many of them, and that together with a relatively small population, hampers the development of deposits too far distant from the populated areas and industrial centres.

Progress in the development of the non-metallic minerals has been steady rather than colourful. Most of the operations are on a much larger scale than in 1917, but there have been few changes in the principal sources of output. Minerals of domestic origin, however, are being used much more extensively than in 1917 when a large part of the requirements were imported. Until about fifteen years ago, for instance, most of the requirements of limestone for building purposes were imported, but investigations showed that the Canadian stones were of high quality and for the past several years Canadian quarries have been supplying most of the domestic demand.

By provinces and territories the net result of the expansion outlined above is shown in Table I which also supplements the information given in the chart.

As stated elsewhere, the progress the industry has made can be credited largely to the work of the engineer, metallurgist, and geologist. So many illustrations come to mind that it is difficult to select those that are typical. In his reconnaissance work, the geologist broadly outlines the areas favourable for the occurrence of deposits and in his detailed investigations, he acquires knowledge of their mode of occurrence, which provides a key to the exploration and discovery of further deposits in the area. He works in close relation with the prospector and he frequently makes discoveries in the course of his work. It was a geologist of the Department of Mines and Resources, for instance, who discovered the mercury deposits in the Pinchi Lake area, British Columbia, a few years ago. From these deposits Canada is now producing sufficient mercury to meet its own needs and to supply a large part of the Allied needs. Another of the Department's geologists was the co-discoverer of the large bodies of chromite found in the Bird River area in Manitoba during the summer of 1942. Test work is underway on sample shipments from the deposits.

In mining, the work of the engineer overlaps to some extent that of the geologist, and he is often a combination of geologist, engineer, economist, cost accountant, and operator. He develops methods for the mining of the ore; plans, and usually supervises, exploration and development programmes; attends to the maintenance of production; is in charge of surveying and related work, which forms an important part of mine operation; and is frequently called upon to make appraisals of properties for possible future development.

The metallurgist is interested chiefly in the treatment of the ores for the extraction of the metals. In Canada, his work has largely made possible the successful development of the huge base metal deposits now in operation. Before the copper-nickel deposits of the Sudbury area could be developed, for instance, it was necessary to find a suitable means of separating the nickel from the copper. The copper-zinc deposits of the Flin Flon area in Manitoba were discovered in 1915, but were not brought into production until 1927. Much of this time was required in developing suitable methods for the extraction of the metals. Several of Canada's metallic ores are of a complex nature and are difficult to treat and it is mainly the skilful work of the metallurgist that has enabled the successful development of such ores.

The mineral technologist has made his chief contribution to the industry's headway in his work on the metallic minerals. He is interested in the resources of the minerals, their economic characteristics, and mining, marketing, and uses, and in problems of processing in the manufacture of mineral products, particularly ceramic products. The additions of rock wool and high grade magnesia, referred to above, to the list of minerals produced in Canada, are directly the result of surveys and investigations carried out by Dominion Government mineral technologists. Their special knowledge and that of privately employed technologists are being used to particular advantage in meeting the non-metallic mineral requirements of the war industries.

This progress in mining during the past twenty-five years

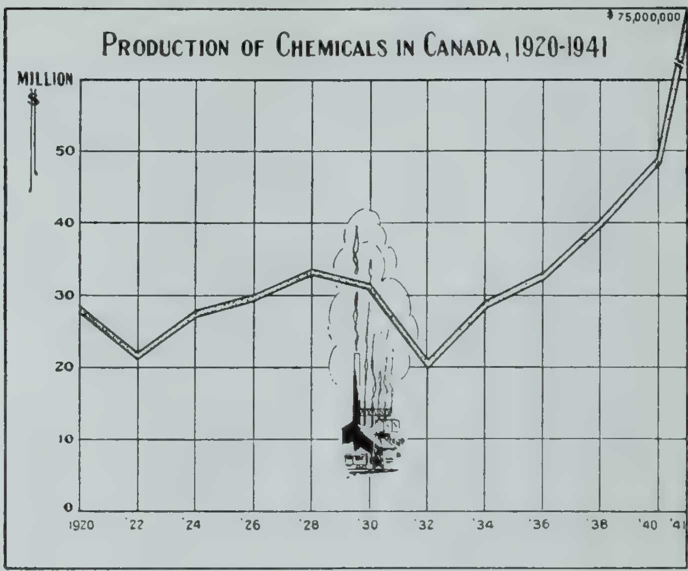
(*Continued on page 274*)

TABLE I

| Province | Total Metal Output | | Total Non-metals (including fuels) | | Total All Minerals | |
|---|---|---|---|---|---|---|
| | 1917 | 1942 | 1917 | 1942 | 1917 | 1942 |
| | $ | $ | $ | $ | $ | $ |
| Nova Scotia | 60,000 | 502,700 | 21,044,000 | 31,149,000 | 21,104,000 | 31,652,000 |
| New Brunswick | 10,000 | 14,100 | 1,430,000 | 3,492,000 | 1,435,000 | 3,508,000 |
| Quebec | 2,084,000 | 61,464,100 | 15,316,000 | 43,281,000 | 17,400,000 | 104,749,000 |
| Ontario | 73,131,000 | 230,508,000 | 15,931,000 | 27,918,000 | 89,067,000 | 258,423,000 |
| Manitoba | 318,000 | 11,792,000 | 2,310,000 | 2,804,000 | 2,628,000 | 14,643,000 |
| Saskatchewan | — | 16,020,000 | 861,000 | 3,593,000 | 861,000 | 19,613,000 |
| Alberta | — | 1,200 | 16,527,000 | 46,410,700 | 16,527,000 | 46,411,000 |
| British Columbia | 26,395,000 | 64,008,000 | 9,747,000 | 12,653,000 | 36,142,000 | 76,665,000 |
| Yukon | 4,453,000 | 3,301,000 | 29,000 | — | 4,482,000 | 3,301,000 |
| North West Territories | — | 5,151,000 | — | 72,000 | — | 5,223,000 |

# CHEMICAL INDUSTRY

H. McLEOD, A.C.I.C.
*Statistician, Dominion Bureau of Statistics, Ottawa.*




The story of the chemical industry in Canada closely parallels the story of industry as a whole. Prior to the last war, Canada was mainly an agricultural country, but in the years which have since elapsed she has become a nation in which manufacturing has assumed the major rôle in its economic life, and she has come to occupy a prominent place in the world markets for manufactured goods. As is well known, there have been periods of serious decline in business operations, but over the quarter of a century there has been an upward trend that has been remarkable. In 1915, the gross value of manufactures in Canada was $1½ billions; in 1940, when the country was again in the first year of war, the total was $4½ billions, a threefold advance in the 25 years. The mining industry experienced a similar expansion in which aggregate output value rose from $189 millions in 1917 to $564 millions in 1942.

As a result of this growth in manufacturing and mining, there arose a highly diversified demand for chemicals and chemical products, offering opportunities which were quickly exploited by a well-founded chemical industry. As volume developed, the manufacture of new items, many of which were previously imported, was undertaken; new plants were built and existing facilities were expanded. From about $28 millions in 1920, when detailed records first became available, the output of heavy and fine chemicals of all kinds rose to $75 millions in 1941. The following chronology gives in brief form the more important developments during this period.

1919—Soda ash made by Brunner, Mond Canada, Ltd., Amherstburg, Ont.

1921–22—Liquid chlorine made by Canadian Salt Co. Ltd., Sandwich, Ont.

1923—Acetylene black made by Canadian Electro Products Co. Ltd., Shawinigan Falls, Que.

1924—Phosphoric acid made by the Electric Reduction Co. Ltd., Buckingham, Que.

1925—Sulphuric acid first made from smelter gases in new plant at smelter of the Mond Nickel Co. Ltd., Coniston, Ont.

Insulin made at Connaught Laboratories, Toronto, Ont.

1927—Butyl acetate and ethyl acetate made by Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

1929—Vinyl acetate made by Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

1930—Pentasol acetate made by Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

Synthetic ammonia made by Canadian Industries Ltd., Windsor, Ont.

New sulphuric acid plant of Canadian Industries Ltd. at Copper Cliff, Ont. commenced operations utilizing smelter gases from smelter of the International Nickel Co. of Canada Ltd.

Nitre cake made by Canadian Industries Ltd. at Copper Cliff, Ont.

Iron oxides made by the Northern Pigment Co., New Toronto, Ont.

Synthetic nitric acid made by Canadian Industries Ltd. at Beloeil, Que.

Superphosphate and fertilizer mixing plants of Canadian Industries Ltd. at Beloeil, Que. and Hamilton, Ont., commenced operations.

The Mallinckrodt Chemical Co. started to manufacture fine chemicals in Canada.

Merck & Co. Ltd., Montreal, Que. started to manufacture fine chemicals in Canada.

1931—Synthetic ammonium sulphate, synthetic ammonium phosphate, and triple superphosphate made by the Consolidated Mining and Smelting Co. of Canada Ltd., at Trail, B.C.

1932—Sodium silicate made by the American Cyanamid Company, Niagara Falls, Ont.

Liquid sulphur dioxide made by Canadian Industries Limited, Hamilton, Ont.

Sodium chlorate plant rebuilt by the Electric Reduction Co. Ltd., Buckingham, Que.

Phenol, cresol, and other tar derivatives made by the Dominion Tar and Chemical Co. Ltd., Toronto, Ont.

Nitrous oxide made by Cheney Chemicals Ltd., Toronto, Ont.

1933—Acid calcium phosphate made by the Electric Reduction Co. Ltd., Buckingham, Que.

Sulphur dichloride and sulphur monochloride made by Canadian Industries Ltd. at Windsor, Ont.

Sodium silicate plant of National Silicates Ltd., New Toronto, Ont. commenced operations.

Vinyl acetate resins made by Shawinigan Chemicals Ltd., Shawinigan Falls, Que.

Zinc oxide made by the Zinc Oxide Company of Canada Ltd., Montreal, Que.

1934—Calcium chloride made by the Brunner, Mond Canada, Ltd., Amherstburg, Ont.

Ferric chloride made by Canadian Industries Ltd., Windsor, Ont.

Caustic soda-chlorine works of Canadian Industries Ltd. at Cornwall, Ont., commenced operations.

Radium salts and uranium salts made by the Eldorado Gold Mines Ltd., Port Hope, Ont.

1935—Liquid hydrogen peroxide made by Canadian Industries Ltd. at Shawinigan Falls, Que.

Disodium and trisodium phosphate made by the Electric Reduction Company of Canada Ltd., Buckingham, Que.

1936—Acetone made by Shawinigan Chemicals Ltd.

Acid sodium pyrophosphate made by Electric Reduction Co. of Canada Ltd.

Elemental sulphur produced commercially by Consolidated Mining & Smelting Co. of Canada Ltd., Trail, B.C.

Acetic anhydride made by Shawinigan Chemicals Ltd.

1937—Perchlorethylene and trichlorethylene made by Canadian Industries Ltd., at Shawinigan Falls, Que.

Vanillin made by Howard Smith Chemicals Ltd., Cornwall, Ont.

1938—Lactic acid made by Beamish Sugar Refineries Ltd. at Toronto, Ont.

Stearic acid made by W. C. Hardesty Ltd. at Toronto.

Metallic naphthenates made by Nuodex Products of Canada Ltd. at Toronto.

Aluminum fluoride made by Aluminum Co. of Canada at Arvida.

1939—Caustic soda-chlorine works of Canadian Industries Ltd. at Shawinigan Falls came into production.

Tetrasodium pyrophosphate made by Electric Reduction Co. Ltd.

1940—Ammonium chloride, zinc chloride and sodium sulphite made by Canadian Industries Ltd. at Hamilton.

Calcium phosphide and acid sodium orthophosphate made by Electric Reduction Co. Ltd.

1941–42—Potassium chlorate, potassium perchlorate, barium chlorate, ammonium perchlorate made by Electric Reduction Co. Ltd.

Sodium thiosulphate and sodium metabisulphite made by Canadian Industries Ltd. at Hamilton.

Carbon bisulphide made by Cornwall Chemicals Ltd., Cornwall, Ont.

Nickel formate made by Catalytic Chemical Corp. Ltd. at Toronto.

Phthalic anhydride and dibutyl phthalate made by Dominion Tar & Chemical Co. Ltd. at Toronto.

Huge new plants for manufacture of sulphuric acid, ammonium nitrate and special war chemicals.

Probably no phase of Canada's war effort has shown such spectacular expansion as the explosives and chemicals programme. Before the war the explosives industry was occupied almost entirely on commercial requirements, and the chemicals industry was in no position to feed a large-scale munitions output. In October 1939, the Chemicals and Explosives Branch of the Department of Munitions and Supply was set up to expand explosives production and to place the chemical industry on a parallel course of development. Since that time, in every part of the country great plants have mushroomed up. Capital expenditure for new factories in this field has amounted to more than $100 millions and recent announcements indicate a further expansion by the addition of 10 new plants which, when completed, will make 38 projects in all within this special programme. Now operating are 28 units, of which 15 are classed as major undertakings. Three of these are making explosives, three are mammoth shell-filling plants, one is a large fuse-filling plant and the others make chemicals of various kinds. Of the 13 smaller projects, eight are making chemicals, one makes fuse powders and four are making or filling smoke bombs. Three of the new units under construction are for large-scale alkylation of petroleum fractions for high-octane aviation gasoline. Over 60,000 employees are working in these establishments. Another huge wartime programme is in connection with synthetic rubber for which plants are now in course of construction.

Space does not permit detailed reference to developments in the chemical process industries and in the manufacture of allied chemical products, but the following tabulation will serve to indicate the growth in some of the more important fields during the period under review.

| | Gross production in millions of $ | |
|---|---|---|
| | 1919 | 1941 |
| Pulp and paper | 140.0 | 334.8 |
| Distilled liquors | 1.3 | 22.9 |
| Breweries | 20.1 | 63.3 |
| Rubber goods | 36.6 | 119.1 |
| Sugar refining | 102.6 | 62.4 |
| Leather tanning | 46.9 | 33.6 |
| Glass | 7.1 | 14.6 |
| Artificial abrasives | 3.0 | 20.7 |
| Coke and gas | 24.4 | 50.8 |
| Petroleum refining | 43.3 | 155.4 |
| Non-ferrous smelting and refining | 51.6 | 379.3 |
| Soaps | 17.4 | 23.2 |
| Paints | 19.5 | 40.2 |
| Fertilizers | 2.5 | 15.2 |
| Medicinals and pharmaceuticals | 13.9 | 35.5 |

In the refining of metals and reduction of ores there has been a tremendous expansion. During the last war, the problem of ore treatment at Trail, B.C. had been solved and the electrolytic refining of zinc had started in 1916, while at Port Colborne, Ont., the first refined nickel was made in Canada in 1918. Since then, the operations at these works have been greatly increased. In 1926, the aluminum reduction works at Arvida, Que., now expanded to one of the largest in the world, started operations. In 1927, the Noranda smelter commenced shipments. In 1928, metallic cadmium was first produced in Canada at Trail, B.C. In 1930, production of refined zinc was started at Flin Flon, Man.; the copper refinery at Copper Cliff, Ont. began operations; and bismuth was first made at Trail, B.C. In 1931, Canada's second copper refinery was started at Montreal, and selenium was produced for the first time at Copper Cliff. In 1933, the refinery at Port Hope, Ont, started to produce radium and uranium salts. In 1935. tellurium was first produced at Montreal. In 1940, cerium was made at Shawinigan Falls, and in the fall of 1942, the magnesium plant at Haley's Station, Ont., came into production.

---

The above brief outline of material progress is, of course, only a small part of the story. Mention should be made also of the ever-broadening interest in chemistry, of the increasing attention to chemical research, of the growing body of technical personnel, and of technical knowledge which has resulted in more efficient use of materials and resources. The speed and efficiency with which the present huge wartime undertakings have been brought into operation is ample evidence of the skill and versatility which has been attained by the industry of to-day.

# PULP AND PAPER

E. HOWARD SMITH
*President, Canadian Pulp and Paper Association*

AND

PAUL KELLOGG, M.E.I.C.
*Acting President, Newsprint Association of Canada*

The period between the end of the last war and the beginning of the present conflict witnessed an expansion in the production of pulp and paper which made it Canada's greatest peacetime manufacturing industry. Its rôle since 1939 has been no less outstanding. Prior to the Hyde Park Agreement, when dollar balances lost some of their former lustre, the quarter billion dollars of foreign exchange which the pulp and paper industry provides to Canada was invaluable for the purchase of materials and munitions abroad and is still an important factor in the Canadian economic picture. Since 1941, the industry has been a giant reservoir for horsepower and manpower which the nation has sorely needed. It has made other important contributions as well.

It has been rightly said that "no industry is either completely essential or completely non-essential in a wartime economy: it is its production for the war effort which counts." Judged by this standard, the pulp and paper industry has a high degree of essentiality.

Since it is agreed that the maintenance of a free press is essential in this hemisphere, it seems worth remembering that seven out of every ten papers read between Alaska and Cape Horn are printed on Canadian newsprint.

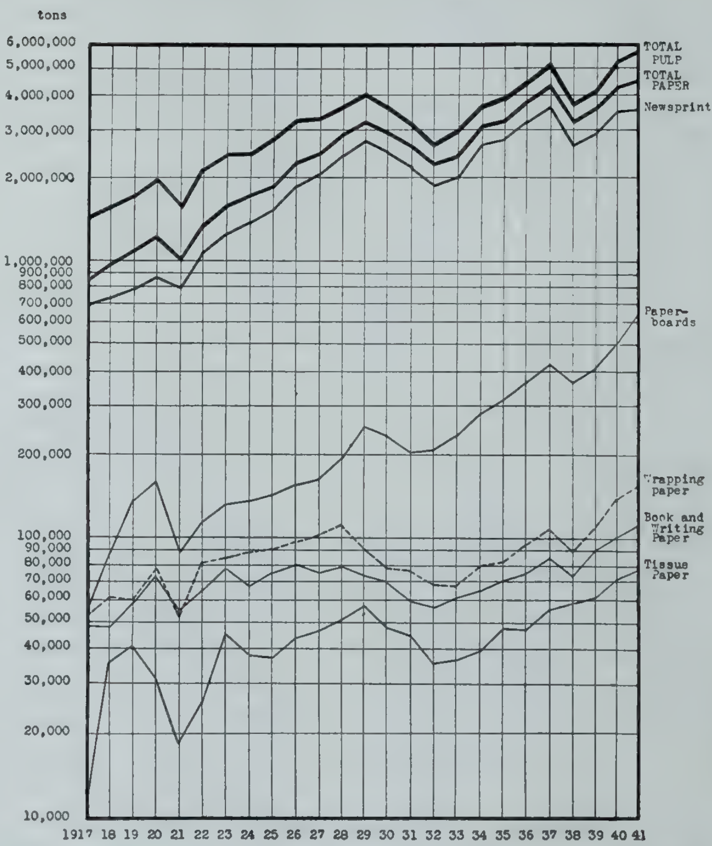
If it is important that food and munitions be not only produced but delivered to the fighting forces, then the board and wrapping used in their packaging can hardly be regarded as non-essential. If food must be packed for the civilian population and the products of the industry can suitably replace tin, these products, it seems reasonable to assume, are fulfilling a wartime function.

If ships and planes and guns are weapons of war, the thousands of square feet of blueprint paper on which they first take shape are perhaps as essential as nuts and bolts.

If the rationing of food and gasoline is necessary to win the war, the millions of pounds of paper required to print the ration books and application forms are no less necessary. If bonds must be sold, they must be printed on paper. No suitable substitute has yet been evolved.

If housing the armed forces is vital, the wallboard which goes into their construction is no less vital. If explosives are essential, the woodpulp which now replaces cotton linters in the manufacture of explosives has an equal degree of essentiality.

Maps, the "orders of the day," sanitary drinking cups, paper towels—the list might be extended almost indefinitely and include, to some extent at least, every product which the industry or converters produce. To those who give the question a moment's thought, it must seem immediately obvious that, without paper, the country could not function, the war effort would bog down.




**Variations in pulp and paper production in Canada. (This chart is drawn on a logarithmic scale and shows comparative trends in volume which may differ greatly in actual values. It should be noted that direct comparisons of volumes cannot be made on this scale by measuring proportional vertical distances).**

If this great peacetime industry is an asset to Canada at war, it may be worthwhile briefly reviewing its development, particularly since 1918.

The growth of the pulp and paper industry in Canada was due to a favourable combination of many factors. These included abundant forests, river routes, water-power, mills, machines and men, and proximity to substantial markets.

### The Forests

More than one-fifth of the total land area of Canada is covered with productive forests—an area roughly equal to the combined areas of the British Isles, France, Spain, Portugal, the Netherlands, Denmark and Sweden. Quebec, Ontario and the Maritimes together account for 80 per cent of the total accessible stand, British Columbia for 9 per cent and the Prairie Provinces for 11 per cent.

### The Rivers

Accessibility of forests does not mean more proximity as the crow flies. Accessibility is measured in terms of getting the logs out. On the whole, Canada is fortunate in having usable rivers in conjunction with her forest resources to make these resources accessible. While the greater part of the Dominion drains into Hudson Bay and the Arctic Ocean, in eastern Canada where our forest resources are greatest, the Great Lakes and St. Lawrence drainage basin dominates, and the chief rivers with their network of tributaries interlace the forested areas making them accessible for utilization.

### Water Power

To run a pulp and paper mill requires vast sources of energy or power but the bulk of the forests are concentrated in "the acute fuel zone" where native coal is not conveniently or economically available. Here again Canada has been singularly fortunate in having that other source of energy abundantly available in this zone—water power converted into electricity.

With this combination of natural resources plus vision, brains and capital, and a vast nearby market, the development of the pulp and paper industry in Canada was almost inevitable.

### Mills

The mills of the Canadian industry have been built in most instances at points where there is available water or electric power in abundance. The same situation usually provides the means whereby adequate supplies may be delivered to the mills and also a means of shipping the products by water or railways.

Other mills which do not use wood as a raw material, are conveniently located at water or rail centres closer to their markets.

### Men and Machines

The development of men and machines has proved an important factor in the phenomenal growth of the paper industry in the past 25 years. The formation of the Technical Section of the Canadian Pulp and Paper Association has been closely associated with this growth. Through the regular services of this association, technical men and operators of the industry are given many opportunities of increasing their own individual worth to the industry and to their own companies. It is impossible to estimate the increase in the value to the industry of members of the Technical Section, who have written papers, taken part in discussions, served on committees, or given of their own time and energy, often at considerable sacrifice and usually with the full understanding, co-operation and support of their companies. Chemists and engineers have become more and more active in the affairs of the industry, serving on both operational and managerial staffs.

Engineering developments have contributed to a large extent to the increased production that has been accomplished in most Canadian mills. Dealing with a few of these developments we have the improvements that have taken place in the machinery available for manufacturing groundwood pulp. The newer types of grinders produce many times the tonnages of the older machines, with an accompanying saving in horsepower expended. Wastes from the groundwood process have been considerably reduced by the improvement in the types of refiners which make it possible to reduce coarse material, previously rejected, to acceptable stock. Techniques have been developed whereby the quality of pulps produced by the sulphite and sulphate processes has been improved. Bleaching processes have been improved and others discovered which have produced new pulps with a very high degree of purity. Recovery procedures applicable to some of the pulping processes have enabled us to recover the chemicals originally used in the process and also to reclaim to some extent the chemicals and heat which heretofore had been exhausted to the atmosphere. These processes which reduce wastes have contributed to a great extent in the economic development of the industry. Research toward the solution of the utilization of the potential value of more of our waste products will have far-reaching effects on the future of the industry and the nation.

Increased production of newsprint has been the industry's biggest gain during the years 1913 to 1943. This has been accomplished by the designing and installation of new high-speed newsprint machines, capable of running up to 1,500 ft. per minute. Coupled with this, we have the accomplishment of our designers and engineers, whereby machines installed to run at speeds from 600 to 900 ft. per minute are now operating at speeds of from 1,000 to 1,200 ft. per minute.

Research work carried out at the Pulp and Paper Research Institute of Canada has also been a contributing factor in the development of both men and machines. The men trained in the research post-graduate departments of our Canadian universities, and those trained at the Institute are scattered throughout the industry, many in positions of importance. The Institute has also provided many tests and machines whereby with increased tempo of production we are able to carry on adequate control testing of our products. Besides all this, there is an unrecorded service that is being continually rendered by the Research Institute. This service consists of consultations that take place between mill men and members of the Institute staff. There is no way of measuring the help that has been given to puzzled manufacturers and operators, not only in paper making, but also to a considerable extent in paper using and in connection with the development of machinery for mills.

### 1918–1939

The growth of the industry from 1918 has been phenomenal. In the boom years following the last war, gross output jumped to a peak of over $232,000,000 in 1920. This was followed by a drop in 1921 which was general throughout the industrial field. From 1922 to 1929, there were steady annual increases in total value of production culminating in 1929 in a total of roughly $244,000,000 which exceeded for the first time the abnormally high total of 1920. There were annual reductions during the next four years to $123,000,000 in 1933 followed by successive increases to $226,000,000 in 1937. In 1938, gross output dropped to $184,000,000 but rose again to $208,000,000 in 1939. (*The trend in each division of the industry is shown graphically in the accompanying chart for the period covering 1917-1941.*)

At the outbreak of war four years ago, pulp and paper was rightly regarded as "Canada's greatest manufacturing industry."

In 1939 there was an investment in mills alone of roughly $600,000,000 or more than three times that of its closest competitor.

Counting only those working in the mills, it outranked the nine other leading Canadian manufacturing industries in salaries and wages paid out ($44,737,000) and was second only to sawmills in the number of workers employed (31,016). An additional 100,000 men or more were employed in the woods operations.

It consumed 40 per cent of the total electric power employed by all manufacturing industries.

Its annual bill for transportation was approximately $60,000,000 and it was a large buyer of goods and services from other Canadian industries.

It was acknowledged by the Dominion Bureau of Statistics to be the greatest single factor in sustaining the balance of trade.

Whole communities depended on the industry. It affected the livelihood of half a million people.

A dark spot on the history of the industry has been its failure to provide an equitable return on their capital to those who have invested in it—a failure due to the inability of the industry to operate at an adequate percentage of capacity coupled with a low price level. For years, the bulk of the thousands of investors who supplied the money to build the industry had little or no return on their investment.

To fill in the 1939 outline, it may be worthwhile looking at the division of the industry's products. The most important single product from a tonnage and dollar point of view was and is newsprint, but books, writing paper, wrapping paper, wallpaper, roofing papers, wallboard, tissue papers—all are pulp and paper products. In addition, the industry was producing pulps used for other than paper products—for rayon, cellophane, explosives and plastics (a field that seems destined to show a wide expansion).

On a volume basis the individual items broke down roughly as follows:

| | 1939 |
|---|---|
| Newsprint | 64.5% |
| Pulp made for export | 20.5 |
| Paper boards | 9.2 |
| Wrapping paper | 2.6 |
| Book and writing paper | 1.9 |
| Tissue paper | .6 |
| Other paper | .7 |

On a tonnage and dollar basis, this was broken down as follows:

| 1939 | tons | $ |
|---|---|---|
| Newsprint. . . . . . . . . . . . . . . | 2,900,000 | 121,000,000 |
| All other paper and board. | 700,000 | 50,000,000 |
| Pulp made for export. . . . . | 700,000 | 30,000,000 |

### Canada in the World Picture

Prior to the war, Canada faced intensive competition in supplying world markets with pulp and paper. The chief competition came from the Scandinavian group—Norway, Sweden and Finland. This was particularly true in the case of pulp. In newsprint production, Canada had developed to a far more dominating position than she held in pulp. In the pre-war years of 1937-39, Canada accounted for 35 to 40 per cent of total world production of newsprint. As early as 1913, Canada led the world with exports of 256,661 tons of newsprint. By 1938, her exports were more than nine times that quantity and she contributed to the total almost twice as much as the other 11 leading export countries combined.

Our chief market for newsprint and pulp is, of course, the United States—a market which, prior to the war, absorbed about 82 per cent of our pulp exports and 77 per cent of our newsprint shipments.

With the outbreak of the war, the world market in pulp and newsprint changed radically. Exports from the Scandinavian group to countries not dominated by Germany were drastically reduced, thus leaving virtually only the North American producers—Canada, Newfoundland and the United States—to supply the rest of the world.

In 1940, new production records were created by the Canadian industry, and tonnage and dollar value exceeded 1929 for the first time. In 1941 these records were again surpassed.

It has already been pointed out that, in the early stages of the war, the quarter billion dollars of foreign exchange produced by the industry was of paramount importance to Canada but that, with the Hyde Park Agreement, the importance of this quarter billion was somewhat shaded. Coincident with this, the nation faced a power shortage and was also gravely threatened with lack of manpower.

Here again the industry demonstrated its value to the nation. In the Lake St. John area, in the St. Maurice valley, along the St. Lawrence and in eastern Ontario, power originally developed for the industry's mills was in part diverted for the manufacture of aluminum and other vital war materials. Production of the pulp and paper mills affected was allocated to mills where there was no power shortage and a plan of compensation worked out. An overall reduction of the output of the industry also went into effect.

What further reduction in the industry's operations, if any, will take place is problematical. Wood supply, transportation, manpower, shortage of essential chemicals and other materials may be determining factors. That many of the products of the industry have, however, a high degree of essentiality in a wartime economy is beyond question.

### Wartime Machine Shop Board

No sketch of the industry's wartime operations would be complete without mention of a field in which it blazed the trail—wider sub-contracting.

When it became apparent that there was in Canada a shortage of machine tools and a dearth of technically trained men and skilled mechanical labour, the industry created a Wartime Machine Shop Board. Under this Board it embarked on a programme of first, training men; secondly, upgrading or thinning out its staffs to make men available for war industries and, thirdly, the making in its own machine shops of machine parts. The activities of the Board have shown continuous expansion and, among the diversified list of product being made, are parts for corvettes, mine sweepers and cargo vessels; parts for the manufacture of ordnance and other items.

In the past twenty-five years, the industry has played a dominant rôle in the economic development of the country. To-day it is making a worthwhile contribution to the war effort. When peace returns, it may logically be expected to play its part in the rehabilitation of our sailors, soldiers and airmen, and resume its enviable place as "Canada's greatest manufacturing industry."

---

## MINERAL INDUSTRIES

*(Continued from page 269)*

has obviously been of tremendous value to the country. It has provided new fields of employment for tens of thousands of Canadians and a direct or indirect means of support for hundreds of thousands of others. It has provided new outlets throughout the Dominion for the products of other industries; its operations have paved the way for the opening up of large sections of the country that would otherwise have probably received little attention; it has helped to forge an economic link between the industrial east and the agricultural west; and it has helped to place Canada in a high position among the exporting countries of the world.

Perhaps the best evidence of the benefits that have been derived from the industry's progress is found in Quebec. Most of the northwestern section of that province was largely a wilderness twenty-five years ago. As a direct result of the discovery and development of metal deposits, prosperous mining communities with populations ranging from a few hundred to several thousand have been built up. Roads and railroads have been built to service the properties and a large part of the revenue of the province is now derived from a formerly unproductive region. The production of metals from this region has thus greatly strengthened the economy of the province, and has made possible a scheme of colonization which has opened up many hundreds of square miles to settlement.

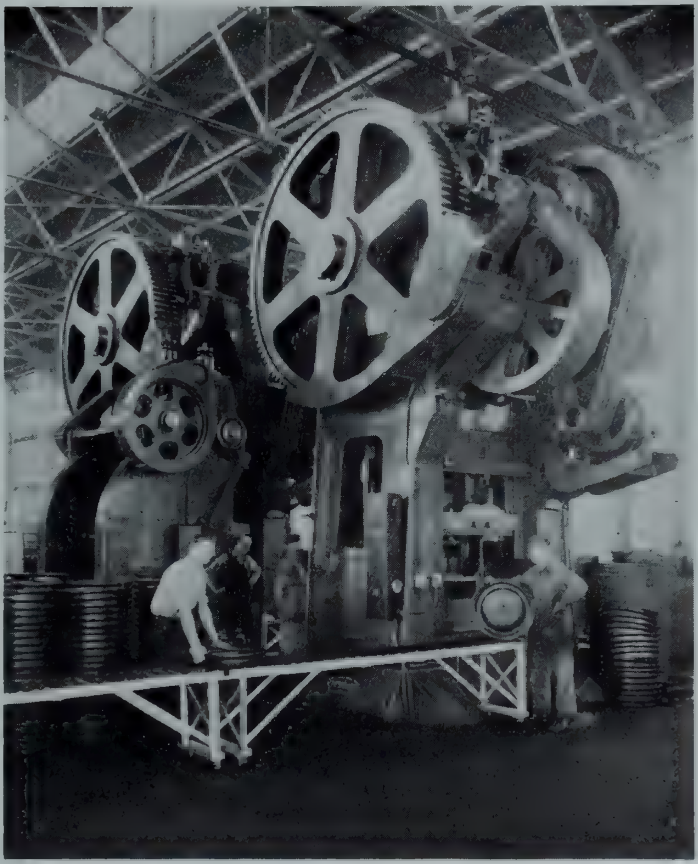
Canada has accordingly shown a threefold increase in the value of its mineral production in twenty-five years. This is an impressive record, but it is an achievement of the past. Whether or not corresponding headway will be made in the next quarter of a century is largely a matter of conjecture. Much will depend upon the possibilities of the large areas throughout the Dominion that have as yet received comparatively little mineral development attention. Much will depend also upon the course of international developments following the war, more particularly in reference to the effect these developments may have on world markets for metals. Canada has reached or at least is approaching a stage of maturity in the development of its mineral resources. Thus there will be a continued and increasing need for a well-planned development of these resources. Even then the headway may not be as colourful as in the past, but it is likely to be steady and prolonged.

---

# AUTOMOTIVE INDUSTRY

T. R. ELLIOTT
*General Motors of Canada Limited, Oshawa, Ont.*

A review of the Canadian automotive industry over the past quarter of a century reveals that in the two decades following 1918 the industry laid the groundwork for a superlatively effective participation in the war. If those twenty years had been consciously devoted to training for war production the effect on Canada's all-out effort could scarcely have been better. Among the first to be called upon by the Government to fabricate war goods in quantity, the automobile companies went into production ahead of schedule on assignment after assignment.



**Giant press, first of its kind in Canada, stamps out 2,000 finished wheels a day for military vehicles.**

Normally efficient in building motor cars and trucks, the industry was immediately singled out to build many war products of an unfamiliar nature and some they had never heard of. The individual companies met the challenge with characteristic vigour, summoned executives, production men and skilled engineers around the table and tackled the job. Technical secrets were shared with one-time competitors, machine tools and other facilities were exchanged, production short-cuts were passed along to others and the war job got rolling.

Automotive engineers worked with the British Army technicians, with the Admiralty and with Ottawa to devise ways to put the required machines of war into mass production, to avert shortages of critical material, and then, when products had been turned out, to improve their performance under battle conditions. The extraordinary variety of war goods for which the motor car industry assumed responsibility is in itself a tribute. A partial list includes:

- Aircraft fuselages and other aircraft components
- Field guns, gun parts, gun sights and gun carriages
- Machine guns
- Shell components and fuses
- Tank components
- Fire control instruments
- Universal carriers, reconnaissance cars and other combat vehicles
- Machine tools
- Naval gun mountings
- Transport and service vehicles, such as field workshops, dental clinics, power generating outfits, water purification units, laundries, etc.

All of which would indicate that the automobile industry in this country had a special appropriateness in wartime production. The key to the riddle lies simply in the development which took place in the industry during the 20 years prior to the outbreak of hostilities. The development included advancements in technology, in engineering, and in methods of manufacture to such an extent that the whole commercial and industrial life of Canada felt the impact. The discovery by the automobile companies that manufacturing costs could be reduced by mass production, carefully planned and well organized, soon had its effect on Canadian industry in general, with the result that changes were wrought in the Dominion's social life and in the status of Canadian products in the markets of the world. The motor car industry led in the reduction of labour effort and in the improvement of quality in product. It led in the payment of higher wages and in the reduction of hours per working week.

While all this was going on, with consequent influence upon the whole fabric of the Dominion, the industry remained by its very nature one of the most competitive in the world. Steady improvement in the design of the industry's product was essential. And prices were whittled with a regularity which was born of compulsion.

Efficiency had always been developed so that Canadian-made automobiles might be sold in Canada at the minimum advance over American prices. So well was this done that prices in Canada were lower than in any other automobile-producing country in the world, except the United States. It is recalled that before the war the Singer 4-cylinder car, weighing 2,465 lb., had a retail price of approximately $1,400.00; the Austin 14-horse-power—weighing 2,632 lb.—$1,250.00; the Morris 14 horse-power, weighing 2,912 lb.—$1,240.00; whereas the corresponding retail price of the Canadian Chevrolet, a six-cylinder, 29 horse-power car weighing over 3,000 lb., was $1,000.00. The car buyer in the United Kingdom, with higher motor car production than ours, paid 70 per cent more for a comparable car than the buyer in the United States, while the Canadian buyer paid only 24 per cent more. In Germany, also with a big production, the price comparison was 200 per cent higher than the United States; in France 116 per cent higher.

There was one additional factor in the industry's development through this period that is not as well understood, and it had an important bearing on the ability to tackle the wartime job when the time came. That factor was the policy of the Canadian automotive industry as a whole of paying a premium for Canadian materials, where necessary to do so, in order to establish Canadian production sources of required materials. It was because of that policy that the percentage of Canadian content in Canadian cars consistently grew right up until the outbreak of war.

A single example might be cited. Body hardware and miscellaneous die-cast parts were for years imported because there were no die-casting industries in Canada equipped to handle Canadian requirements. The result was that a new industry was created in Canada, using Canadian zinc, supplying all the motor car companies' needs and, in addition, building up an increased demand throughout the industry generally for Canadian produced zinc.

When it is realized that there are 5,000 important parts in an automobile and that most of them have to be fabricated by "contributing" companies it can be understood that the policy of the motor car industry in developing and supporting the factories of these companies across Canada has a substantial effect upon the Dominion's economic life. The number of contributing industries from which the motor car companies draw material is estimated at 600, and in the years immediately preceding the war the annual purchases from these companies across Canada by the motor car companies amounted to some $85,000,000. The effect upon employment and purchasing power can be imagined.

The requirements of war, because of all this background, found the Canadian automobile industry ready to accelerate its war production from day to day, to such a degree that in 1942, while the principal motor car factories employed directly only four per cent of the workers, they turned out 20 per cent of the whole war production total of the Dominion. This record is proof not only that the industry in a short time had been able to subordinate all normal interests to the needs of the nation at war and that the period of "change over" had been short and efficient but also that an outstanding job had been done in utilizing to productive advantage the skills, facilities and production capacities of those hundreds of auxiliary concerns now known in the war's terminology as "sub-contractors" but which the motor car industry had helped to develop in the first place as suppliers.

This, then, was the first contributing factor to the Dominion's surprisingly ambitious arms programme when war came. The point to be emphasized is that it was "normal practice" with the automotive industry to assign responsibility to "sub-contractors" and thereby build up production men all over Canada with initiative and resourcefulness. It was little wonder when munitions jobs had to be tackled that the key men chosen to direct these enterprises were drawn from the automotive industry's well-developed reservoir; and little wonder that these production men turned out a good job. It was no miracle; it was mass production. And mass production is just mass brains applied to a specific task.

The next development in the arms programme in which the industry figured was the creation of a new modern type of munitions industry. The emphasis remained on quality production but new visions of what the word "quantity" meant began to be entertained. The products were new to the makers. Most personnel had never seen these guns and shells in the modern version. That, to some extent was an advantage. Engineers and production men were not handicapped by old techniques. What if this or that gun part always had been forged? If it could be made better by casting or stamping that is the way they did it. What if tank parts always had been rivetted? Wouldn't welding be better? And in that spirit, bringing fresh viewpoints to the job, automotive engineers saw that existing practice could be improved on. Collaborating with ordnance officials they introduced innovations in manufacturing method which permitted astounding savings in time and money.

Typical example of production skill was early on record in the case of a passenger car producer who got an anti-aircraft gun of foreign design into production seven months after the order was received, cut four months from the time required by the original gun company and 80 days from the time required by a leading British armament maker. The motor car company suggested that the barrel could be broached instead of processed by traditional methods. This cut the manufacturing time for this part to 15 minutes from three and one half hours.

A better known instance is the case of an automotive company in Canada which applied the technique of cost cutting and material saving to the mass production of shell fuses. Substitutions were made for critical materials, procedure was simplified, inspection was streamlined and machining reduced. Originally the fuses were machined out of bar brass and more than half of the brass for each unit was machined off and returned as scrap. To-day the fuses are being made of a zinc alloy by a die-casting method which is fast and accurate. The substitution of zinc alloy for brass resulted in a saving of 3,633,000 lb. per month of brass and in its place only 1,042,500 lb. per month of a much less critical metal, zinc, is used. The cost of the fuses to the Government was reduced by approximately 70 per cent.

Another plant of the same company applied the same technique to a project for the manufacture of naval gun mounts. Engineers in tooling for the job felt that a considerable amount of critical metal could be saved by making the mount of structural steel instead of the cast steel called for. The plan was approved and the structural steel stand was turned out at a cost of $275.00 compared with $504.00 for the cast steel model. In addition—180,000 lb. of critical steel was saved on the small initial order.

Accent is still on saving but emphasis is also placed on quality, and the products of automotive factories are rigidly tested. To check performance in the field, Canadian automobile companies first launched training programmes for men in uniform and thousands of officers and other ranks have been called to the factories and taught the proper techniques for obtaining peak performance of military vehicles in the field. These "war colleges" have been a big factor in obtaining full usefulness of the mechanized armies of the United Nations.

Going a step further the companies have sent a considerable contingent of their best service technicians to the actual battle fronts, there to check and report on performance of war products so that no chance might be overlooked of making them still better.

Summarizing wartime development of the automobile industry in Canada, it would certainly appear that management and engineering have contributed significantly to the great objective; they have supplied their ingenuity, they have sent streams of war material down the roaring assembly lines and, at the same time, have reduced the cost of the stream. And they have done the job in co-operation with a decentralized industry throughout Canada in a way which marks that far-flung industry for a new and even more important assignment in the days that are to come.

# AIRCRAFT MANUFACTURE

RALPH P. BELL

*Director-General, Aircraft Production Branch, Department of Munitions and Supply, Ottawa.*

The first heavier-than-air machine flown in the British Empire was the *Silver Dart.* Its initial flight was off the ice on the Bras d'Or lakes near Baddeck, Nova Scotia, on the twenty-third of February, 1909. The pilot was J. A. D. McCurdy.

Seventeen months prior to this, on October 1, 1907, at Halifax, Nova Scotia, Doctor Alexander Graham Bell, the inventor of the telephone, in association with J. A. D. McCurdy, F. W. ("Casey") Baldwin, Thomas Selfridge, and Glen H. Curtiss, formed what was known as the Aerial Experiment Association.

While the legal origin of this organization took place in Halifax, McCurdy states that all the discussions leading to its creation had previously been completed in Baddeck.

The idea on which this organization was based originated with Mrs. Alexander Graham Bell, who provided the money with which to finance it. Without her vision and her financial sacrifice—for the funds she contributed represented practically all her financial worth—the spectacular results from which those participating have received undying fame and credit would probably never have been realized.

W.I.B. Photo

**The *Mosquito*—fastest bomber in the world to-day—built by The de Havilland Aircraft of Canada, Limited.**

The youth of the industry is emphasized by the fact that McCurdy is still in the forefront, occupying as he does the position of Supervisor of the Purchasing Division of the Aircraft Production Branch of the Department of Munitions and Supply in Canada.

While Doctor and Mrs. Bell and their associates are usually referred to as the pioneers in this field as far as Canada is concerned, a tremendous amount of basic research work in the science of aerodynamics, which is the foundation on which the whole structure rests, had been done prior to 1907 by Wallace Rupert Turnbull.

It is an odd and interesting coincidence that Turnbull did his work in another rural community in the maritime provinces—in the village of Rothesay, New Brunswick—and that Turnbull, himself, is also a Canadian and a native of the Maritimes.

Actually, Turnbull's activities date from 1902 and include such basic work as the first wind tunnel in Canada and the invention of an electrically-controlled variable-pitch constant-speed propeller. Propellers based on Turnbull's patents are now being built in enormous quantities by the Curtiss Wright Company in the United States, and also by the Bristol Aeroplane Company, Limited, Bristol, England.

Writing at this time, Turnbull said: "Just as soon as the mechanical engineer can command at his designing table full data concerning the lift, drag, and centre of pressure of aeroplanes, the thrust and efficiency of different forms of aeroplane propellers, the strength and suitability of materials, and the complete elements entering into the stability of the aeroplane, just so soon, and not before, can we reasonably expect the problem of aero-navigation to be really solved."

As some one subsequently said: "That was certainly calling his shots for the next twenty-five years."

In 1916, at Toronto, Ontario, McCurdy established Curtiss Airplane and Motors, Limited, the first organization in Canada to build aircraft on a commercial scale. That company and its successor, Canadian Aeroplanes, Limited — formed by the Imperial Munitions Board — built just short of 3,000 planes during the last war, a remarkable performance for those days.

Aircraft manufacture ceased in Canada with the close of the last war and was not revived until 1923 when Canadian Vickers, Limited, began the production of eight single-engined amphibians for the Canadian Air Board.

In November, 1934, Noorduyn commenced the design of the *Norseman* in Montreal; and the first *Norseman* flew on November 7, 1935.

For the four years preceding the outbreak of the present war, Canada's aircraft industry employed on an average less than 1,000 persons, occupied a total floor area of approximately 500,000 sq. ft., and produced on an average less than forty planes a year.

To-day, Canada's aircraft industry employs over 90,000 men and women, occupies well in excess of 10,000,000 sq. ft. of floor space, produces ten times as many aircraft in a month as it formerly produced in a year, and has a well-balanced long-range programme based on the following nine types, each of which stands at the very top of its field in world competition:

### TRAINERS:

Fairchild PT-26 low wing monoplane—known in Canada as the *Cornell*—the most modern primary trainer in the world.

North American AT-16 low wing monoplane—known in Canada as the *Harvard*—universally recognized as the greatest single-engined advanced trainer in the world.

*Avro Anson*, the Canadian versions of which are now five in number—the two latest, Mark V and Mark VI respectively, are scheduled to come into production during 1943 and will have moulded plywood fuselages—is the outstanding twin-engined trainer in the world.

Canadian *Bolingbroke*, a twin-engined medium bomber of long range that has been adapted for advanced bombing

**Noorduyn *Norseman*, the only wholly Canadian designed aircraft.**

and gunnery training, is not only a topnotch machine for training purposes but still remains a valuable active combat type.

COMBAT TYPES:

Coastal reconnaissance bomber, PBY-5A, famous the world over as the *Catalina*—designated by the R.C.A.F. as the *Canso*—unchallenged in its field and class it stands out as one of the great aircraft of the war for use on ocean patrols.

Dive bomber, Curtiss SB2C-1, or *Hell Diver*—the Canadian versions of which are designated SBW-1 and SBF-1—the latest and most powerful dive bomber in the world.

High speed bomber, DH-98—or as it is more familiarly known the *Mosquito*.—This latest and most famous aircraft of a long line from the boards of the De Havilland design group has already established itself as one of the deadliest and most effective weapons of the whole allied armoury. It is the fastest bomber in the world to-day and one that will write sky history in this war.

Four-engined long range bomber, the *Lancaster*, the fastest, the most manoeuvrable, and the one capable of carrying the largest and heaviest bomb load in its field, this great battleship of the air is Canada's most ambitious undertaking in the aircraft field.

TRANSPORT:

Noorduyn *Norseman*—or as it is designated in the United States, the C-64—the only wholly Canadian-designed aircraft in the programme; easily the greatest and most adaptable single-engined transport in the world, equally efficient and manoeuvrable on wheels, skis, or floats, known the world over to airmen who fly the remote places of the earth, the *Norseman* is a proven champion in its field.

Seven of these types of aircraft are already in production and two come into production within the next few months.

The Hawker *Hurricane*, a single-seat, interceptor fighter is still in large-scale production in Canada under the designation *Hurricane II*, but is scheduled to "fade out" early in 1943.

Canada's aircraft industry is now capable not only of providing all the planes required for the gigantic British Commonwealth Air Training Plan, which is probably Canada's greatest single contribution to the whole war effort, but in addition is contributing substantially to the Allied cause in various parts of the world in both combat and transport types.

Simultaneously with the production of these aircraft, factory facilities from coast to coast with a total of over 10,000,000 sq. ft. of floor space have been built and equipped and over 90,000 employees, 90 per cent of whom never worked on aircraft in their lives before, have been recruited and trained.

Thirty-five years ago, an effort of imagination in a woman's mind resulted in five visionary men experimenting in a small wooden workshop on a Cape Breton hillside, laboriously building something they hoped might fly—to-day, we have an industry stretching from coast to coast, employing almost a hundred thousand persons, and turning out thousands of aircraft per year from primary trainers to the largest bombers.

As the skill of the individual worker increases, production is steadily rising and costs are as steadily falling.

Here is one of Canada's great new industries and one of the few arising out of the war for which a commercial post-war future can reasonably be visualized, for aircraft

**The *Canso*, coastal reconnaissance bomber.**

is one of the few items of wartime manufacture for which there will be a world-wide peacetime demand.

Canada has the basic raw materials. Canada has the modern facilities. Canada has the skilled workmen and workwomen.

Two things are required:

(a) the adoption of a policy calculated to firmly and permanently establish Canada's aircraft industry on the foundation already created;

(b) the constructive imagination and leadership necessary to guide the industry through the immediate post-war period.

Canada stands at the keystone of the arch of aerial world transportation. As one of the first four trading nations of the world, it is imperative that Canada's post-war transportation and communication services encircle the globe in competition with those of its friendly rivals, and that Canadian-built aircraft be found wherever aircraft fly.

Intelligent, courageous, and inspired leadership can make Canada's aircraft industry one of the greatest industrial assets of the Nation.

# STEEL

DESMOND KILLIKELLY
*Chief Inspector, Steel Company of Canada, Limited, Montreal.*

The growth of the steel industry of Canada to its present high standard of value, in our economic field of industrial endeavour, is one of the greatest achievements that history will record of our country's material development. From its early inception, dating back to the French regime in Canada, there is woven into its history a wealth of romance and legend, marking the vicissitudes of its struggles and its ultimate successful establishment. Its very failures in the early years of its efforts may be regarded as monuments in our history which express the faith and determination of Canadian enterprise in its battles against adversity, eloquent of that daring and courage which are characteristic of nation builders.

The past twenty-five years which mark the first quarter-century of *The Engineering Journal*, have witnessed an almost phenomenal expansion of plant and increase in output in the steel industry, and in none of the arts and sciences in Canada, has any industrial development contributed more largely and effectively towards the advancement of the professions than has the steel industry to the engineering profession in all its various branches. Wonders have been wrought in the results obtained by new applications of alloying materials in new combinations. In the field of research, chemists and metallurgists strive for new and better products in probing for the solution of steel problems. It is a constant quest of the unknown, for the potentialities of steel appear to be limitless. To the civil and mechanical engineer, new qualities are being constantly revealed of its strengths, uses and workabilities. To this realm of progress and economic achievement, Canada has made a notable contribution.

**Canada's largest blast furnace. This stack has a daily capacity of 980 net tons of pig iron.**

A few men of vision and courage, engaged in the primary production of iron and steel, maintained faith in its future against the heavy odds of competition from the larger steel industries of the United States and other highly industrialized countries. Faced with the dual handicap of a restricted domestic market and of foreign competition having relatively easy access to that market, the success of the steel industry in Canada is in large measure due to the foresight and wisdom of those who have directed its fortunes.

During the two years of 1927 and 1928 Canada actually showed a more rapid increase in steel production than the United States, due to a larger construction programme, which, in rate of increase in construction, was five times as rapid in Canada as in the United States during those two years. The lean years which followed the economic debacle of 1929, resulting in world-wide depression in trade, did not lessen the value and capabilities of the steel industry in Canadian economy. In the years immediately preceding the outbreak of war in 1939, when heavy demands were being made upon the steel industries of Europe for the production of war material, Canada's steel industry, by reason of the happier and more peaceful atmosphere of its geographical position, was available for the production of a fair share of the world's needs in consumable steel goods for peaceful uses.

It is a strange fact of history that war was literally the parent of the steel industry of Canada. It was for the defence of Canada, over two centuries ago, that Talon, then the Intendant of New France, was ordered by the government in Paris to organize and carry out a search for iron ore, and to investigate the possibilities of establishing a forge to smelt the ore.

Deposits of iron ore were discovered on the banks of the St. Maurice river in the province of Quebec, and by 1736 "Les Forges de St. Maurice" were established and carried on their operations until as late as 1883. A special incident of historical interest was the treasonable act of one Pellisier, one of the lessees of the plant, who aided the Americans in their invasion of Canada in 1775 by casting shot and shell at "Les Forges" to be used by them in their siege of Quebec.

In the World War of 1914-18, Canada again called upon her iron and steel industry for the implements of war. The response was prompt and of an invaluable character in all the varied requisites of war's insatiable demands for steel. Again the call came in 1939 and the readiness and response have constituted a magnificent contribution to Canada's war effort, the extent of which has been made possible largely through the primary producing industry of iron and steel within Canada. Indeed, if that basic industry ever needed proof of its economic and security value to Canada, the current war has amply provided it. It was not upon existing plant facilities alone that this task fell. Tuned as they were to the production of materials for domestic purposes, and of a limited demand, there were now costly adjustments to be made to meet an extraordinary condition and the still greater task of plant expansion for increased capacity. Expanding an existing iron and steel industry to meet the sudden and imperative exigencies of war is not a simple or easy undertaking. Before planning plant extension and increased capacity, there are many factors to be considered which are of great primary importance. Provision must first be made to assure an adequate supply of raw materials; that iron ore and limestone can be quickly secured and brought together for the production of pig iron; that coal in sufficient quantity and quality can be obtained for conversion into coke; that the necessary increase in labour for operational services will be available.

The time element for the extension of plant to provide increased capacity is of no lesser importance. There are things which require considerable time for completion despite all human desire or effort.

The erection of a modern blast furnace requires at least a year under normal conditions and with increased pig iron production a heavy strain is put upon existing open hearth capacity for converting the iron into steel. Rolling mill facilities and capacity are the next factors of importance in meeting war requirements, and the suitability of existing mills for the manufacture of the various classes of finished and semi-finished steel products thus demanded, depends upon the type or section of product required. Such a condition arose at an early stage of the present war, when Canada embarked on the important project of shipbuilding. Fortunately, the advent of war found the construction of a new plate mill well under way at Hamilton; a dismantled plate mill at Sydney was quickly rebuilt and put into operation and a new blooming mill was added to the steel plant at Sault Ste. Marie.

In 1939 there were ten blast furnaces in existence in all Canada for the production of pig iron, two of which, however, had not been in operation for several years. The eight operating furnaces had, at the end of 1939, a daily capacity totalling 4,125 gross tons with a total production for the year of 846,419 net tons. By the end of December, 1942, two more blast furnaces had been built; one at the plant of the Steel Company of Canada, Ltd., at Hamilton (at present the largest blast furnace in the Dominion), and the other at the plant of Canadian Furnace Limited at Port Colborne, Ont., bringing a total of twelve blast furnaces into operation and the production of pig iron rose to 1,975,015 net tons. In the production of steel ingots and castings, during the past twenty-five years, the records are impressive in reflecting periods of prosperity and depression in Canada. In the closing year of the first World War (1918), Canada's production of steel ingots and castings reached the then record tonnage of 1,672,954 long tons of 2,240 lb. each. The first million-ton year of steel production in Canada had been reached in 1913 and from that year onward to 1934 there were fluctuations below and above the million-ton mark indicating the cycles of trade. It has been truly said that the steel industry is a "sensitive barometer of capital goods activity," and that "when capital goods are selling in satisfactory volume in normal years of peace, the steel business is good. When it is not good, you may be sure there is a lessened demand for capital goods."

In 1932, a year of trade depression, the production in Canada of pig iron and of steel ingots and castings fell to the low level of 144,130 and 339,346 long tons respectively. By 1935, however, production of steel ingots and castings had again risen over a million tons per annum and has not since fallen below a million tons.

The demands of war have greatly accelerated steel production of all grades in Canada and with the vastly increased development of Canada's water powers, in the generating of electric energy, the introduction of the electric process of steel production became possible and its employment has steadily increased. What may be regarded as the principal values of this process of steel manufacture are its special adaptability for the production of some of the finer grades of steel, and under the pressure of wartime emergencies, it provides an important additional capacity for the production of all grades of steel. Great as is its contribution to the war effort, it is nevertheless a fair classification to place the electric furnace process, where operated as a single industry, in the category of a secondary producer of steel, dependent, as it is, upon a supply of steel scrap, or the pig iron produced by the primary iron and steel industry, as its raw material.

For the year 1939, Canada's total production of steel ingots by the open hearth process was 1,410,339 net tons. The electric furnace process added 79,718 net tons of steel ingots while steel castings amounted to 60,997 tons; a total steel production of 1,551,054 net tons. The production for the year 1942 rose to 2,624,280 net tons of open hearth steel ingots; 318,641 net tons of electric furnace steel ingots, and 178,440 net tons of steel castings; a total steel production of 3,121,361 net tons, an increase over the year 1939 of 1,570,307 net tons.

At the present time, there are only three companies in Canada engaged in the production of iron and its products from the ore to the manufacture of semi-finished and finished articles. As primary producers they constitute the core of Canada's steel industry. Taking their raw materials from the earth, assembling them at the blast furnaces and mills, and, after several metallurgical and mechanical operations, shipping the resulting products to their destined uses, this integrated character of steel producing operations involves an extremely high capital investment in relation to the sales value of its products. Investment in mines, land, buildings and equipment calls for tremendous capital outlays, while obsolescence, as a vital factor in the life and progress of the industry, and the eternal quest for new and better products, constantly create the need for progressive developments and modernization of plants. Some realization of this may be gathered from the fact that, before the current war, there were already roughly 4,000 distinct types of steel required by the various steel consuming industries; the term "tailor-made steel" being aptly applied to the modern products. The American Iron and Steel Institute is authority for the statement that 57 of the 92 known chemical elements are used in steel mills, directly or indirectly, in the production of steel. The engineering activities of our Dominion have been demanding alloy steels of a highly specialized nature in increasing variety, but no one country in the world possesses, in its native resources, all the elements required for the manufacture of these high-grade steels, so that steel making may be said to have developed an international flavour of an interdependent character. However, under the exigencies of war, much has been done, and is being done, to simplify and reduce the number of special steels hitherto considered necessary for various uses. This has had the desired effect of accelerating and increasing production to a marked degree.

In the wake of the primary iron and steel producers follow the large number of secondary steel industries, scattered through the Dominion, which occupy a most important position in the life and progress of the steel industry of Canada. They are legion in their variety of productive enterprises. Foundries, finishing mills, bridge and other structural assembling plants, automobile and aeroplane factories, shops for the construction of railway rolling stock, machinery, boilers, Diesel engines and a multitude of others requiring steel in some form as their raw material, adding greatness to Canada's industry and progress through years of peace. War has transformed countless numbers of these factories into the production of instruments of war, expanding capacity in many cases, while numerous new enterprises have been created for similar purposes.

Industrial development in Canada has generally followed a geographical pattern tending to concentrate in well-defined districts, the location of which has been determined by the proximity to raw materials, or by the facilities and economic values of assembling and distributing centres. Largely because of the latter fact there has been built up an industrial East. But as Canada grows in population and development of her rich natural resources, actual and potential, we may expect to see a wider extension of industrial activity which will include the western provinces now occupied almost entirely in agricultural pursuits. Already, in the province of Manitoba there is a growing secondary steel industry, which, though long established, has been little known as to its activities and value. Many expansions and additions to

*(Continued on page 321)*

# STEAM POWER

J. G. HALL, M.E.I.C.
*Assistant to the vice-president, Combustion Engineering Corporation, Toronto.*

Although the story of steam plant design in Canada during the past twenty-five years does not have such romantic appeal as that of the radio, aeroplane, etc., it is not without interest. Owing to the abundance of hydro-electric power in most of our industrial areas, the steam plant in the public utility field has occupied a secondary position, except in some parts of the Prairie Provinces and the Maritimes. However, in recent years it has been realized more and more that new hydro-electric power in future may not continue to be cheap, that steam and hydro in many cases can supplement each other efficiently and that a combination involving by-product power and process steam is worthy of serious study.

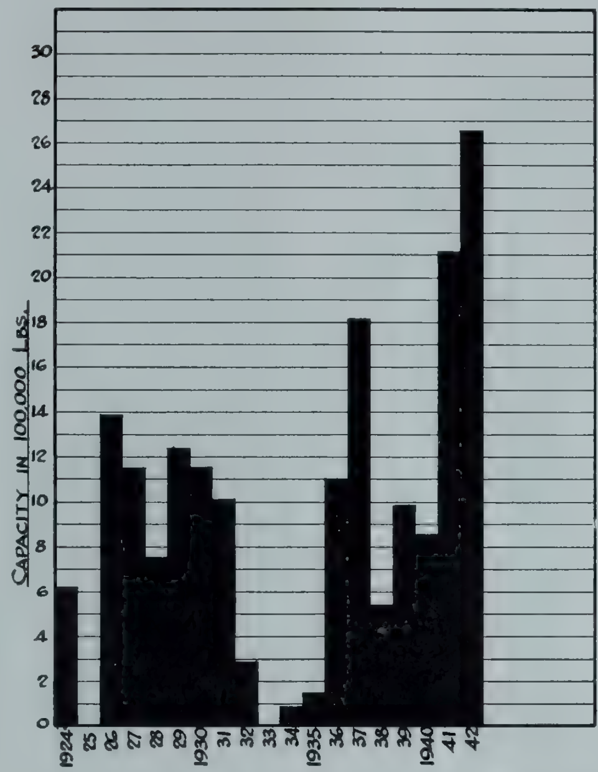



**Chart showing the total capacity of all steam generating units (over 50,000 lb. per hour) installed each year from 1924 to 1942.**

In 1918 the average boiler unit was small with insufficient setting height and over-all efficiency low, as compared with present standards. In a few places in the Middle West and the Maritimes there were moderately large steam plants in the public utility field, but the capacity per boiler unit rarely exceeded 20,000 lb. of steam per hour, while in other parts of the country they were almost entirely used for standby purposes.

About 1920 the introduction of pulverized fuel firing in boiler practice in the United States created a new interest in steam generation. It was something radically different and gave every indication of being more efficient than prevailing methods. In addition to higher capacities and efficiencies which were being obtained, it appeared to be particularly suitable for burning the wide range of available Canadian coals. Also, about that time the pulp and paper industry began its spectacular expansion. And in the next decade many large pulverized-fuel fired plants were installed. This naturally gave stoker manufacturers the incentive to redesign their equipment to meet competition with the result that each method of firing merited consideration in power plant studies. Manufacturers of only one type of firing equipment, as well as those men whose experience had been limited to particular methods, endeavoured for several years to perpetuate their own ideas. To-day, however, it is realized by independent-thinking steam plant engineers that no one method occupies an exclusive field, but that each installation must be considered on its merits. A study of all factors, such as characteristics of fuels available, suitable steam plant heat balances, etc., must be made before the best method of firing can be chosen. In other words, over-all economic efficiency and not merely thermal efficiency should be the deciding factor.

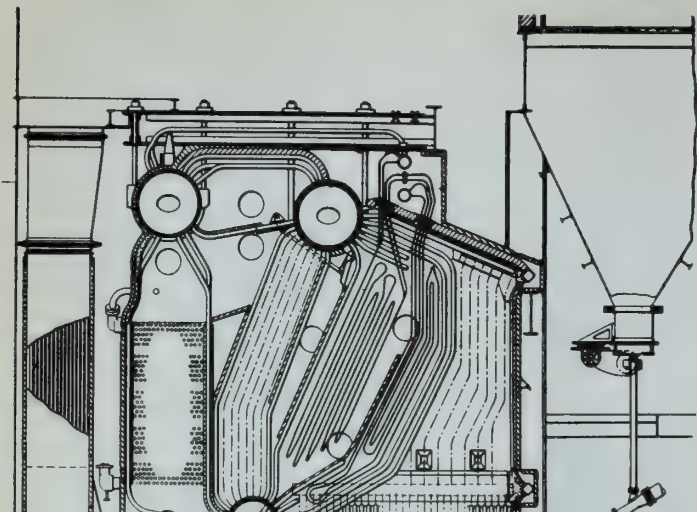
During the depression years following 1930 the number of plants installed decreased, but gradually business conditions improved until 1939, when the war caused such an unusual demand that statisticians were forced to discard their carefully prepared curves showing anticipated increases.

The above chart shows the total capacity installed each year from 1924 to 1942, inclusive, of all steam generating units with a capacity of over 50,000 lb. of steam per hour each. This illustrates very clearly the effects of the pulp and paper industry boom, the depression years and the war.

Most people look upon the modern pulverized-coal fired steam generator as something which first saw light about 1922, but actually the basis of our present design was recognized prior to 1912. About that time five units of British design, known as "Bettington boilers for atomized fuels," were installed in Nova Scotia and New Brunswick and tests showed results which were considered outstanding. This type of generator consisted in general of a boiler built around the furnace, burning coal pulverized in a hammermill as required, and using preheated air for combustion. While it is true that the original details have been greatly improved since that time, due credit for the essentials of our modern design should be given to the two Bettington brothers, as well as to those who financed them and to the companies which had sufficient foresight and confidence to install units so radically different from the then standard practice.

For many years, engineers concentrated on higher capacity per unit, increased pressure and temperature and better thermal efficiency, but later began to realize the relative importance of reliability. If stand-by units could be reduced or eliminated, capital charges would be lower, hence a reduction in boiler outage became very important in power plant studies. To-day many plants report units with a record of more than 97 per cent availability over a period of several years. One utility plant in the United States has recently taken a unit off the line for inspection after an operating period of approximately eleven months. Of the 8,147 hours in that period, it was in operation a total of 8,067 hours, or 99 per cent of all the available time. It may be assumed that this phase of boiler-room layout will receive more and more attention by designers.

One of the main factors in the success of our modern design is the use of water cooling in the furnace. This is a direct result of the development of pulverized fuel firing. The early experiments in Milwaukee and elsewhere, headed by such men as John Anderson, John Blizard, Henry Kreisinger and others, showed that with increased heat releases and higher temperatures, standard refractory furnace designs were inadequate. Air-cooled walls were tried out and are still used for some conditions, but further improvement seemed imperative. Water cooling of the ashpit was tried with success, then a portion of each side wall was added, the idea being held by some engineers that there was a limit to the area that could be watercooled, which, if exceeded, would cause unstable ignition and incomplete combustion. To-day, however, furnaces are built without any refractory limitations. In the figure on the next page it will be noted that very little, if any, refractory material is directly exposed to flame temperatures.



**Sectional elevation of a modern steam generator.**

Water cooling is also applied to stoker-fired installations and has assisted in obtaining higher average operating efficiencies, lower maintenance and decreased outage. When new units are installed it is a relatively simple matter to include furnace wall cooling, and many designs, even in the smaller sizes, include it as an integral part of the installation. In existing plants, although water cooling shows very definite advantages and has resulted in increasing the useful life of many boilers which would otherwise have been discarded, there is a limit to which it can be employed without unjustifiable capital expenditure. Furnace water cooling is of particular advantage when coals are burned which have low ash fusion temperatures or those which contain high percentages of metal oxides. By the adoption of water-cooled furnaces large deposits of Canadian coals formerly considered unsuitable have been made available for high capacity and high efficiency plants.

A development of particular interest to western Canada is the increased use of the lignites found in Saskatchewan, Alberta and, to a limited extent, in British Columbia. These vary widely in moisture content, the deposits in Saskatchewan having 30 to 35 per cent, while those in Alberta and British Columbia range downwards to the point where they merge into the sub-bituminous class. Owing to the low heating value per pound and consequent high freight cost, their economical use is, generally speaking, limited to the four western provinces.

In addition to high moisture content, many of them have severe clinkering characteristics, hence underfeed stokers have a limited application, except in very small boilers. Spreader and travelling grate types are favoured, the latter particularly for large units and where heat recovery by means of air preheaters can be used to advantage. Smaller water-cooled areas are generally used when the Saskatchewan lignites are burned, although some plants report good success with large percentages of the furnace so protected. This latter applies more particularly at high capacities and with preheated air.

The early experiments with pulverized lignite gave valuable data. When it was pulverized and allowed to stand for a day or more in bins, it arched over, causing irregular feeding, so that the storage system is seldom used and direct firing has become standard in all recent Canadian installations. The high moisture content also reduces the pulverizer capacity and, as nearly twice as much must be burned for the same steam output due to the low heating value, over-size mills are required. The decrease in capacity has been partly offset by drying in the mills with highly preheated air or gas.

Two utility plants in Saskatchewan report good results with pulverized lignite; one metallurgical plant in British Columbia, after trying pulverizers and stokers, decided in favour of the former when plant extensions became necessary. It is thus apparent that the choice of equipment cannot properly be made until all factors have been carefully studied.

In 1918, a plant operating at 200 lb. gauge pressure and a total temperature of 550 deg. F. was considered a high pressure installation in this country. In 1926, a pressure of 600 lb. and a total temperature of 700 deg. F. were used, while in 1937 one firm installed units of 900 lb. design pressure and a total temperature of 820 deg. F. This pressure has not as yet been exceeded, although a total temperature of 850 deg. F. has been reported by a different company.

It is interesting to note that the metallurgist has been called upon to play an important part in this phase of steam plant work. In 1930, engineers were prepared to design plants using higher pressures and temperatures than were then in use, but were limited by the metals available. During the depression period, materials were developed which would withstand the conditions in prime movers and steam generating units, arising from higher pressures and temperatures. In recent years, in the United States, units having a pressure of 2,500 lb. gauge and 950 deg. F. total temperature have been installed. Owing to the increased available energy in the high pressure and temperature areas of the Mollier chart, it would appear reasonable to assume that pressures approaching the critical point, as well as temperatures far beyond those in present practice, will be given careful consideration when found to be economically justified.

Larger units, increased use of water-cooled surfaces exposed to radiant heat, higher heat releases, pressures, etc., have created radical changes in boiler room auxiliaries. The reciprocating feed pump has been replaced by single-stage or multiple-stage centrifugal types. Piping has had to be redesigned to suit the new conditions, including extensive application of welding, and there is now more general and intelligent use of instruments and controls. Possibly the most important change has been in feed water equipment. The old boiler compound "cure-all" method has been replaced by scientific analyses and treatment. Methods satisfactory for units operating at pressures of 200 lb. and with low heat transfer rates were found to be unsuitable and even dangerous for modern conditions. As a result, the feed water chemist now plays a very important role in steam plant design and operation.

It will be noted that reference has been frequently made to "steam generators" rather than to "boilers." The reason is that to-day we consider the unit as a whole rather than its individual parts, such as boiler, furnace, firing equipment, etc. In 1918, there were two general classes of boilers in use; viz. fire tube and water tube with straight tubes. Many of both classes are still in use but, in the water tube type, bent tubes have largely replaced straight tubes. Two, three or four drums are included in various designs, although two or three drums are most common due to simplicity and cost. Welded drums are becoming standard with many manufacturers and will doubtless increase as greater welding and x-ray facilities are made available. For low pressure heating, the welded steel-encased type is most common although, where some moderately high pressure steam is required or may be necessary at a later date, the horizontal return tube type is popular.

As mentioned previously, Canada is favoured with large amounts of hydro-electric power so that steam turbines are not used to the same extent as in other countries. Space will not permit of a detailed account of turbine practice in this country, but a few notes should be of interest. In 1918, a 5,000 kw. steam turbo-generator was considered a large unit and it was not until 1926 that a 10,000 kw. 3,600 r.p.m. machine was installed in Edmonton. This was followed in 1929 by a 15,000 kw. unit in Regina. To-day the largest in service has a capacity of 25,000 kw.

The detailed study of power plant heat balances has brought into prominence the different kinds of steam turbines now available. In addition to the straight condensing and back pressure types so widely used for many years, there are now the automatic controlled bleeder condensing, bleeder back pressure and mixed pressure bleeder types. These can be used singly or in combination, depending on the nature of the particular conditions. Standard designs are available from all recognized manufacturers and are being given careful consideration in industrial areas, even where water power is or may later be available.

At the outbreak of war, Canada was forced to change from peacetime to wartime effort almost overnight and very soon the effect on the country's steam plants became apparent. Utility companies, instead of endeavouring to sell electric power for the generation of steam at any price which would tempt firms to shut down their boilers, now began to invoke the cancellation clauses in their contracts. In 1939, the capacity of electric steam generators exceeded a million and one-quarter kilowatts, while at the beginning of 1943, after about 3½ years of war, a negligible fraction of that amount was being used in isolated cases and at highly restricted off-peak periods.

In addition to the limits of shops to turn out steam generating and allied equipment, there was the problem of finding designers and draughtsmen. Where possible, plans were made to use existing designs, either in their entirety or with slight modifications. One company with many plants from coast to coast has installed 72 units each of approximately 25,000 lb. of steam per hour rated capacity since 1939. The uniformity of design was carried out, not only in the boilers and firing equipment, but also in piping, pumps, feed-water treatment, coal-handling equipment, buildings, etc. The value of this general policy became more evident as plant additions were required. By placing orders for one or more duplicate units, engineering time was eliminated and often several months were saved in delivery, installation and starting up.

An unexpected effect of the war was the necessity for changing a large number of boilers from oil to coal firing. As the submarine menace increased in 1941, the problem of crude oil transportation became acute and, in addition, larger quantities of fuel oil were required for ships both in the Navy and Merchant Marine.

Prior to July 1942, a number of large boilers had changed to coal firing, resulting in a saving of oil at the rate of 26 million gallons per year. At that time, the Government ordered all installations burning more than 10,000 gals. per year to convert. This involved approximately 4,100 actual boiler plants or 15,500 boilers. Of these, more than 7,000 were equipped with stokers; the remainder were hand fired, using either forced or natural draft.

The work which began in July was completed by December 31st, with the exception of 39 plants where the change-over was well advanced. This involved a cost of five million dollars, and effected an additional saving of 100 million gals. of fuel oil per year.

In view of the short time available and the scarcity of both materials and man-power, this is a remarkable record and an indication of what can be done by proper co-operation of Government and industry.

The question is often asked as to what the steam plant of the future will be like and if steam will continue to hold its place in the heat and power fields. In the field of straight power generation it is, of course, thermally very inefficient, due to the large latent heat loss in the exhaust. This is quite apparent when it is realized that even in the very efficient utility plants in the United States less than 30 per cent of the heat energy in the fuel is actually made available as electric power at the bus-bar. The mercury vapour unit is reported to be past the experimental stage, but so far only a few installations have been made. Also, like most binary-fluid designs, it can only maintain its high efficiency when used in conjunction with steam. It would appear, therefore, that steam will maintain its position until some new medium has been discovered and developed to the point where it is better from the standpoint of over-all economic efficiency, including first cost, operating cost, reliability, maintenance, safety, etc.

As mentioned previously, if Canada should continue to develop industrially, further hydro-electric developments capable of delivering cheap power will be found to be limited and even now relay steam plants are being used in conjunction with hydro to provide for low water periods. There is every indication that hydro and steam plant designers and operators will be called upon to work in close co-operation.

Another important field which the steam plant will be called upon to serve is in the utilization of by-product power by the use of process steam. In this way there is little or no latent heat loss and considerable savings are possible. The combination is, of course, generally restricted to conditions where there is a reasonable balance between steam and power loads, or where steam demand is the governing factor.

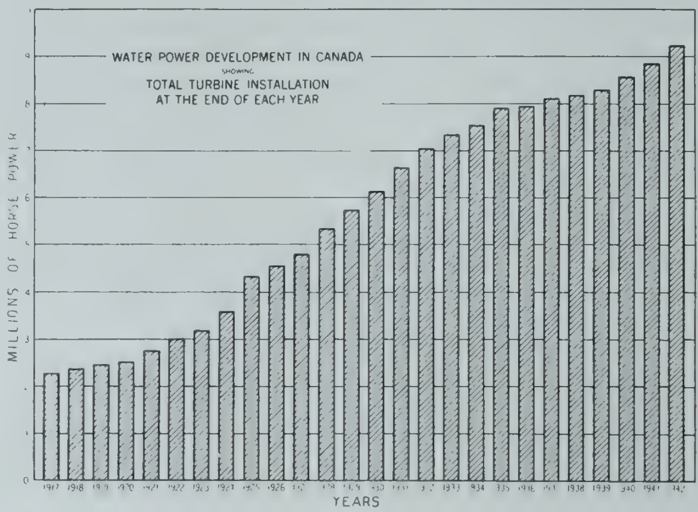
Grateful acknowledgment is hereby tendered to Mr. George Sancton of Fraser & Chalmers Limited for details of the Bettington boiler and to the Canadian Steel Boiler Institute for data required for the capacity chart.

---

# WATER POWER DEVELOPMENT

VICTOR MEEK, M.E.I.C.
*Controller and Chief Engineer, Dominion Water and Power Bureau, Surveys and Engineering Branch, Department of Mines and Resources, Ottawa*

In the twenty-five years which have elapsed since the founding of *The Engineering Journal,* in May, 1918, no single factor is of more fundamental significance in Canada's progress during this period than the great increase that has taken place in water-power development. This increase of 6,938,000 hp. amounts to more than three times the total installed capacity of 2,287,000 hp. at the beginning of 1918 and has brought the total, at the end of 1942, to 9,226,000 hp.




The period under review had its beginning in the last year of the First World War when an acute power shortage in southern Ontario led to the undertaking of the great Chippawa-Queenston power project on the Niagara river by the Hydro-Electric Power Commission of Ontario. Although this development did not come into operation until the end of 1921, too late for use in World War I, it marked the commencement of an era of large-scale water-power development which was to extend throughout the Dominion and which was to provide the low-cost energy necessary not only for the establishment and expansion of extensive peace-time industries but also for the tremendous production of war materials and equipment for the use of the United Nations in the present world conflict.

The peace-time interval from 1919 to 1939 witnessed a large and widespread growth in Canadian industry. The most notable enterprise was undoubtedly the expansion of the pulp and paper industry to an extent where it led all other manufacturing industries in capital investment, in wages paid, and in the net value of production, and was the greatest factor in maintaining Canada's favourable balance of trade. This industry is dependent upon an abundance of wood and ample supplies of low-cost power and, before the war, was consuming more than 50 per cent of all power sold for industrial purposes, by central electric stations in Canada, in addition to the production from water-power developments directly owned and operated by the mills themselves, having an installed capacity of almost 650,000 hp. Although the pulp and paper industry provided the most spectacular growth in the peace-time interval, particularly in point of power utilization, the whole industrial base expanded to such an extent as to bring Canada to a position of first rate industrial importance amongst world nations. Contributing greatly to this programme of expansion was the growth in the mining, smelting and refining of base and precious metals, the growth of automotive, steel, machinery manufacturing, textile, food processing and packing, and many other industries. Power production kept pace with this industrial expansion both by the construction of new developments and by the systematic extension of existing facilities. Indeed, in the period of business depression following 1930, these new developments provided a surplus of power-generating capacity, a surplus, however, which was to be of the utmost importance in the war years to come. In addition to the greatly increased demands for power by industry in this peace-time interval, a tremendous growth took place in the use of electric energy for domestic and commercial purposes. Extension of transmission and distribution facilities, introduction of radio, electric refrigeration, air conditioning, and numerous electrically-driven labour-saving devices together with improvements in lighting and heating appliances combined to bring about this great increase. By the end of the period, electric service was virtually universal in urban communities and had been greatly extended into rural areas in many parts of the country.

For almost four years, Canada has again been involved in a great world war, and the enormous part that this country has been able to take in providing the materials and equipment so urgently required by the armed forces of the United Nations, in almost every theatre of the war, is attributable to the broad expansion which had previously taken place in industrial, and in power-producing and distributing facilities. At the outbreak of the war the power situation was peculiarly favourable. During the immediately preceding years, construction had proceeded on several hydro-electric power projects and, owing to the lag brought about by the industrial depression, power demands, particularly for firm power, were considerably less than power capacity. As a result, substantial supplies of power were immediately available for war production purposes and further large amounts, which were being sold as secondary power for raising process steam in pulp and paper mills, could be diverted to primary war use with relatively little delay. Such supplies were soon earmarked for war purposes but as the war progressed it was evident that additional capacity would be required and new construction was undertaken and prosecuted with such vigour that, during the war period up to the end of 1942, hydro-electric installations were brought into operation totalling more than 1,000,000 hp. Further construction is proceeding which should add as much more within the next twelve to eighteen months. During the war period, also, extensive additions and interconnections have been made to transmission systems, daylight saving is in force the year round throughout Canada, restrictions have been imposed in the use of power for certain non-war purposes and other measures have been taken to make available the maximum amount of power for war production. It is difficult to make a definite estimate of the total power being used for war purposes but it should be safe to say that more than one-third of Canada's hydro-electric capacity is now in war service, supplying power for the production of aluminum, copper, nickel, lead, zinc, and other war metals, and for the manufacture of ships, planes, tanks, guns, motor vehicles, and the host of other things required in this country's vast war programme.

## Review of Outstanding Developments (1918-1943)

As already stated, the water-power capacity installed in Canada during the twenty-five years (1918-1943) totalled 6,938,000 hp. Every province was represented in this great programme of development as is shown in Table I.

Table I—Total Turbine Installation by Provinces (1918-1943)

| Province | Hp. installed (1918-1943) | Per cent of total |
|---|---|---|
| British Columbia | 495,394 | 7.2 |
| Alberta | 61,875 | 0.9 |
| Saskatchewan | 90,805 | 1.3 |
| Manitoba | 342,075 | 4.9 |
| Ontario | 1,728,440 | 24.9 |
| Quebec | 3,982,774 | 57.4 |
| New Brunswick | 117,096 | 1.7 |
| Nova Scotia | 109,666 | 1.6 |
| Prince Edward Island | 628 | — |
| Yukon and Northwest Territories | 9,700 | 0.1 |
| Total | 6,938,453 | 100.0 |

This indicates that Quebec had by far the greatest share of water-power development and Ontario and Quebec combined, where much of the country's heavy industry is concentrated, were credited with more than 82 per cent of the total installation. Substantial developments, however, were made in all the provinces with the exception of Prince Edward Island which, owing to its size and topography, has limited water-power resources.

It is also of interest to record the development year by year during the period under review. This is done in Table II and shows very substantial increases for every year from 1921 to 1935. Heavy installations continued through the depression years from 1930 to 1935. These were offset, however, by very much smaller installations in the recovery period until the outbreak of the war when the greatly increased power demand brought about further large additions in the last three years.

It is not possible, in a brief article, to describe in detail the many developments undertaken during the past twenty-five years, but reference will be made to a number of the larger ones in the various provinces.

British Columbia—To meet steadily increasing power demands in Vancouver and the lower coastal mainland area, the British Columbia Power Corporation enlarged its Stave Falls station on Stave river by 36,000 hp., constructed the Ruskin station on the same river with an installed capacity of 94,000 hp. together with the Alouette station on Stave lake of 12,500 hp. The corporation also increased the capacity of its plant on Jordan river on Vancouver Island by 20,000 hp. for the supply of Victoria and vicinity.

In the West Kootenay area, the West Kootenay Power and Light Company built new plants at Corra Linn and South Slocan on the Kootenay river and reconstructed or added to its plants at Upper and Lower Bonnington Falls on the same river. This new construction added 242,000 hp. to the company's generating capacity which serves chiefly the large power requirements of the Consolidated Mining and Smelting Company of Canada.

The East Kootenay Power Company constructed two hydro-electric plants totalling 22,200 hp. on the Bull and Elk rivers to supply mining needs in the East Kootenay district.

The Powell River Company, operating pulp and paper mills on the mainland coast at Powell river, added 25,860 hp. to its power installation on Powell river and constructed a 24,800 hp. plant on Lois river. Pacific Mills Limited, another pulp and paper enterprise on the coast, increased its power-generating capacity by 6,300 hp.

In the Prince Rupert area, the Northern British Columbia Power Corporation constructed a plant of 4,380 hp. on Falls river and, to serve an area centering on Vernon, the West Canadian Hydro-Electric Corporation installed 7,600 hp. in a plant at Shuswap Falls on Shuswap river.

Alberta—In Alberta, the Calgary Power Company constructed two new hydro-electric developments during the period, both in the Bow River basin. The Ghost development on the Bow of 36,000 hp. was brought into operation in 1929 and the Lake Minnewanka—Cascade River development of 23,000 hp. in 1942. The company also greatly extended its transmission system to embrace most of Alberta from Edmonton south to the international boundary.

Saskatchewan—All hydro-electric development in Saskatchewan took place during the period. The Churchill River Power Company brought its Island Falls development on Churchill river into operation in 1930 with an installation of 42,000 hp. and, by additions in 1937 and 1939, enlarged the development to 87,500 hp. Power is transmitted to Flin Flon and Sherridon for the operations of the Hudson Bay Mining and Smelting Company and Sherritt Gordon Mines respectively. In 1939, the Consolidated Mining and Smelting Company of Canada completed a plant of 3,300 hp. at Wellington lake on Charlot river for gold-mining operations at Goldfields, Saskatchewan.

Manitoba—With the exception of a 1,900 hp. development completed by Gods Lake Gold Mining Company in 1935 on Island Lake river in northeastern Manitoba, all other waterpower development during the period was made on the Winnipeg river. The City of Winnipeg hydro-electric system completed its Pointe-du-Bois station by adding 65,400 hp. and a new plant was constructed at Slave Falls with an installation of 48,000 hp. Power is transmitted for distribution in the city of Winnipeg. Two plants controlled by the Winnipeg Electric Company were built on the Winnipeg river; one at Great Falls with an installed capacity of 168,000 hp. and the other at Seven Sisters Falls where an initial installation of 60,000 hp. has been made. Power is transmitted to Winnipeg and vicinity, also to the Manitoba Paper Company's mill at Pine Falls, to the central Manitoba mining area and to Kenora in Ontario.

The Manitoba Power Commission, established in 1919, purchases power from the Winnipeg Electric Company and serves 151 municipalities throughout southern Manitoba by means of a network of 1,825 miles of transmission and distribution lines constructed and extended during the past twenty-four years.

Ontario—During the past twenty-five years, the developments carried out by the Hydro-Electric Power Commission of Ontario far surpassed all others in the province. In this period, new plants constructed by the Commission or acquired by purchase totalled more than 1,300,000 hp. representing almost 75 per cent of the Commission's total generating capacity. In addition, the Commission purchases under contract 835,000 hp. from companies generating power in the province of Quebec. The great Chippawa-Queenston development of 560,000 hp. on the Niagara river was the largest of the Commission's construction undertakings but other large developments included Chats Falls on the Ottawa river (112,000 hp.), Cameron Falls (75,000 hp.) and Alexander Landing (54,000 hp.) both on the Nipigon river, Barrett Chute (56,000 hp.) on the Madawaska river, and the Canyon plant on the Abitibi river (330,000 hp.), the latter completed and operated for the Ontario Government. Among smaller developments, five were built on Muskoka waters (28,550 hp.), three on the Trent river (21,400 hp.), two on the South river (3,100 hp.), one on the Mississippi river (3,720 hp.), and on the English and Albany rivers in the Patricia district developments totalling 20,400 hp. were made and are operated for the Ontario Government. Additional installations made in older plants and plants acquired by purchase totalled 50,000 hp. During this period, the Commission vastly extended its network of transmission and distribution lines, bringing electric service to virtually all parts of the province and supplying some 900 urban and rural municipalities.

In addition to the developments undertaken by the Hydro-Electric Power Commission, several privately-owned power organizations and a number of industrial companies added substantially to Ontario's water-power development. Serving Sault Ste. Marie, the Great Lakes Power Company built three plants on the Montreal and Michipicoten rivers

Table II—Canadian Water Power Development

Turbine installation by provinces (1918-1943) in horse-power

| Year | British Columbia | Alberta | Saskatchewan | Manitoba | Ontario | Quebec | New Brunswick | Nova Scotia | Prince Edward Island | Yukon & Northwest Territories | Canada |
|---|---|---|---|---|---|---|---|---|---|---|---|
| End of 1917 | 297,169 | 33,122 | 30 | 78,850 | 955,955 | 856,769 | 16,251 | 34,051 | 1,989 | 13,199 | 2,287,385 |
| 1918 | 10,364 | ........ | 5 | 6,475 | 25,358 | 48,534 | 60 | 267 | 209 | ........ | 91,272 |
| 1919 | 831 | ........ | ........ | ........ | 55,237 | 31,600 | 2,815 | 875 | 35 | ........ | 91,393 |
| 1920 | 1,170 | ........ | ........ | ........ | 20,872 | 18,187 | 2,850 | 2,430 | .... | ........ | 45,509 |
| 1921 | 728 | ........ | ........ | 13,800 | 108,518 | 95,248 | 9,000 | 11,285 | 19 | ........ | 238,598 |
| 1922 | 19,295 | ........ | ........ | 34,900 | 139,596 | 49,066 | 11,075 | 234 | 22 | ........ | 254,188 |
| 1923 | 26,561 | ........ | ........ | 28,000 | 90,630 | 36,077 | 1,050 | 1,189 | .... | ........ | 183,507 |
| 1924 | 4,374 | 1,410 | ........ | ........ | 199,230 | 177,069 | 1,420 | 15,241 | .... | ........ | 398,744 |
| 1925 | 83,360 | ........ | ........ | 21,900 | 207,166 | 437,425 | 2,250 | 65 | .... | ........ | 747,666 |
| 1926 | 20,000 | ........ | ........ | 44,000 | 5,684 | 136,067 | 4,860 | 510 | .... | ........ | 211,121 |
| 1927 | 11,380 | ........ | ........ | 28,000 | 24,409 | 183,476 | ........ | 2,269 | .... | ........ | 249,534 |
| 1928 | 79,560 | ........ | ........ | 56,000 | 71,050 | 317,600 | 20,000 | 5,940 | 165 | ........ | 550,315 |
| 1929 | 5,000 | 36,000 | ........ | ........ | 48,350 | 208,312 | 45,500 | 34,768 | .... | ........ | 377,930 |
| 1930 | 71,000 | ........ | 42,000 | ........ | 136,000 | 122,700 | 21,050 | 5,100 | .... | ........ | 397,850 |
| 1931 | 25,200 | ........ | ........ | 79,000 | 57,150 | 382,200 | ........ | 2,225 | .... | ........ | 541,325 |
| 1932 | 57,800 | 1,065 | ........ | ........ | 62,900 | 256,990 | ........ | 168 | .... | ........ | 378,923 |
| 1933 | 3,810 | ........ | ........ | ........ | 147,000 | 136,000 | ........ | ........ | .... | ........ | 286,810 |
| 1934 | 115 | ........ | ........ | ........ | 650 | 210,000 | ........ | 4,200 | .... | ........ | 214,965 |
| 1935 | 780 | ........ | ........ | 1,900 | 204,400 | 150,000 | ........ | ........ | .... | 5,000 | 362,080 |
| 1936 | 425 | ........ | ........ | ........ | 1,750 | 30,000 | ........ | 4,300 | .... | ........ | 36,475 |
| 1937 | 1,050 | ........ | 19,000 | 12,500 | 15,475 | 116,366 | ........ | 2,770 | .... | ........ | 167,161 |
| 1938 | 18,041 | 400 | ........ | 15,600 | 5,579 | 31,377 | 334 | 7,180 | 178 | ........ | 78,021 |
| 1939 | ........ | ........ | 29,800 | ........ | 13,840 | 53,700 | ........ | 1,100 | .... | ........ | 98,440 |
| 1940 | 50,750 | ........ | ........ | ........ | 796 | 236,180 | ........ | 7,500 | .... | ........ | 295,226 |
| 1941 | ........ | ........ | ........ | ........ | 19,900 | 236,000 | ........ | ........ | .... | 4,700 | 260,600 |
| 1942 | 3,800 | 23,000 | ........ | ........ | 66,900 | 282,600 | ........ | 4,500 | .... | ........ | 380,800 |
| Total | 792,563 | 94,997 | 90,835 | 420,925 | 2,684,395 | 4,839,543 | 133,347 | 143,717 | 2,617 | 22,899 | 9,225,838 |

totalling 62,000 hp. and added 7,200 hp. to its plant at Sault Ste. Marie. The Canada Northern Power Corporation, supplying power in the Porcupine and Kirkland Lake mining areas, increased its generating capacity on the Montreal and Mattagami rivers by 31,200 hp. The Keewatin Power Company installed 30,875 hp. on the Winnipeg river at Kenora. Among pulp and paper companies, the Abitibi Power and Paper Company added 81,650 hp. to its generating capacity chiefly at two plants on the Abitibi river, the Spruce Falls Company built plants totalling 58,750 hp. on the Mattagami and Kapuskasing rivers, and the Minnesota and Ontario Paper Company constructed three plants on the Seine river totalling 36,500 hp. The International Nickel Company increased its generating capacity by 28,200 hp. on the Spanish river and numerous lesser installations were made by other power and industrial organizations.

Quebec—The great increase in water-power development of 3,982,000 hp. in Quebec during the past twenty-five years was accounted for very largely by the activities of a few large privately-owned public utility organizations. The Shawinigan Water and Power Company and its subsidiaries or associates, serving a large area in central Quebec increased its generating facilities by 742,500 hp., chiefly on the St. Maurice river. New plants on that river were constructed at La Gabelle (172,000 hp.), Rapide Blanc (160,000 hp.), and La Tuque (178,000 hp.), and additions were made at Shawinigan Falls (129,000 hp.), and Grand'Mère (77,000 hp.). Other new construction included a 22,000 hp. plant at St. Narcisse on Batiscan river, 4,500 hp. at St. Raphael on du Sud river, and 4,000 hp. at St. Alban on the Ste. Anne-de-la-Pérade river. Large extensions were also made to the company's widespread transmission and distribution systems.

Montreal Light, Heat and Power Consolidated and companies now under its control, viz. Beauharnois Light, Heat and Power Company and Montreal Island Power Company, accounted for 823,400 hp. in new installations. The great development of 689,000 hp. at Beauharnois on the St. Lawrence river was the outstanding achievement; the Cedars development on the St. Lawrence was increased by 89,400 hp. and a plant on Rivière des Prairies at St. Vincent-de-Paul was constructed with an installed capacity of 45,000 hp.

Serving the Eastern Townships area south of the St. Lawrence, the Southern Canada Power Company constructed two developments on the St. François river, one at Drummondville (18,400 hp.) and the other at Hemming Falls (33,600 hp.); a smaller plant of 2,000 hp. was built at Burroughs Falls on Nigger river.

The period witnessed the establishment of four new power organizations of large magnitude: three in the Ottawa River valley, Gatineau Power Company, Maclaren-Quebec Power Company, and Ottawa Valley Power Company; and two in the Saguenay River district, Saguenay Power Company and Aluminum Power Company.

Gatineau Power Company constructed three large plants on the Gatineau river at Paugan Falls (238,000 hp.), Chelsea (170,000 hp.), and Farmers (96,000 hp.), and a smaller one of 2,500 hp. at Corbeau Rapids. The company also acquired by purchase a number of other plants which were either installed or extended during the period including two on the Ottawa river, Bryson (51,400 hp.) and Hull (22,500 hp.), one on Gordon creek at Kipawa (24,000 hp.) and others on the Rouge, Nord, and Ouareau rivers where installations totalling 7,765 hp. were made. An extensive transmission system was constructed throughout the territory covered by the company's operations.

The Maclaren-Quebec Power Company completed two large developments on the Lièvre river, one at High Falls (120,000 hp.) and the other at Masson (136,000 hp.).

Ottawa Valley Power Company joined with the Hydro-Electric Power Commission of Ontario in constructing the Chats Falls development on the Ottawa river; the company undertaking the works in Quebec province and installing 112,000 hp. The output from this installation is sold to the Commission for distribution in Ontario.

Saguenay Power Company, supplying chiefly the aluminum industry and pulp and paper mills in the Saguenay River and Quebec districts, constructed a large development of 540,000 hp. at Isle Maligne on the Saguenay river at the outlet of Lake St. John. A plant of 3,500 hp. built during the period at Garneau Falls on Chicoutimi river was also acquired by the company.

The Aluminum Power Company, serving the aluminum industry, completed a permanent installation of 280,000 hp. at Chute-à-Caron on the Saguenay river and installed temporarily 110,000 hp. at the same site. A major development is also under construction at the present time at Shipshaw on the Saguenay which will have an installed capacity, when completed, of 1,020,000 hp.; 170,000 hp. of this capacity was installed and in operation at the end of 1942 and it is expected that the full development, including the transfer of the temporary units from Chute-à-Caron to Shipshaw, will be completed by the end of 1943.

To supply the mining industry in northwestern Quebec, the Canada Northern Power Corporation constructed a 40,000 hp. development on Quinze river and the Province of Quebec one of 48,000 hp. at Rapid No. 7 on the Upper Ottawa river.

The City of Sherbrooke, supplying its own needs, built a new plant of 5,800 hp. at Westbury on the St. François river and reconstructed a plant on the same river at Weedon adding 4,300 hp.

Serving the lower south shore district of the St. Lawrence and also the town of Campbellton in northern New Brunswick, the Lower St. Lawrence Power Company built a plant of 9,600 hp. on the Métis river.

Among pulp and paper companies developing power for their own needs, Price Brothers constructed a plant of 17,600 hp. at Chute-aux-Galets on the Shipshaw river, one of 11,000 hp. on Chicoutimi river and added 5,300 hp. to other existing plants. North Shore Paper Company built a plant of 70,000 hp. on the Outardes river to supply its mills at Baie Comeau. Smaller installations were made by other companies.

No account of the major power programme in Quebec would be complete without a reference to the highly important work carried out by the Quebec Streams Commission in the construction and operation of storage dams for the regulation of stream flow. The Commission now controls 21 reservoirs on the St. Maurice, St. François, Gatineau, Lièvre, Nord, Ste. Anne-de-Beaupré, and Métis rivers and on Lake Kenogami. Virtually all of these reservoirs have been created during the past twenty-five years, the most notable of which have been the Gouin reservoir on the St. Maurice river (5,000,000 acre-feet), Baskatong and Cabonga reservoirs on the Gatineau river (3,165,000 acre-feet), Cedar Rapids reservoir on the Lièvre river (500,000 acre-feet), Lake St. François and Lake Aylmer reservoirs on St. François river (340,500 acre-feet), and Lake Kenogami reservoir (312,000 acre-feet). Other reservoirs not under the control of the Commission have been created by private power interests, the outstanding ones being those on Lake St. John (3,850,000 acre-feet) and on the Peribonka river (5,440,000 acre-feet) for the regulation of the Saguenay river.

NEW BRUNSWICK—The outstanding water-power developments in New Brunswick during the past twenty-five years were undertaken by the New Brunswick Electric Power Commission, the Gatineau Power Company, and the Bathurst Company.

The New Brunswick Electric Power Commission, established in 1920, serves power to most urban and a number of rural communities in the province over 2,290 miles of transmission and distribution lines leading from two power plants constructed by the Commission; one a hydro-electric plant on the Musquash river (11,100 hp.) and the other a fuel-electric plant on Grand lake (25,000 hp.) The Commission also purchases a small amount of power from other sources.

At Grand Falls on the St. John river, the Gatineau Power Company completed a hydro-electric development of 80,000 hp. and transmission lines leading to Dalhousie and Edmundston; power being used chiefly for the operation of pulp and paper mills in those communities.

The Bathurst Company constructed a hydro-electric plant of 14,500 hp. at Grand Falls on the Nipisiguit river for the operation of its pulp and paper mills at Bathurst.

Lesser installations were made by the Maine and New Brunswick Electrical Power Company on Aroostook river (5,100 hp.) and the Municipality of Edmundston on Green river (1,050 hp.).

NOVA SCOTIA—The past twenty-five years have witnessed a four-fold increase in water-power development in Nova Scotia largely through the operations of the Nova Scotia Power Commission and the Avon River Power Company.

The Nova Scotia Power Commission, established in 1919, has constructed 14 hydro-electric developments totalling 76,350 hp. and 1,400 miles of transmission and distribution lines serving communities and industries throughout the province. The larger developments are five on the Mersey river (39,600 hp.), three on Indian and North East rivers (15,700 hp.), two on East River Sheet Harbour (16,140 hp.), and one on Tusket river (3,000 hp.).

The Avon River Power Company, serving power to Halifax and communities in the Annapolis valley, constructed three plants on Black river (16,500 hp.), two on Avon river (6,200 hp.) and other smaller plants, giving the company a total generating capacity of 24,825 hp.

The Minas Basin Pulp and Paper Company built two hydro-electric plants on the Ste. Croix river totalling 6,970 hp. for the operation of its pulp mill at Hantsport. A number of other lesser plants were constructed by industries and municipalities during the period.

YUKON AND NORTHWEST TERRITORIES—In the Yukon, the only new water-power development was the addition of a 5,000 hp. unit in the hydro-electric plant of the Yukon Consolidated Gold Corporation on the North Fork of the Klondike river. Power is used principally for the operation of gold dredges in the Klondike district and for the supply of Dawson city.

The first hydro-electric development in the Northwest Territories was constructed by the Consolidated Mining and Smelting Company on the Yellowknife river (4,700 hp.) to supply gold-mining properties in the Yellowknife area to the north of Great Slave lake.

### Current and Future Development

Under the urge of war demands, construction is currently proceeding on several projects which will add another 1,000,000 hp. to the Dominion's total. These include the completion of the outstanding Shipshaw development on the Saguenay river by the Aluminum Power Company (740,000 hp.); the addition of units at Rapide Blanc (40,000 hp.) and La Tuque (44,500 hp.) plants of the Shawinigan Water and Power system; the completion of a 65,000 hp. development at DeCew Falls in the Niagara area by the Hydro-Electric Power Commission of Ontario; and the construction of a 130,000-hp. development at Brilliant on the Kootenay river in British Columbia by the Consolidated Mining and Smelting Company of Canada. A development in early prospect is one of 300,000 hp. at Des Joachims on the Ottawa river by the Hydro-Electric Power Commission of Ontario.

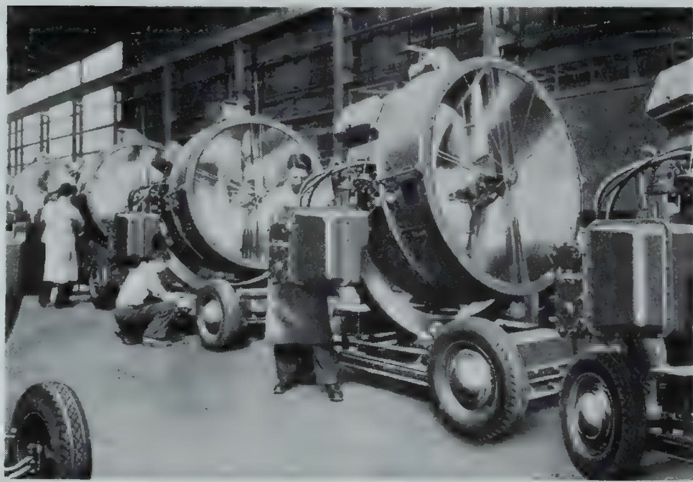
When the war is over, large quantities of power now being used for war production will be available for other purposes. At that time, however, there will have accumulated, undoubtedly, an enormous demand for goods and equipment brought about by wartime destruction, rationing and curtailment. Canada's industries with large supplies of low-cost hydro-electric power available should be in an unrivalled position to take a great share in this work of reconstruction and rehabilitation. Looking further to the future there are very large reserves of power still undeveloped throughout the Dominion which will be of fundamental importance in fashioning the development of other natural resources in the years to come.

# ELECTRICAL EQUIPMENT

D. C. DURLAND

*President, Canadian General Electric Company, Limited, Toronto.*

Canada's electrical industry during the past 25 years has experienced a phenomenal growth. A few facts and figures exemplify the rapid progress that has been made. The annual per capita consumption of electricity has increased from 660 kw.h. in 1918 to 3100 in 1942 to give Canadians the distinction of being the world's largest per capita users of electricity. The output of central stations increased from 5.5 billion kw.h. to 37.1 billions in 1942 or an increase of 6.7 times.



**Portable anti-aircraft searchlights are being built by Canadian electrical manufacturers.**

What are some of the factors that have brought about this rapid growth in the use of electricity? The principal one is the large proportion of Canada's electricity produced by hydraulic power. Canada is fortunate in having many water power sites that not only lent themselves to relatively low cost development but also were fairly close to established centres of population and to sources of raw materials. Canada has a progressive central station industry with the foresight and courage to embark on large scale hydro-electric projects and the ingenuity to carry them to completion. The Dominion also has an efficient electrical manufacturing industry with research, engineering and manufacturing facilities for the constant improvement of equipment as well as for the development and manufacture of new products to meet the growing demands of Canadian industry. These factors combine to make available large amounts of low cost electricity which is freely utilized in industry, municipalities and homes.

In 1941, the electrical apparatus and supplies industry had 211 plants, 33,086 employees, and a selling value of products of $177,902,626. In 1918, this industry had only 68 plants, 8,863 employees and a selling value of products of $30,045,399.

Since our immediate interest is with the advances in equipment during the past quarter century, let us review some of these developments. The sequence in which they are named does not in any way indicate their relative importance in the Canadian electrical scene.

### Fabrication by Arc Welding

One of the greatest advances in electrical apparatus was the transition from cast to fabricated steel construction. Although successful results were obtained by electrically welding together steel parts as far back as 1918, there was for several years a reluctance to adopt this method of manufacture for electrical machinery. In 1925, the first all-welded tanks for large transformers were built in Canada. In 1927, the first all-fabricated vertical waterwheel-driven generator was built. Fabricated-steel construction has the advantages of greater strength, lighter weight and gives the engineer an opportunity to build-in higher efficiency and better functional design. To-day, practically all electrical apparatus is fabricated by welding. Last year, for the first time, steel spiral casings for large hydraulic turbines were completely arc welded. A continuous improvement in welding electrodes and arc welding machines has been largely responsible for the success of the process.

### Generators

Keeping pace with the development of larger water power sites, generators have steadily increased in size. The 75,000-kva. generators currently being installed at the Shipshaw station, represent the largest generators in electrical output ever built in Canada. The vertical-shaft generator has largely displaced the horizontal type. The vertical-type generator lends itself admirably to large hydraulic installations where the water wheels can be readily installed at a level to give the best economy and efficiency. The development of a satisfactory thrust bearing, which carries the total weight of the rotating parts as well as the thrust of the water, has been responsible for making large vertical waterwheel-driven generator installations practical. The single thrust bearing on each of the 75,000-kva. units mentioned above carries a total load of 562 tons.

In 1940, the first station designed for generators with a completely enclosed re-circulating cooling system was built. This system keeps out dust, flies, and fuzz from trees and thereby reduces maintenance costs. It also reduces the fire hazard and provides greater security for continuous operation, as the units do not have to be shut down for periodic cleaning.

### Electric Steam Generators

Another unique piece of electrical apparatus—the electric steam generator—was introduced to serve the pulp and paper industry. These generators make process steam from surplus or off-peak power.

Between 1920 and 1939, over 1,500,000 kw. in electric steam generators were installed in Canada. In 1937, these consumed over 25 per cent of the central stations output. When the growth of war industries threatened a power shortage, power was diverted from steam generators to operate machines in war plants. To-day the power utilized by electric steam generators is only six per cent of central station output and is still decreasing.

### Transformers

In no piece of electrical apparatus has the increased knowledge of electrical phenomena, gained since the last war, been more successfully applied than in the transformer. Trouble-free transformers of greatly increased capacity have been built for operation at voltages as high as 230,000 with little or no increase in physical dimensions.

Since the year 1900, there has been a steady development and improvement of silicon steel for transformer cores. Step by step the quality of transformers has been improved until hysteresis losses in transformers have been reduced from 1¾ watts per lb. in 1903 to ⅓ watt in 1943.

In the shielded-winding transformers, developed in 1926, high concentrations of voltage stress inside the winding due to lightning are prevented by the scientific use of electrostatic shields. Electrostatic shields external to the windings and connected to the line terminals control the stress distribution.

In 1932, transformers using a new liquid cooling and insulating material were introduced to Canada. This material, in addition to the desirable characteristics of mineral oil, has the property of being non-inflammable and non-explosive. This liquid when used in transformers eliminates the necessity of expensive fireproof vaults and permits the economical installations of transformers indoors close to the centres of load. When used in capacitors it permits smaller, lighter weight, fireproof and more reliable units.

### Switchgear

Since 1918, there has been a continuous improvement in switchboards. Deadfront steel panels replaced marble, slate, and more recently ebony asbestos. To-day, switchgear is factory-assembled and is received on the site complete, ready to connect to the main circuits. Metalclad switchgear, the latest development, is not only factory assembled but the complete metal enclosure adds to the safety, efficiency and appearance of the equipment. Ingenious mechanisms have been developed to permit the quick removal of a circuit breaker for overhaul and the insertion of a "spare."

The increase in the size and power of modern systems has thrown greater burdens on circuit breakers and has resulted in the development of breakers with greater interrupting capacity. The oil-blast principle of arc extinction has made these higher ratings possible, without any appreciable increase in physical size. In recent years there has been a definite trend towards the use of air circuit breakers, and for voltages of 550 and less they are now used almost exclusively.

### Lightning Arresters

Entirely superseding the exide film and similar types of lightning arresters in vogue between 1918 and 1930 is the new "Thyrite" type arrester. This arrester utilizes a ceramic material which has the remarkable characteristic of being substantially an insulator at the lower voltages and becoming an excellent conductor at the higher voltages encountered from surges and impulse conditions.

### Power Factor Correction

For many years low power factor was more or less disregarded, probably because of excess system capacity and also because of the small amount of inductive equipment in service. The greatly increased use in recent years of inductive equipment—induction motors, transformers and induction furnaces—coupled with heavy circuit loading, called for the serious consideration of power factor correction. The magnetizing current of such inductive equipment can readily be either partly or entirely neutralized by the use of suitable corrective equipment—either capacitors, or synchronous machines operating at a leading power factor.

### Transportation Equipment

In 1938 a revolutionary advanced design of electric street car was placed in operation in Canada. These new cars are faster, quieter, and more comfortable than their predecessors. In 1936, trolley coaches were placed in operation in Montreal. These vehicles give the comfort and flexibility of a modern bus, but because they take their power from overhead power lines, have lower operating costs, are quieter, and can maintain faster schedules. In the field of industrial haulage many diesel-electric locomotives have been placed in service during the past few years. These locomotives are unusually economical to operate.

### Motors

For years the motor was nothing more than a device for supplying rotational power to the plant line shafting. The chief consideration was that the motor be of sufficient horsepower to turn the shafting or other driven member. Speeds were only a matter of selecting pulleys of a size to give the desired result. The electric motor of to-day is a highly specialized tool, designed to meet the exacting requirement of modern industry, in which motors with special characteristics as to power requirement, torque, speed and surrounding conditions are specified. In modern plants the use of individual motors, mounted on the machines they drive, has practically eliminated overhead shafting and belts.

The squirrel-cage induction motor, with its simplicity, robustness, and versatility, is the type most frequently used in industry to-day. The following three types are in general use—(1) The normal torque for full voltage starting. (2) The high torque, low starting current. (3) The high slip, high torque motor.

The use of standard NEMA frame dimensions by all the leading manufacturers brings to the user the advantages of interchangeability in respect to mounting dimensions between motors of the same ratings but of different makes.

Depending on the surrounding conditions, the following types of induction motors are available. (1) Standard protected type. (2) Splash proof. (3) Totally enclosed fan-cooled. (4) Totally enclosed. (5) Explosion proof.

The modern synchronous motor with its high efficiency and high starting and pull-in torque is no longer regarded as a special machine but is considered for many drives for which induction motors may have been employed in the past, especially where low speeds are involved or where some degree of power factor improvement is desired.

### Use of Motor Power

In 1917, each of the 606,523 employees in manufacturing industries in Canada had at his disposal only 2.7 hp. For each of the 658,114 employees in manufacturing industries in 1939 there were available 6.2 hp. of electric motors and 1.5 hp. of other power producers. To-day, there are probably 6 million hp. in electric motors at work in Canadian plants as contrasted with 1.3 million hp. in 1923.

### Motor Control

Although a succession of improvements contributed to safety, accessibility and longer life of control equipment there are a few developments worthy of special mention. For instance, temperature overload protection, in which a temperature relay heater conforms to the heating characteristics of the motor, permits the motor to stay on the line until the danger point is approached. This eliminates many unwarranted outages from service. The introduction of improved automatic control has been in a large measure responsible for bringing the synchronous motor out of the special class and rendering it suitable for operation by ordinary plant operators. The sequence control of machine tool operations and industrial processes of all kinds can be taken care of automatically by timing devices incorporating telechron motors or electronic tubes, which operate in conjunction with other relays and suitable control equipment.

Recent years have seen the electrical industry applying old principles in new ways and developing entirely new, highly specialized devices to aid other industries in the solution of their production problems. Ward-Leonard control illustrates the former trend. This system, invented in 1891 by Mr. Ward Leonard, has been used for flexibility, wide speed range and smooth acceleration on large drives, but not until lately has it been used extensively in the smaller sizes. Electrical manufacturers now supply the motor-generator set, the D-C motor and the various control equipment as a "packaged" unit in ratings up to 50 hp.

### Electronic Equipment

Electronic equipment dates back to the last war when radio was introduced. The radio tube is the best known member of the electronic family. To-day, rapid strides are being made with frequency modulation to replace amplitude modulation used in the ordinary radio. The former eliminates static and fading, two of the worst features of the latter type. During the past few years intensive development has taken place in television equipment, in which electronic tubes play an important part.

In recent years, a galaxy of electronic tubes has been developed, the best known of which is the photo-electric cell which has the unique characteristic of becoming a conductor in the presence of light. This tube is used in motion picture projectors, counting and sorting machines, door openers, street lighting systems and in many other applications. Electronic tubes are used for such purposes as control of theatre lighting. They also make possible the modern seam-welding machines, widely used for fabricating airplane parts and the bodies of military vehicles. Electronic tubes permit large currents to flow for very short periods, such as a fraction of a cycle, to give a succession of welds on thin metals that resemble the stitching on a piece of cloth.

Electronic tubes are widely used as rectifiers—every radio set uses one. This same principle is now widely used for power rectifiers using steel tanks instead of glass tubes. Canada's first power rectifier went into operation in 1927. Since that time, hundreds of rectifiers have been installed, principally in the aluminum industry where this apparatus is employed to convert alternating to direct-current for the aluminum pot-lines.

### Lamps and Lighting Equipment

In 1918, the gas-filled incandescent lamp developed in 1913 was still the lamp in common use. It was not until 1926 that the now familiar inside frosted lamp with its increased diffusion, glare reduction, and softening of shadow effect came on the scene. Incandescent lamps have been continually improved in light output and quality. This combined with substantial price reductions gives the user an average of well over four times as much light for his lamp dollar, as he obtained a quarter of a century ago.

One of the more recent developments has been gaseous discharge lamps. In 1933, a sodium lamp and a high intensity mercury-vapour lamp were developed. These sources produced light at the highest efficiencies ever achieved, the sodium at sixty lumens per watt and the mercury at forty lumens per watt. However, because of the characteristic colour of the light emitted by these sources—orange-yellow for the sodium and yellow-green for the mercury—their use is limited to certain locations where the colour of the light is not a factor but where high efficiency is of definite value. A more recent development is the 1000 watt water-cooled mercury vapour lamp. This lamp is only 3½ in. long and is used where an intense point of light is required.

The most remarkable development since Edison's first practical incandescent lamp is the fluorescent lamp introduced in 1938. This lamp not only makes available a relatively cool source of white light but also gives from two to three times as much light as an incandescent lamp of the same wattage. Highly efficient fluorescent lamps when used in war factories contribute greatly to better lighting and increased production.

During the past 25 years, many new uses for artificial light have been developed. These include highway and airport lighting; sports and protective floodlighting, automobile headlights and traffic control as well as the improved lighting of industrial, commercial, and home interiors. Comparative lamp sales best illustrate the growth of lighting during the past 25 years. It is estimated that in 1918 only 8,000,000 lamps (6,400,000 large style and 1,600,000 miniature) were sold in Canada. It is estimated that last year 68,500,000 lamps (39,000,000 large style and 29,500,000 miniature) were placed in service.

Lighting practice since 1918 has been the subject of intensive research, both from the qualitative and quantative needs of our eyes. This research has demonstrated the benefits of raising the level of illumination in our war factories from approximately 10 foot-candles in 1918 to from 50 to 200 foot-candles in 1943. The studies carried on during the past 25 years by the lighting industry have contributed greatly to the production records established by industry.

### X-Rays in Industry

Within the past few years, X-rays have invaded the industrial field for the examination of large castings and welds on boilers and pressure tanks, for possible flaws. Detection of flaws with X-rays, during the early stages of manufacture, saves considerable time and money. Modern industrial X-ray equipment operates at one million volts.

### Insulating Materials

Great strides have been made in the development of better insulating materials. The introduction of a dense plastic bonded material that can be formed into collars and cylinders was a distinct advance. Practically all power transformers now built in Canada utilize cylinders of this type to separate the high and low voltage windings.

Improvements and new developments in electrical insulations have resulted in such benefits as better space factors, more dependable operation over longer periods and under more adverse conditions of service. The most outstanding improvements have been in insulating varnishes, particularly in the field of synthetics, such as the alkyds and the phenolics. Synthetics have also been successfully applied to tubing and sheet insulating materials.

Wire insulation has been greatly improved. For instance, tellurium compounded rubber introduced in 1932 gives to trailing cable a jacket which it is almost impossible to destroy by abrasion or rough usage. A new magnet wire introduced to the Canadian market in 1940 insulated with a synthetic resin of the vinyl acetate type is tougher and more flexible than the conventional enamel coatings. This wire is now used almost exclusively for winding motors, small generators and coils. The restrictions on the use of rubber as a result of the present war have greatly stimulated the use of synthetic rubber coverings. For instance, one typical insulation resembles rubber but has the added desirable characteristics of being non-combustible and resistant to moisture, acids, alkalies and oils. It is being used for aircraft cables, tank wiring, field communication cable, admiralty cable, machine tool wiring, switchboard wiring and battery and coil leads.

### Electric Heating Equipment

The first major application of electric heat in industry was in 1917, when it was applied for heat-treating gun barrels. Since then its use in industry has shown great growth. To-day, electric heat is widely used in elevator-type furnaces, conveyor belt furnaces, small box-type furnaces for tool rooms, salt baths for treating aluminum, pot type furnaces for cyanide or lead hardening; industrial ovens for core baking, paint drying and dehydrating and in air heaters, strip heaters, immersion heaters, cartridge type heaters, soldering irons, melting pots and other small devices. One of the most important developments was the utilization of inert gas atmospheres in electric furnaces for bright annealing and copper brazing. Another recent industrial heating application is the infra-red oven in which heat is produced by special incandescent lamps that emit a large proportion of infra-red rays. Drying is done in these ovens in from one-tenth to one-fifth of the time required by other methods.

### Domestic Appliances

Prior to 1919, the use of electric appliances in the home was meagre indeed. Light was almost the only domestic use of electricity. There were several reasons for this; (1) electric appliances were expensive and had not reached a high state of development; (2) houses were, in the main, not adequately wired for the extra loads; (3) the public generally was not familiar with the economies, labour saving, and conveniences that electric appliances for the home could provide. A "standard wiring" evolved in 1922 did much to improve wiring systems. Electrical manufacturers have continuously improved their products and developed new appliances for the home. The result was a tremendous growth in the use of appliances until their manufacture was restricted by the war. It is interesting to note that the annual domestic consumption of electricity is steadily increasing and, in 1940, showed an increase of

(*Continued on page 327*)

# PUBLIC WORKS

F. G. GOODSPEED, M.E.I.C.
*Superintending Engineer, Department of Public Works of Canada, Ottawa*

The past quarter of a century, commencing in the last year of the First World War, and finishing in the fourth year of the Second World War, has included a period of great prosperity for Canada, and also a period of extreme depression and unemployment. Each of these conditions, war and peace, prosperity and depression, have had their influence on the construction of public works.

In 1914-15, the expenditures of the Department of Public Works had risen to approximately thirty million dollars per year. By 1918, during the war, these expenditures had dropped to approximately fourteen million dollars per year, governmental expenditures being concentrated during that time on the war effort. Between 1918 and 1929, ordinary departmental expenditures did not exceed twenty million dollars annually, although in the first three years after the war considerable sums were expended from war appropriations for the construction of military hospitals, etc., making the total expenditure for each of those years from twenty million to twenty-two million dollars.

In the years of depression and unemployment which followed, expenditures increased to a maximum of approximately thirty-one million dollars in 1935-36 when a sum of nearly eighteen million dollars was expended on special works carried out under the Public Works Construction Act for the relief of unemployment.

At the outbreak of war in 1939, all Public Works contracts were cancelled, and since that time, the ordinary work of the Department has been limited generally to the maintenance of existing structures and buildings, no large departmental works having been constructed. However, very considerable work has been carried out by both the Chief Architect's and Chief Engineer's Branches of the Department in the construction of buildings and works for the Department of National Defence and for the Department of Munitions and Supply, which works were financed from war appropriations. The actual construction work carried out by the Department during these years, including work done under war appropriation, has been practically equal to that of the peace time era.

The construction and maintenance work of the Department of Public Works has been carried out under the three branches of the Department: the Chief Architect's Branch supervising the construction and maintenance of public buildings; the Chief Engineer's Branch in charge of the construction and maintenance of engineering works such as docks, wharves, breakwaters, bridges, the carrying out of dredging, etc.; and the Government Telegraphs Branch in charge of the construction and maintenance of Government telegraph and cable lines.

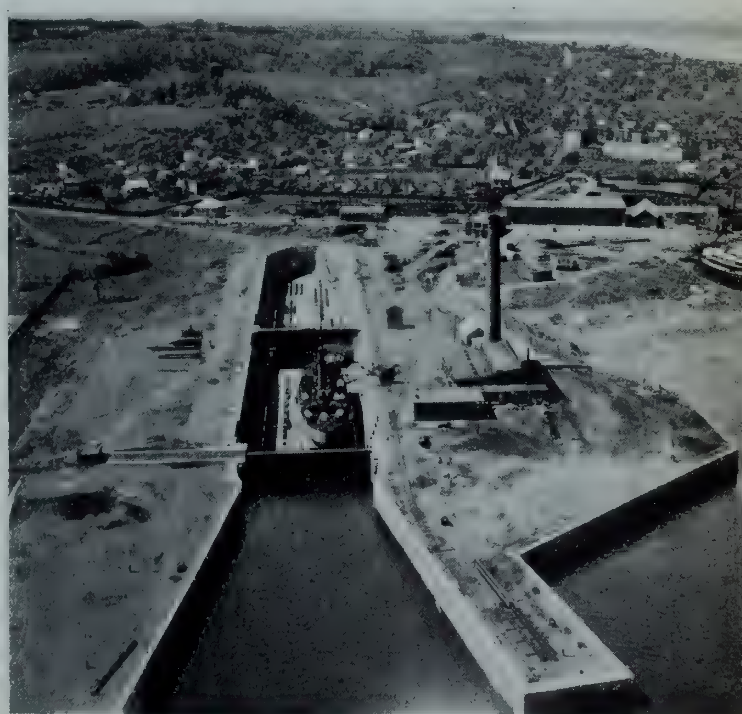
About 1880, the Dominion Government embarked on a policy of providing telegraph service to outlying areas and a considerable mileage of line was constructed in eastern Canada and in the then Northwest Territories. In 1918, the total mileage of wire amounted to 11,711 miles. This has been reduced since that date to 11,513 miles, partly by the sale and abandonment of lines in settled areas to private telephone or telegraph companies. In 1928, 2,092½ miles of line were sold to the B. C. Telephone Company. During the period since 1918, the service has continued to be used extensively; lines exist in every province of Canada except Manitoba, and in the Yukon Territory and Newfoundland. In 1942, an income of $224,468.00 was received from some 474,311 messages. The service has been of immense benefit in outlying areas, particularly to the fur and mining industries, to fisheries, and in the enforcement of law and order. The telegraph lines which followed the coast and the submarine cables leading to adjacent islands, largely to serve lighthouses in peace time, now form a vital network available for defence purposes. A limited telephone service is also provided. Since 1930, this branch of the Department has been under the direction of F. G. Sims, General Superintendent of Telegraphs.

Under the direction of C. D. Sutherland, Chief Architect, practically all Dominion public buildings across Canada are erected and maintained by the Architect's Branch. This work is well known to the public. Post offices, customs and federal buildings, armouries and military hospitals form part of the list. While Ottawa is justly proud of the Confederation and Justice Buildings, and the National Research Buildings on Sussex Street and the Montreal Road, the list of notable buildings constructed within twenty-five years by the Department, outside Ottawa, includes Postal Station "A" in Toronto, the Post Office in Hamilton and the Federal Building in Winnipeg.

To undertake to describe the major works carried out by the Chief Engineer's Branch of the Department during the past twenty-five years would be impossible in the limited space available, but a few of these works may be mentioned.

Between 1918 and 1926, three graving docks capable of accommodating the largest vessels afloat were completed in Canada. The Champlain dry dock at Lévis, Quebec, had been started in 1911 but the project was ultimately completed in 1921. In 1920, the new Esquimalt graving dock was commenced and carried through to completion in 1926. Both of these works were constructed, and are owned and operated, by the Department of Public Works. In 1923, the Saint John graving dock, constructed on the east coast of Saint John, New Brunswick, was completed by the St. John Dry Dock and Shipbuilding Company under the Dry Dock Subsidies Act. This provided Canada with docks of approximately the same dimensions, with lengths varying from 1150 to 1164 ft. 6 ins., widths varying from 125 to 131 ft. and providing a depth of 40 ft. over the entrance sill, located on each coast and on the St. Lawrence river. At Esquimalt, one of the dry docks operated by the Public Works Department, travelling cranes from five to fifty tons capacity, and a one-hundred ton stationary derrick are provided by the Department to be used by con-

**The Champlain dry dock at Lévis, Que.**




**The new graving dock at Esquimalt, B.C.**

tractors on ship repairs, on a rental basis. At Champlain dry dock these facilities must be provided by the contractors.

On the Pacific Coast, extensive development and improvements have been carried out on the Fraser river, which in peace time carries a very great volume of shipping. By the construction of jetties, the protection of banks with rock and extensive dredging, the flow of the river has been concentrated in a fairly direct channel through the sand bars existing between New Westminster and the Gulf of Georgia. The depth of water available for vessels at low water has been increased from sixteen feet in 1918 to twenty-one feet in 1942. Assembly wharves for shipment of lumber were constructed at Nanaimo and Port Alberni, and harbour improvements carried out at Victoria. In the Prairie provinces a large reinforced concrete seed-cleaning plant designed by C. D. Howe and Company was erected at Moose Jaw, and extensive dyking has been carried out on the Assiniboine and Roseau rivers for protection against flooding.

During the years of depression, considerable sums of money were provided for the relief of unemployment, and construction work not customarily undertaken by the Public Works Department was carried out. While the Dominion of Canada, through the Department, assists in the construction of international and interprovincial bridges, it is not customary to construct highway bridges, which come within the jurisdiction of provincial governments. However, in 1932-37, highway bridges were constructed over the Red river at Selkirk, Manitoba, over the South Saskatchewan river at Outlook and over the North Saskatchewan river at Borden, Saskatchewan. These bridges, when completed, were turned over to the provincial governments for maintenance and operation. International bridges were constructed at Edmundston and Clair over the St. John river and at Vanceboro over the St. Croix river in New Brunswick in conjunction with the United States Government. An interprovincial bridge was constructed over the Ottawa river at Hawkesbury. Extensive bank protection and drainage work was also carried out from special funds provided for the relief of unemployment.

In the province of Ontario the construction of rock mound breakwaters and extensive dredging at Port Arthur and Fort William, the construction of a terminal elevator at Prescott, harbour improvements at Toronto, and the construction of Burlington bridge, were major works carried out. Harbour developments which should also be mentioned in the province of Ontario are those at Midland, Collingwood, Goderich, Windsor, Leamington, Port Stanley and Hamilton.

In Quebec, the construction of Fryer's Island dam in connection with improvements on the Richelieu river, the construction of Queen's wharf at Quebec, and harbour developments at Sorel, Matane and Rimouski, together with the construction of piers at Havre St. Pierre and Baie Comeau, may be mentioned.

In the maritime provinces, terminals have been built for the Wood Islands-Caribou ferry between Prince Edward Island and Nova Scotia, and harbour developments at Pictou and Brooklyn. Much of the development of Courtenay bay and St. John harbour was also carried out by this Department before being taken over by the National Harbours Board.

Changes have occurred during the last quarter of a century in the kinds of material used in the construction of wharves, breakwaters, etc. While timber, rock and concrete are used most extensively, the treatment of timber with creosote as protection against sea-borers—the teredo and the limnoria—has come into very wide use, as well as the treatment of superstructures for preservation against decay. Previous to 1920, little treated material had been used, although some treated southern pine had been imported from the United States. At that time, the Canada Creosoting Company had plants at Trenton, at Transcona in Manitoba, and had just completed one at North Vancouver. In the early twenties, however, a number of plants for the creosoting of timber were constructed across Canada, and the use of creosoted B. C. fir, pine and hardwood has continually increased until, at the present time, creosoted material is used in practically all timber structures built along the coast. Creosoting timber for protection from sea worms is invaluable, and the treatment of timber superstructures, where used, against decay is becoming more and more common.

About 1930, the use of steel sheet piling for wharf construction was introduced in Canada through an agency of the British Steel Piling Company, Limited, of England, and a number of structures were built of Larssen piling. In 1934, the Algoma Steel Company commenced the manufacture of steel sheet piling and subsequently numerous wharves were constructed of this material, particularly on the east coast and the Great Lakes. On the west coast, where large sizes of timber and long lengths of piling have been plentiful, pile wharves have been adhered to almost entirely. Due to the prevalence of teredo, creosoting of piles is very necessary on this coast. Practically no cribwork or steel sheet pile work has been used in British Columbia. Since the outbreak of war in 1939, little steel sheet piling has been available for use in Canada, due the the requirements for steel in war industries. Lack of steel has also reduced the quantity of reinforced concrete used.

In 1918, the Department owned and operated a very considerable dredging fleet employed on both the Atlantic and Pacific coasts, the Great Lakes and in the interior waters of the Prairie provinces and British Columbia. Subsequent to 1918 a great portion of this fleet was disposed of and more dredging has been carried out by private contract. A part of the fleet of dredges is still maintained and operated by the Department, affording valuable information as to the actual cost of dredging, which serves as a check on contract rates.

Supervision of the construction of private structures, insofar as they may interfere with navigation, is controlled by the Department through the operation of the Navigable Waters Protection Act, which requires the approval of the Governor General in Council for any structures built in or on a navigable waterway. On the submission of the plan

(*Continued on page 327*)

# ENGINEERS IN THE CONSTRUCTION INDUSTRY

J. B. STIRLING, M.E.I.C.
*Vice-President, E. G. M. Cape and Company, Contractors, Montreal,*
*President, Canadian Construction Association*

It will be remembered that, before the last war, most of the engineers engaged in or by the construction industry were then employed as field engineers or instrument men. Even these were few in number. The professional engineers, architects, engineers of public works, railway district or resident engineers, besides making the designs, did practically all their own layout work, and only rarely did the construction forces carry engineers on their staffs.

**Grain storage elevators and flour mill on the Welland Canal, near Port Colborne, Ont.**

At that time, university courses in engineering had not long been established, and the numbers of engineering graduates in the country were small, but nevertheless, despite the fact that a considerable amount of engineering construction had been carried out in recent years, the engineer had not yet demonstrated to the construction industry that there was a wide field of usefulness for him in the construction organization. Moreover, the engineer or architect, whether employed by the government or by a private client, had not made the demands upon the construction industry that are now made in relation to the industry's responsibility for quality, correctness and records of work—demands which, to be met, required the employment of engineers.

During those pre-war years there was, however, an interesting development. A few engineers who had been employed on construction—chiefly on supervision—decided to enter the construction field themselves. Some of these men, possessing the proper balance between technical skill and the commercial instinct, and being endowed with the necessary resourcefulness, integrity, optimism and perseverance, combined with robust health, made an unqualified success of their ventures. They earned the respect and confidence of their fellow-engineers who were engaged in strictly professional work, and had to supervise the execution of their contracts. Others, unfortunately in the majority, found the going not to their liking, and returned to activities to which their talents were better adapted.

Thus it is seen that in the first decade of this century the engineer's place in the construction industry was a comparatively unimportant one. To-day it can be said that the industry is dominated by engineers—that is, the engineer, with few exceptions again, is actually the owner or operating head of the majority of construction companies carrying out the important projects throughout the country. In the membership lists of The Engineering Institute of Canada and of the Canadian Construction Association there are many names common to both; their number is increasing yearly. Such membership in The Engineering Institute is, moreover, not confined to the principals of such construction companies, but is held also by other categories of contractors' personnel, such as superintendents, field engineers and draughtsmen. In some of the larger companies, encouragement has been given—and will be given more freely in the future—to the employment of younger engineers as foremen, timekeepers or material checkers, for the mutual advantage of both the company and the man concerned. There are to-day some very excellent superintendents who as young engineers were far sighted enough to forget, temporarily at least, the "professional" attitude, and give a few years to learning the construction business at first hand.

This successful invasion of the construction industry by engineers has followed the considerable changes which have occurred not only in that industry, but also in industry at large. Some of the changes in the construction industry may be mentioned here:

1. Construction has become much more competitive. In proportion to the amount of work offered, there has been a notable increase in the number of construction companies and individuals engaged in the business. This severe competition has resulted in very low profits, and there is, without question, a greater "casualty list" in that business than in most others. To survive, the contractor must bring to his tendering and operation of work the best skill and judgment that he can obtain.

2. New construction methods demand, for their proper execution, personnel which understands the reason for and the importance of doing work in the manner planned and specified.

3. Engineers in charge of the design and supervision of projects have a somewhat changed attitude towards the execution of the work. To-day it is fairly common practice, for example, to give a contractor a bench mark and a base line, after which, in many cases, the balance of the engineering work on the project is the contractor's job, if not responsibility. This work is of course subject to the supervising engineer's checking, which, if the contractor has the engineer's confidence, is not very elaborate. This procedure extends to other features in the work, so that in the main the resident engineer's duties, apart from his usual duties as supervisor, have become largely a matter of checking the figures of the contractor's engineer as far as actual "instrument work" is concerned. In general, this manner of carrying out work is working out well, and while it means at times a sizeable engineering staff in the contractor's organization, the results in the end appear to be satisfactory to both the supervising engineers and to the contractors.

4. Construction on many projects has, for reasons best known to owners, been commenced prior to the completion of plans and specifications. Thus, it frequently becomes necessary for owners and their supervising engineers to discuss details of the proposed work with the contractors —details of methods, sequences, schedules, etc. Sometimes, alternative methods must be planned and the benefit of the

*(Continued on page 327)*

# LUMBER INDUSTRY

W. J. LeCLAIR, M.E.I.C., M.C.S.F.E.
*Secretary-manager, Canadian Lumbermen's Association, Ottawa.*

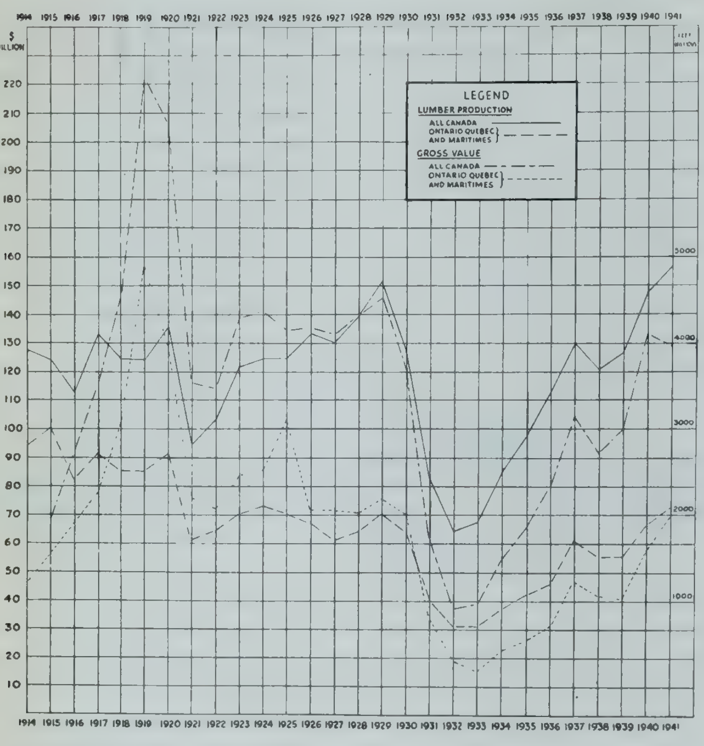



**Fig. 1—Trends in the lumber industry during the past quarter century.**

The Canadian lumber industry welcomes this opportunity of assisting in the marking of a very important anniversary to the engineering profession in Canada. It is peculiarly fitting that lumbering should do so because, traditionally, engineering and lumbering have had much in common and, economically, they are mutually dependent. Wood probably was the first material of construction. References are made in Babylonian lore to its use over 4,000 years ago, and we are all familiar with the Scriptural record of its prominence in the construction of Solomon's temple. Among the respected "Fathers of Engineering," none hold more eminent place than the millwrights Rennie and Telford. In Canada, from earliest times the lumber industry has availed itself of the services of the surveyor and engineer and, in turn, engineering has accepted many thousands of miles of highway locations originally chosen by lumbermen as forest trails and logging roads. The earnings of early Canadian lumbermen provided the capital nucleus for a great part of our railway construction, our hydro-electric development and our more recent pulp and paper and plywood manufacture. With the imminent development of the field of plastics, lumbering already is being most prominently identified.

### Engineering in Lumbering

From the engineering interest point of view, the past twenty-five years have shown a steady development in mechanization in lumbering. From very necessity, brought about by the large size of trees in British Columbia, a high degree of mechanization was early introduced on the West Coast. In the East, however, the traditional methods of logging were continued until about coincident with the general financial collapse of 1929. In the year 1928, the author strongly urged in an address in Montreal the building of truck roads in logging operations and the greater use of the truck. Such ideas, even at that time, were decidedly novel. Now good truck roads are the order of the day and the use of trucks is considered indispensable in logging operations if one is to judge from demands for priorities for automotive equipment and tires.

The construction of conservation dams on many of our large rivers and the resultant development of comparatively large artificial lakes introduced new problems in the transportation of logs. Diesel-powered towing equipment has obtained fairly general use. The old steam-powered paddle-wheel alligator or winch-boat is still in evidence in some places, but it has been largely replaced by designs equipped with screw propeller, and specially designed Diesel tugs are in general evidence. Log chutes through power dams and fish ladders on log-driving dams are further recent developments. The floating of square timber in cribs and rafts was practically discontinued before the advent of the quarter century with which we are dealing and it is now only a matter of fond memory. The British Admiralty, with characteristic immutability, still places an occasional order for "Waney Pine," but delivery to shipside is now made by rail.

### Wartime Lumber Demands

It can be stated quite conservatively that the Canadian lumber industry has been a very material factor in the survival of democracy in the present titanic struggle with the Axis powers. Britain was always a large wood-consuming country. She produced comparatively little lumber herself and depended on imports as indicated in Table I.

TABLE I
Timber Imports into United Kingdom
1934-1938

| Product | % | | Source | % |
|---|---|---|---|---|
| Softwoods—Sawn | | | Europe | 66 |
| Not Further Prepared | 70 | 87% | Canada | 15.5 |
| Planed | 14 | | U.S.A. | 1.5 |
| Box Boards | 3 | | Others | 4.0 |
| Hardwoods—Sawn | | | U.S.A. | 4.6 |
| Not Further Prepared | | | Canada | 1.5 |
| Mahogany, Walnut, | | | Other British | 1.0 |
| Oak and Teak | 3 | 10% | Poland and | |
| Others | 5 | | Jugoslavia | 1.3 |
| Planed | 2 | | Japan | .4 |
| | | | Others | 1.2 |
| Pit Props | 2 | | | 3 |
| Other Timber | 1 | 3% | | |
| | 100 | | | 100 |

Europe was the principal source of her supply, with Canada and the United States materially contributing. The outbreak of war cut off supplies from Europe completely and the enforcement of U.S.A. neutrality legislation prevented the entry of U.S.A. shipping into the war zone. In consequence, Canada became immediately Britain's principal source of timber. Coincidentally, Canada's own tremendous development of a war industry and her assumption of responsibility for the training of Empire airmen, in addition to provision for the immediate establishment of large Canadian naval, army and air forces, made quite unprecedented demands upon her lumber supplies.

A veritable miracle of assembly and delivery of lumber was achieved in Canada during the first two years of war. The succeeding production effort was only slightly less miraculous when one considers the handicaps of depleted manpower, the anaesthetizing effects of price fixing and excess profits confiscation by Government. The lumber trade had been particularly hard hit by the depression which preceded the war, and the fixing of a standard profit on the basis of a four-year depression period worked real hardship and may work ultimate injustice. The competition of Government contractors and munitions industries for labour has resulted in greatly advanced wage scales to the accompaniment of decreased individual worker efficiency due to the replacement of young, physically fit and experienced men with older and inexperienced men and women. Actually, the trade attained an all-time high last year in the matter of production despite handicaps.

Engineers generally are thoroughly familiar with the great quantities of lumber which have gone into construction. They may not be as acquainted with the importance of lumber in equally essential fields. Of most spectacular interest is the tendency to an ever increased production of wooden aeroplanes. The record breaking Mosquito bomber is an all-wood plane and the new Anson construction programme is predicated on practically all-wood construction. As a result of this development in aerial warfare, three Canadian lumber species have attained pre-eminence. Yellow birch veneer and straight-grained lumber have become items of supreme importance and, to ensure their supply, a Crown company known as Veneer Log Supply Limited under the presidency of S. J. Staniforth has been set up with headquarters in Montreal. A similar Government agency known as Aero Timber Products Limited has been set up to handle the production and collection of Sitka spruce. A third development is still in comparative infancy —red pine lumber and veneer is about to replace an imported species.

The construction of wooden ships is attaining ever greater prominence with the famous *Fairmile* and the motor torpedo boat (M.T.B.) claiming most publicity. The outbreak of war saw a share of army motor transport bodies made of wood and later there was a deflection to steel. Now all such bodies in Canadian and U.S.A. production are made of wood and, to meet the abnormal requirements, greatly altered specifications have been adopted by the authorities.

### Economic Trends

A study of the curves in Fig. 1 tells the story of lumber production in Canada during the past quarter century. It is interesting to note that there was a much smaller extra

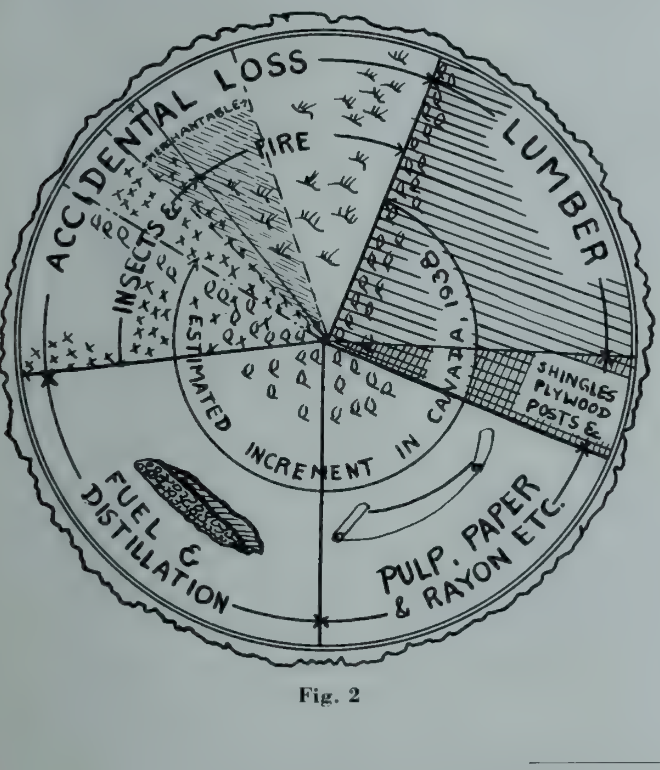



Fig. 2

demand for lumber in World War I than in World War II. Equally interesting is the fact that lumber values did not start to climb until the first war was almost over and reached final dizzy heights only a year after it was over. Economists will no doubt draw comfort from the fact that these statistics prove conclusively that inflation has been prevented insofar as the lumber trade is concerned.

A point of peculiar interest is recovery of the four eastern Canadian provinces in the production field. The public generally believed the fallacy that lumbering in eastern Canada was passé. Actually, last year the four eastern provinces produced more than the whole of Canada did during the depression years. This is a fact which ought to be borne in mind by engineers because it is indicative of what must be in future if this basic industry is to survive. At about the beginning of the period under review, British Columbia started dominating the production picture by reason of her virgin forests of large trees. Doubt naturally developed in the minds of many if lumber produced from the smaller trees and more scattered stands of eastern Canada could compete. Through varying vicissitudes it has been proved that it could, and now with the abnormal drain on British Columbia resources, the supply of extremely large timber is definitely fast declining. With possibly a 300-year growth cycle for British Columbia to contend with against possibly a 75-year cycle in eastern Canada, it is reasonable to suppose that the present generation will see a return of eastern Canada to a position of dominance. The future of Canadian lumber will largely rest with the smaller tree species of the East, and engineers and architects will have to adjust design to utilize smaller sizes of lumber. This has been practised for years in Europe and is steadily gaining acceptance in both eastern Canada and the United States.

### Lumber Industry Future

The industry has learned by sad experience the impossibility of maintaining any degree of stability without organization. The literally thousands of producing units with their unbridled competition in periods of financial panic is principally responsible for the phenomenal decline during the depression years 1930-37. In 1937, a serious attempt was initiated by the white pine trade to correct this condition and other groups have subsequently joined in the effort. Through the medium of the Canadian Lumbermen's Association with its component bureaux dealing with particular problems, the trade is able to look forward to the future with much better heart. An important factor in this movement is the publication of the journal *Timber of Canada* with its weekly supplement *Timber News*. It is through its experience in this publishing effort that it can fully appraise the association value of other journals and in particular the *Journal* of The Engineering Institute of Canada which with this issue celebrates its 25th anniversary. There has been no medium yet devised which can replace the press in the matter of education of the public or broadcasting of ideas with contingent broadening of view and improvement in performance.

From the point of physical adequacy of timber supplies, Canada can take equal comfort. The world supplies of timber are undoubtedly shrinking fast, but Canada needs only the will to provide a perpetual yield. It is to be hoped that the influence of engineers will be found on the side of a sane consideration of this factor in any scheme of post-war rehabilitation. Figure 2 is drawn from data available in the last normal year of operation. It will be seen that natural reproduction alone more than compensates for present depletion if the accidental loss from fire, insects, and disease can be eliminated.

# HIGHWAYS

ERNEST GOHIER, M.E.I.C.
*Chief Engineer, Department of Roads of the Province of Quebec*

**Pavement laid in 1941 on Highway No. 11 near Sainte-Agathe.**

The development and improvement of highways in the different provinces of Canada has not been so spectacular as in some of the states south of us, although steady progress has been made in the right direction.

Extensive programmes of works were planned by all provinces in 1939, but when the war came in early September activities had to be curtailed. Since then it has only been possible to complete a few sections of the highways most urgently needed to help the war effort of our country.

Our programme for the post-war period is being based on a master plan covering: 1. International highways; 2. Interprovincial highways; 3. Regional highways; 4. Local highways. In each of these cases our studies take account of relative density of traffic, construction standards suited to present day needs, and suitable provisions for future requirements.

In 1910, there were only 69,500 automobiles in Canada, and the majority of residents of cities, towns and villages were still using horse-drawn vehicles for transportation purposes. The average rate of travel on highways was therefore about five miles an hour, and, in general, the distances travelled were short. In large cities, nearly everyone used the street cars. In the country, there were few facilities for travelling long distances by road.

In 1915, there were 90,000 automobiles in the country, but horse-drawn vehicles were still the means of transport used by the majority of our people.

Dirt roads, opened long ago, were being improved, but mainly to facilitate the movement of horse-drawn vehicles. The best surfaces on rural roads were of waterbound macadam. They had a very high crown and the width varied from 12 to 16 ft.

In laying out these roads, topographical obstacles had been by-passed in order to reduce grades and thus allow horses to haul heavier loads. This accounts for the great number of winding roads with sharp curves and very little visibility that we have inherited.

Nobody foresaw the rapid development of means of transport by highways which took place at the time of the war of 1914-1918.

In the space of five years, between 1915 and 1920, the progress in road transport was far greater than that of the previous 25 years. As a means of locomotion, the horse-drawn vehicle was largely discarded, so that in 1920, there were 408,000 motor vehicles registered in Canada, moving at an average speed of 25 miles an hour.

Five years later, in 1925, there were 728,000 vehicles with an average speed of 35 miles an hour; and, in 1939, we had 1,235,000 cars moving at speeds of from 30 to 80 miles an hour.

Thus the increase in the number and the speed of motor vehicles was so rapid that it has been quite impossible to transform our network of roads so as to keep pace with the ever increasing requirements of motor traffic.

As soon as a main road was improved, the increase in the density of traffic, the sizes of the motor vehicles and faster speeds that followed, caused the road to become almost obsolete in a year or two. The transportation of merchandise by motor trucks and of individuals by autobus, and the growth of night traffic, have helped in this rapid obsolescence.

Under these circumstances, in Canada as elsewhere, most improved roads now have to be rebuilt according to standards suited to modern transport. We have no real guarantee that the main highways, which we are building to-day, will not be obsolete in ten or fifteen years.

To-day, the situation is that thousands of motor vehicles are moving day and night—twelve months of the year—at high speeds, on roads which cannot be used without danger of accident because of bad alignment, poor visibility, or some other failure to meet present day requirements.

Then there is the personal hazard. Thousands of people are driving motor vehicles without the experience needed to do so safely; thousands of others lack the physical and mental requirements needed to drive such vehicles at high speeds alongside a multitude of other vehicles, pedestrians and cyclists; and other thousands are not imbued with the spirit of discipline and caution required for their own and other people's safety.

Having studied the intensities of traffic on our highways before the present war, we must now prepare for their growth in the future. Increases in population, in the number of tourists visiting our country and in the number of vehicles owned by the Canadian people, must be considered, as well as the fact that a road, once improved, attracts to itself a new volume of traffic.

Once we have established, as best we can, the intensity of traffic for which a given highway should be designed, the next step is to determine what type of road is best suited in that case, consideration being given to the funds at our disposal.

It is evident that no fixed rules can be set for these decisions, but we must be guided by research and by experience in the field. Let us examine rapidly the different types of roads which are available:

1. The two-lane pavement;
2. The three-lane pavement;
3. The four-lane undivided pavement;
4. The four-lane divided highway, or dual highway.

### The Two-Lane Highway

As we all know, the two-lane highway is the type with a pavement, whether concrete or bituminous, 20 to 24 ft. in width, having shoulders from 6 to 10 ft. wide, built of ordinary earth, gravel, crushed stone, or of what is called stabilized material. This type is the most extensively used throughout the world and, at the same time, the most criticized. Why? Because the layman does a lot of loose thinking about its traffic capacity.

The average motorist is inclined to be unduly influenced by conditions met at times of abnormal traffic. He will make a trip on a fine summer day, on Dominion Day or Labour Day, when almost everyone is on the road. He may find evident congestion on the particular road he has chosen to travel; then he decides at once that the road is too narrow; probably, he will assume that the widening is urgent; if he should meet an officer or an engineer of the Department, he will ask him when will this road be widened? And in ninety-five per cent of these cases the only honest answer should be "never," in our time at least. And, this answer would not be as inconsiderate as it may appear, because traffic congestion of only short duration does not justify the heavy expenditure of widening the pavement by the addition of new lanes of travel. In fact, congestion must occur frequently, for periods of reasonable duration, to justify increasing the pavement capacity.

The best gauge we have of the necessity for widening is the year-round average for daily traffic. It has been found that the normal traffic density variations will tend to follow definite patterns for certain months of the year, days of the week and hours of the day.

By applying the known factors to the daily average for traffic, it is possible to estimate with reasonable accuracy the periods when congestion will occur. From data obtained from various sources, we consider that the average daily traffic must exceed 3,500 cars, fifteen to twenty per cent of which are trucks, before more than two lanes are really needed. But some allowance must be made, when the width between fences is only 60 ft. or less, with dwellings, garages, etc., very close to the right of way; when shoulders are narrow, thus forcing vehicles to park near or over the pavement edge; when there are many level crossings, when telephone posts and trees are close to the pavement; when the travelling surface reflects light instead of diffusing it; when the pavement is rather slippery and when pedestrians must walk along the pavement on account of the lack of sidewalks. Under such conditions, the above mentioned safe capacity is lower than 3,000 vehicles per day.

The U.S. Bureau of Public Roads estimate that a properly designed two-lane highway has a capacity of 3,000 to 3,500 cars daily, without apparent congestion. But, as already said, the percentage of truck traffic will greatly influence that capacity. The higher the percentage of trucks, the lower the safe capacity of the road, because of the difficulties of overtaking vehicles of such large dimensions.

With such a basis for determining the standards to be adopted and used, then what percentage of our roads will need widening from two lanes to three or four lanes? The author's opinion is that not more than five per cent of our highways will need more than two lanes for many years to come.

### The Three-Lane Road

The safe capacity of a three-lane highway is generally estimated to vary between about 6,000 and 10,000 vehicles per day. This type of road which ordinarily consists of three 11-ft. lanes of concrete or asphalt, and, in some cases, of both, is not unanimously recommended or approved. In certain parts of Canada, a three-lane pavement is preferred to an undivided four-lane roadway. In the Middle-West of the United States, there is a tendency to avoid such type of construction, but, in the eastern states, many lines of such road have now been built and after a careful study of accident records on them, it has been shown that the rate of accidents is lower on a three-lane than on a four-lane undivided pavement, if it is built according to standards suitable to this type of road. It requires better curves and visibility than does a two-lane pavement.

There is a definite place for the three-lane highway, because if we were to ban this particular type of road, the result would be that many miles of two-lane highways, now overcrowded, would never get any relief, because of the much higher cost of four-lane pavements. While a three-lane pavement is acceptable, it should be decided upon only after a very serious study of each individual case, to make sure that on a given road this type will be suitable to traffic requirements.

For this type of road, the author would favour a different colour for the centre passing lane. If the two side lanes are of concrete, the centre lane should be either asphalt or black concrete, or vice-versa, so that each lane may be well delimited and that vehicles may be induced to travel on the outside lanes, except when overtaking other vehicles.

On certain roads, where the need for a four-lane pavement is not urgent at the moment, but may arise in a not too distant future, the speaker would recommend an asphalt centre passing lane, which could be removed later on, and used as a medium strip, and the road converted into a dual four-lane highway by the addition of two concrete lanes.

### Four-Lane Undivided Pavement

The capacity of a four-lane undivided pavement is about 10,000 to 20,000 vehicles per day. A few years ago, in an address delivered before the American Association of State Highway Officials, the speaker stated that he would have liked to see a four-lane divided highway endorsed by all, and that any highway engineer should be ashamed to build a four-lane undivided highway.

I do not agree with the above mentioned statement because I still believe that there is room for the four-lane undivided highway.

Undoubtedly, from the standpoint of safety, the divided highway is superior, and this fact alone is enough to justify the extra cost per mile, but in certain built-up areas the solid four-lane highway is necessary because of the almost prohibitive cost of acquiring bordering properties.

Finally, there is another factor favouring the four-lane undivided pavement. This is its flexibility which is of great advantage where large volumes of traffic move in one direction only at certain hours of the day, towards business and office districts in the morning, and in the opposite direction in the late afternoon. At such times, three of the four lanes, on one side, can be used for the traffic in one direction, the procedure being reversed when the heavy traffic moves in the other direction.

### Four-Lane Divided Highway

The four-lane divided or dual highway has the great advantage of separating opposite flows of traffic, prevents the glare of head-lights of cars coming in the opposite direction, and allows a refuge in the centre at intersections. These things make it much safer, but not necessarily of greater capacity, than the four-lane undivided road. The capacity of such a road is from 15,000 to 25,000 vehicles per day, but, if side accesses are limited and separation of grades provided at important intersections, its capacity will be greatly increased.

### Standards of Construction

The standard to be adopted for each of these kinds of main highway is based on the actual density of traffic, plus an allowance for a certain percentage of reasonable increase during the next twenty to twenty-five years. Allowance will also be made for increases in average speed of traffic, weight of vehicles, and in night driving, which necessitate better alignments, grades and visibility.

Furthermore, the maximum degree of curvature should be four degrees. Any increase in speeds allowed should cause us to follow the example of railways in their layout, in adopting the system of easement curves or spirals which is so largely used in the United States. Also, on account of increases in speeds and volume of traffic, we shall provide these main highways with visibility of not less than 1,000 to 1,200 ft.

### Intersections

The most important intersections should be taken care of by means of well designed clover leaves, or by traffic circles of a diameter not less than 500 ft. with appropriate curves and spirals.

### Rights of Way

As far as rights of way are concerned, it may be noted that, in 1920, Quebec was the only province which had the old French standard width of 36 French ft. (equal in British measure to 38 ft. 4½ in.) for its rights of way.

(*Continued on page 327*)

# IN RETROSPECT

## THE ENGINEERING JOURNAL

This number of the *Journal* marks a special milestone. Twenty-five years of service to the members and to the profession is quite an accomplishment, but it can be considered as just a prelude to the experiences which are ahead. The *Journal* must continue its policy of progress, using each year's attainment as stepping stones to new levels. In an enterprise of this kind there can be no standing still. The constant endeavour must be to give more and better leadership, encouragement and support to those things which are worth while.

By way of reviewing history, and paying tribute to those stalwarts who did so much, and in many cases are still doing so much for the Institute, some reference is being made by word and picture to events of 1918. The following extracts from volume number one should prove interesting to to-day's readers, particularly to those who knew the Institute twenty-five years ago.

It is impossible to recall everything that occurred at that time without reprinting the whole volume. It is hoped that the following references will bring pleasant pictures of the past to many. To those less fortunate persons who were not privileged to know the Institute at that time it is the earnest wish of the editor that these quotations, at least to some extent may make up for the lack.

## THE FIRST VOLUME AND ITS SPONSORS

A glance at the *Journal's* first volume (for 1918) shows that the Institute's new venture got away to a good start. The contents are so varied that it has been difficult to choose extracts which give a fair idea of its character. An attempt has been made, however, and in the following pages we present a few of selected items, with brief explanatory notes attached. Lack of space has prevented the inclusion of many others, which, like those which are given, would be likely to remind many older members of the work accomplished so successfully twenty-five years ago by men whom they knew and esteemed. Some of these are named in the following list of members of Council and Branch officers for 1918:

### COUNCIL

*President*

H. H. Vaughan, Montreal

*Vice-Presidents*

T. H. White, Vancouver
J. M. R. Fairbairn, Montreal
H. E. T. Haultain, Toronto
R. F. Hayward, Vancouver

*Past Presidents*

F. C. Gamble, Victoria
G. H. Duggan, Montreal
J. S. Dennis, Montreal

*Councillors*

J. R. W. Ambrose, Toronto
N. E. Brooks, Sherbrooke
Ernest Brown, Montreal
A. R. Decary, Quebec
H. Donkin, Halifax
A. E. Doucet, Quebec
L. B. Elliot, Edmonton
Walter J. Francis, Montreal
Peter Gillespie, Toronto
J. H. Kennedy, Vancouver
E. D. Lafleur, Ottawa
D. O. Lewis, Victoria
H. Longley, Woodman's Pt., N.B.
G. D. Mackie, Moose Jaw, Sask.
M. H. MacLeod, Winnipeg
E. G. Matheson, Vancouver
G. A. McCarthy, Toronto
D. H. McDougall, Sydney, N.S.
John Murphy, Ottawa
Wm. Pearce, Calgary
F. H. Peters, Calgary
J. M. Robertson, Montreal
D. A. Ross, Winnipeg
R. A. Ross, Montreal
H. R. Safford, Montreal
Julian C. Smith, Montreal
J. G. Sullivan, Winnipeg
Arthur Surveyer, Montreal
L. A. Thornton, Regina
James White, Ottawa

*Treasurer*

Ernest Marceau, Montreal

*Secretary*

Fraser S. Keith, Montreal

Branch Officers

CALGARY
William Pearce, *Chairman*
C. M. Arnold, *Sec.-Treas.*

EDMONTON
L. B. Elliot, *Chairman*
A. W. Haddow, *Sec.-Treas.*

KINGSTON
Activities discontinued until the close of the war

MANITOBA
W. Arch'd Duff, *Chairman*
G. L. Guy, *Sec.-Treas.*

MONTREAL
Walter J. Francis, *Chairman*
Frederick B. Brown, *Sec.-Treas.*

OTTAWA
G. Gordon Gale, *Chairman*
J. B. Challies, *Sec.-Treas.*

QUEBEC
A. E. Doucet, *Chairman*
W. Lefebvre, *Sec.-Treas.*

SASKATCHEWAN
G. D. Mackie, *Chairman*
J. N. deStein, *Sec.-Treas.*

TORONTO
Peter Gillespie, *Chairman*
Geo. Hogarth, *Sec.-Treas.*

VANCOUVER
E. G. Matheson, *Chairman*
A. G. Dalzell, *Sec.-Treas.*
C. Brackenridge, *Acting Sec.-Treas.*

VICTORIA
R. W. MacIntyre, *Chairman*
E. G. Marriott, *Secretary*
E. Davis, *Treasurer*

## THE NEW DEVELOPMENT

President Vaughan's message, printed on page one of the first number of the *Journal* said in part:

"Our new development may be ambitious but it contains great possibilities. In spite of the terrible times through which we are passing, the results, so far, are most encouraging. Our membership applications are not only increasing in numbers but include many eminent engineers who had not previously joined our Society.

"Our first professional meeting was most successful, thanks to the ability and hard work of the officers of the Toronto and Ottawa branches. This *Journal* is the commencement of another effort to carry out our programme and let us all wish it success and endeavour to promote its success by every means in our power."

## THE FIRST GENERAL PROFESSIONAL MEETING

This meeting was held in Toronto, on March 26th and 27th, 1918. It was devoted to "a discussion of the present fuel and power situation in Toronto and marked a new era in the affairs of the engineers in Canada by meeting to discuss a question of general public interest." As a result of the two days deliberations, a committee of council was appointed to bring in a final report, based on a series of papers dealing with the best way of utilizing Canada's coal resources, fuel conservation, the possibilities of central heating systems, heating by electricity, and water power development. Among those taking part in the conference were B. F. Haanel, W. M. Neal, W. J. Dick, Edgar Stansfield, John Blizard, L. M. Arkley, E. J. Zavitz, Arthur Hewitt, F. G. Clarke, R. W. Caldwell, J. B. Challies, John Murphy, J. M. Robertson, P. H. Mitchell and H. G. Acres.

## THE CHANGE OF NAME

In the first number, dated May, 1918, appeared the following editorial statement:—

"The name, The Engineering Institute of Canada, was officially recommended by the Committee on Society Affairs at the same time that this committee submitted the new By-Laws. That the change in name met the general approval of all was shown by the overwhelmingly large majority in favour of the new name, demonstrated by the return of the ballot opened at the Annual Meeting on January 23rd. Council appointed a committee, consisting of the president and Messrs. R. A. Ross and Walter

Group of members attending the First General Professional Meeting of the Institute, at Toronto, March 26-27, 1918.

No complete identification of the persons in the picture is available. It is suggested that members who can provide some information use the accompanying key and communicate their findings to Headquarters.

J. Francis to take the necessary steps to secure the legal adoption by the Society of the name, The Engineering Institute of Canada. A bill was presented to Parliament for this purpose.

Sir Herbert Ames kindly sponsored the bill in the Commons and, in a letter received from him under date of April 17th, he advised that the bill had passed the Private Bills Committee of the House of Commons and went through the Lower House without amendment on April 11th.

"In the Senate, Senator Casgrain, who was the only corporate member of the Institute in either the Commons or Senate at Ottawa, when the suggestion was made to him regarding seeing the bill through the Senate stated that he was glad to have the opportunity. The bill passed the Senate on April 25th, but before its use was legal it was still necessary to receive the assent of the Governor-General. This has just been given."

The formation of three new branches was also announced, at Montreal, Saint John and Halifax, the latter involving a merger with the existing Nova Scotia Society of Engineers.

"The formation of the Halifax Branch completes the chain from ocean to ocean of Societies under one national organization, wherein the welfare of the members of the engineering profession is receiving consideration."

The first chairmen of these branches were respectively, Walter J. Francis, Alexander Gray and F. A. Bowman.

### THE JOURNAL'S SECOND NUMBER

Some questions of the day actively discussed in 1918 are still with us. The second number of the *Journal* (June) has an editorial from which the following is a quotation:

"In the early days of the war, before the significance of the struggle was understood, no one of us experienced either surprise or abhorrence when we learned of military preferment on the basis of political control or family connection. In these days of strain and stress we are just beginning to realize the great sacrifices of life and material which have come about almost directly through the most unaccountable stupidity of our nation, in tolerating for so long the control of politicians in the administration of public affairs, and more particularly in the control of matters relating to the war. Individually we effervesce and boil, but collectively we are inactive and supine.

"Disturbing rumours have come to our ears from time to time of late with respect to preferment in military appointments, and these should be investigated. Time and again we have been told of responsible appointments in engineering corps being given to the less qualified, while the more experienced are passed by. To be more specific, we hear of men of the legal profession, without administrative or engineering training of any kind, being appointed as engineer officers, while trained men of the engineering profession, men of affairs, men who have had charge of operations, who have had supervision of workers, and have had superior training in engineering, are left in the ranks."

This sounds somewhat like reflections which are being made in 1943!

In the same issue a tribute was paid to the services of one who had carried on the arduous duties of secretary of the old Canadian Society of Civil Engineers from 1891 to 1916 and who died in the following year. A tablet to his memory, placed in the hallway of 2050 Mansfield Street, Montreal, reads as follows:

IN MEMORY OF
PROFESSOR C. H. McLEOD, Ma.E.,
WHO WAS FOR TWENTY-FIVE YEARS
SECRETARY OF THIS SOCIETY
DIED 1917

From the July number there has been taken a group picture which shows that even in war time, some engineers were able to relax at intervals from their pressing work. Fortunately some of the figures in the group on the next page are still with us and in good health.

A group of members, on board the *S.S. Loretta*, inspecting the Trent Valley canal on the opening day, June 3rd, 1918. *From left to right:* W. A. Bowden, C. N. Monsarrat, A. T. Phillips, A. L. Killaly, R. L. Dobbin, D. E. Eason, A. J. Grant, past president of the Institute who has just celebrated his eightieth birthday.

## THE SECOND AND THIRD PROFESSIONAL MEETINGS

The Second Professional Meeting was held in Saskatoon on August 8th, 9th and 10th. Its principal topics were road construction and water supply in the prairie provinces, the effect of alkali on concrete, the fuels of western Canada, and legislation respecting the status of engineers. The western branches deserved, and received, great credit for this very successful gathering.

It was followed in September by the Institute's Third Professional Meeting, sponsored by the newly organized but very active Halifax Branch. A group of notable members who attended it is shown on the next page.

## PROFESSIONAL STATUS

The legal status of the engineer was one of the subjects discussed at the Saskatoon meeting, but as might be expected, opinions differed somewhat as to the best method of procedure. The Council, of course, realized that there was a growing demand throughout Canada for legislation on this matter, and the *Journal* in its November issue, had the following to say on the subject:

"From the discussion which has already taken place at some of the western branches it is quite evident that at the moment there is considerable diversity of opinion as to the definite form which legislation should take and that much discussion must follow before a draft Act can be prepared which has been agreed to by all branches and approved by Council.

"The intense interest which has been aroused shows clearly that there is a feeling on the part of the average engineer in Canada that something should be done, and soon. It is evident that there never was a more opportune time for the engineering profession to come into its own than at the present moment. Both during the present war and for a long period thereafter the engineer must play a very prominent part and it is natural that he should assume the position in which the importance of the work he is doing, in a national manner, would be recognized.

"Whatever the form any legislation that is to be sought, may take, it must be founded on the basic principle, that, in securing the elevation of the profession, who are members of the Institute, no attempt should or will be made to insert any clause or clauses, either designed to force engineers to join the Institute or to interfere in any way with the rights of qualified engineers, who are non-members other than to give them the benefits that they as qualified engineers may gain by any legislation which may be effected, dealing with the interests of engineers in general."

SECOND PROFESSIONAL MEETING OF THE INSTITUTE, UNIVERSITY OF SASKATCHEWAN, SASKATOON, AUGUST 9TH, 1918

(1) W. G. Chace, (2) Geo. W. Craig, (3) J. G. Legrand, (4) A. S. Dawson, (5) F. H. Peters, (6) W. C. Murray, (7) President H. H. Vaughan, (8) Wm. Pearce, (9) Geo. D. Mackie, (10) L. A. Thornton, (11) R. F. Uniacke, (12) A. G. Dalzell, (13) Prof. A. R. Greig, (14) Geo. L. Guy, (15) W. T. Brown, (16) Mrs. J. E. Underwood, (17) Mrs. W. T. Brown, (18) Mrs. J. R. C. Macredie, (19) Mrs. L. A. Thornton, (20) Fraser S. Keith, (21) Mrs. G. D. Mackie, (22) Mrs. W. T. Thompson, (23) Mrs. Robertson, (24) Mrs. W. M. Stewart, (25) Mrs. H. McIvor Weir, (26) A. W. Lamont, (27) R. C. Gillespie, (28) J. R. C. Macredie, (29) J. McD. Patton, (30) P. R. Genders, (31) Prof. J. McGregor Smith, (32) G. R. Pratt, (33) E. C. A. Hanson, (34) N. H. Marshall, (35) H. S. Carpenter, (36) D. A. R. McCannel, (37) J. N. deStein, (39) Mrs. A. R. Greig, (40) Prof. D. A. Abrams, (41) C. P. Richards, (42) Mrs. W. H. Green, (43) G. M. Williams, (44) H. A. Bergeron, (45) W. H. Greene, (46) Mrs. Lamb, (47) H. R. McKenzie, (48) J. D. Robertson, (49) H. M. Thompson, (50) B. Stuart McKenzie, (51) E. E. Brydone-Jack, (52) H. M. VanScoyoc, (53) C. M. Arnold, (54) W. J. Ireland, (55) J. E. Underwood, (56) E. Skarine, (57) C. J. Yorath, (58) M. A. Lyons, (59) L. B. Elliott, (60) E. L. Miles, (61) W. M. Scott, (62) H. McI. Weir, (63) E. G. W. Montgomery, (64) W. M. Stewart, (65) D. W. Houston.

THIRD PROFESSIONAL MEETING OF THE INSTITUTE
HALIFAX, SEPTEMBER 12TH, 1918

(1) Andrew Wheaton, (2) Geo. A. Ross, (3) Fraser S. Keith, (4) A. R. Crookshank, (5) K. H. Smith, (6) F. A. Bowman, (7) Alex. Gray, (8) Hon. O. T. Daniels, (9) H. H. Vaughan, (10) His Hon. Lieutenant Governor J. McC. Grant, (11) C. E. W. Dodwell, (12) Mayor Hayes of Saint John, (13) D. W. Robb, (14) Phil Freeman, (15) M. K. McQuarrie, (16) Jas. T. Duke, (17) Edwin Fraser, (18) R. Montgomerie, (19) C. C. Kirby, (20) P. H. Mitchell, (21) Geo. F. Porter, (22) G. Stead, (23) G. S. Macdonald, (24) Major F. G. Goodspeed, (25) R. J. Sly, (26) W. Rodger, (27) W. P. Morrison, (28) Allan H. Wetmore, (29) J. J. Macdonald, (30) H. B. Pickings, (31) L. H. Wheaton, (32) D. L. Hutchison, (33) Fred. G. McPherson, (34) R. H. Smith (35) Frank A. Gillis, (36) Major Sinclair, (37) Ira P. McNab, (38) J. S. Misener, (39) O. S. Cox, (40) W. H. Noonan, (41) B. M. Hill, (42) J. R. Freeman, (43) A. J. Barnes, (44) A. C. Brown, (45) A. F. Dyer, (46) F. H. McKechnie, (47) G. N. Hatfield, (48) Geo. G. Hare, (49) G. G. Murdoch, (50) C. M. Crooks, (51) John P. Mooney, (52) H. L. Seymour, (53) Leslie E. Kendall, (54) C. C. Forward, (55) N. F. Cook.

---

A comparison of the first and the twenty-fifth volumes of the *Journal* helps to give an idea of the development of the Institute since its change of name in 1918, and also of the trend of events during the past twenty-five years. War unfortunately is again with us, and in an even more devastating form. We have not yet been able to announce a cessation of hostilities, as we did in the first volume. There was no armistice editorial last year.

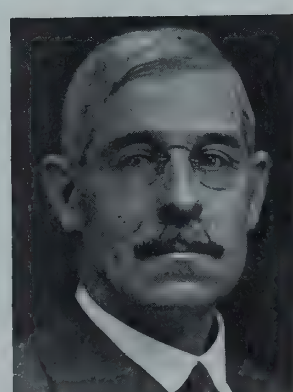
Questions of public interest, however, are more prominent in the *Journal* to-day than in the early days. Many of these, naturally, are connected with our war effort. A few topics of this kind dealt with in our last volume may be named here: post-war planning, national efficiency in wartime, manpower control in Canada, engineering aspects of structural defence; these are examples.

The *Journal* has been able to follow and record the marked progress that has been made in the field of professional organization in Canada, and in the Institute's co-operation with sister societies. Our Institute professional meetings, if not so frequent as in 1918, are held in spite of war difficulties, call together a larger attendance, and are backed up by excellent technical meetings and discussions arranged by our twenty-five branches:

It is not easy to bring home to the widely scattered membership of a body like the Institute the part that each can take in its administration. Much has been accomplished in this respect, however, by the policy which successive councils have adopted of holding as many regional council meetings as possible, and inviting to them officers and representatives of local branches. Council proceedings are now more fully reported. In these and other ways the *Journal* has had a powerful influence in bringing our membership together. Its personal columns have done much to help.

In its present form, the *Journal* has met with the general approval of the Institute members. The editorial staff and the Publication Committee will do all they can to see that this approval will continue, and that the *Journal's* progress will be maintained.

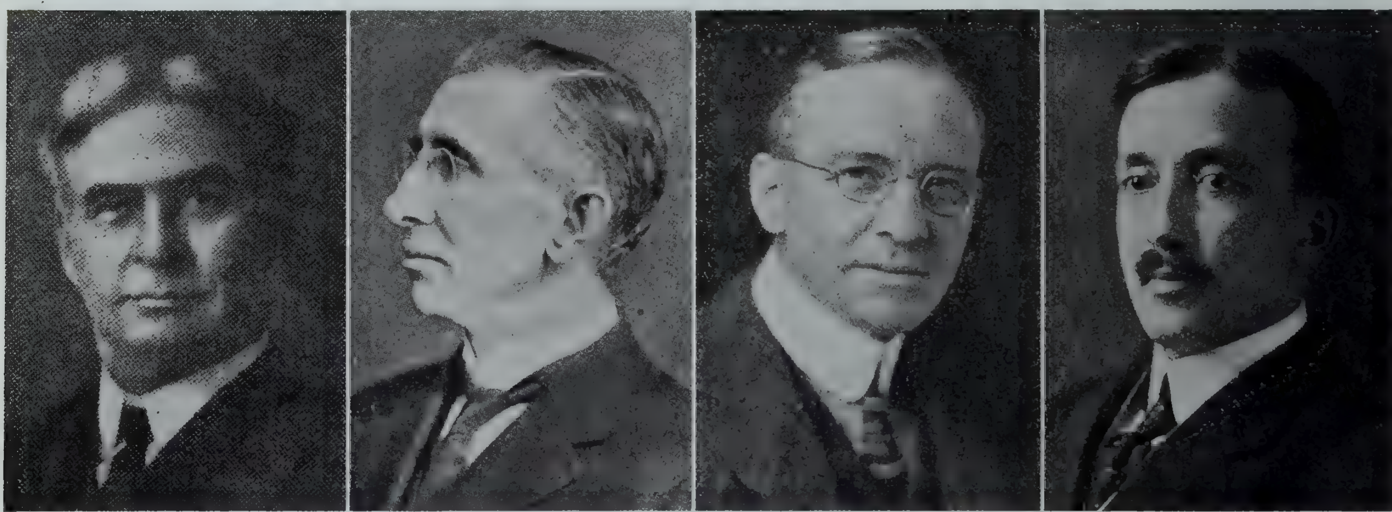
Fraser S. Keith, M.E.I.C.
First Editor of
*The Engineering Journal*,
from 1918 to 1925



R. J. Durley, M.E.I.C.
Editor of
*The Engineering Journal*,
from 1925 to 1938

# ALBUM OF PORTRAITS FROM 1918 *JOURNAL*

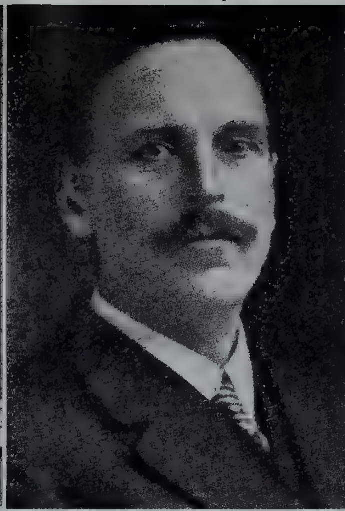
H. H. Vaughan was president of the Institute; G. Gordon Gale was chairman of the Ottawa Branch of the Institute while J. B. Challies was its secretary-treasurer; J. R. W. Ambrose was a councillor of the Institute representing the Toronto Branch.



In 1918, the above were members of Council: E. G. Matheson representing the Vancouver Branch; John Murphy, Ottawa Branch, F. H. Peters, Calgary Branch; Arthur Surveyer, Montreal Branch.

F. A. Bowman was chairman of the Halifax Branch; J. M. R. Fairbairn was a vice-president of the Institute; J. N. deStein was secretary-treasurer of the Saskatchewan Branch; Alex. Gray was chairman of the Saint John Branch.






K. H. Smith was secretary-treasurer of the Halifax Branch; Professor H. E. T. Haultain was a vice-president of the Institute; A. G. Dalzell was secretary-treasurer of the Vancouver Branch; Professor Ernest Brown of McGill was a councillor of the Institute representing the Montreal Branch.

## AN ENGINEERING RENAISSANCE

FRASER S. KEITH, M.E.I.C.

It is difficult to realize that twenty-five years have passed since the first issue of *The Engineering Journal* appeared in May 1918, as the events leading up to its appearance are so clearly etched upon my memory. To the suggestion that at this time I give some personal recollections and record some of the events of twenty-five years ago, particularly those which brought the *Journal* into being, I gladly respond.

The fact that the Canadian Society of Civil Engineers was considering changes in connection with the conduct of its affairs and the fact that the Society's prestige had not been quite in proportion to the influence of its individual members, inspired me to write an editorial in *Construction*—a journal for the engineering, contracting and architectural interests of Canada—which appeared in its issue for February, 1917. This editorial said in part:

"When we consider the qualifications for leadership possessed by many members of the Society, their expert knowledge, their breadth of vision, and their sterling qualities, it is little short of paradoxical that the Society, as a whole, plays no greater part in our national development. All material human progress has had its foundation on engineering in some one or other of its branches. In a country like Canada the engineer is the greatest individual factor in the country's expansion. The Canadian Society of Civil Engineers, composed of three thousand trained men, is potentially a great national asset, yet from the viewpoint of collective influence, it is almost as undeveloped as the mineral and timber areas of British Columbia and the idle prairie lands of the West.

"Why?

*"Because the objects of the Society as outlined in the Constitution and as followed out in practise are self-centered.*

"The word 'Civil' in the name is unquestionably a drawback, because of the prevailing acceptance of the term 'Civil Engineer.' This can be overcome by the adoption of a title such as the 'Institute of Canadian Engineers' or the 'Canadian Engineering Institute', but the fundamental basis of the Society's apparent failure to measure up to its opportunities for national usefulness *will not be surmounted* until the expressed and practiced objects of the Society are of a broader nature."

Largely as a result of this editorial I was invited to meet the special committee of the Council chosen for the purpose of selecting a suitable full-time secretary of the Society.

After the appointment was made, a month or two elapsed before the new secretary commenced his duties in April. During that period he had an interview in Toronto with Professor H. E. T. Haultain, at that time chairman of the Committee on Society Affairs appointed to make suggestions regarding the welfare of the Society. The work of this committee was reviewed to some extent. Three of the recommendations of the progress report of the committee at the annual meeting for 1917 were:

"The publication of a journal or periodical at least once a month, devoted largely or entirely to the Society and its members.

"The engagement as soon as practicable of a Secretary who will devote his whole time to the Society.

"The change in name from Canadian Society of Civil Engineers to The Canadian Institution of Civil Engineers."

During this interview it was pointed out to Professor Haultain that the proposed name was no better than the old one and a name was suggested to him "The Engineering Institute of Canada" as being more suitable. He gave a hearty expression of approval and said, "That's the name!," writing it down in his notebook, and thus the new name for the Canadian Society of Civil Engineers was started on its way to becoming a reality.

The year 1917 was notable on account of the progress made by the Committee on Society Affairs in its constructive proposals.

At a meeting of the Council held at Headquarters in the fall of 1917, the report of the Committee on Society Affairs presented by Walter J. Francis, its secretary, was received. The Council unanimously approved the proposal of the Haultain Committee regarding changing the name of the Society to The Engineering Institute of Canada. It was further resolved that the recommendation of the committee regarding the Society periodical be adopted and a committee consisting of H. H. Vaughan, W. F. Tye and the secretary was appointed to investigate.

The committee decided that the Institute would publish its own journal, the details and editing being left in the hands of the secretary. Later when the annual meeting ratified the report of the Committee on Society Affairs as embodied in a new by-law, the details of the *Journal's* form and features were worked out, the secretary receiving valuable assistance from the newly elected president, H. H. Vaughan. A Committee of Management was formed, but was not active. The secretary was made editor and manager, and in the latter capacity, secured all the advertising for the first few years.

(*Continued on page 321*)

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

## AN APPRECIATION

The following article appeared in the May issue of *Mechanical Engineering,* monthly publication of The American Society of Mechanical Engineers. It is gratefully acknowledged.

"Congratulations are in order to our contemporary across the border, *The Engineering Journal,* monthly publication of The Engineering Institute of Canada, which is celebrating its twenty-fifth anniversary.

"Although the Institute was founded in 1887, it was not until a quarter century ago that *The Engineering Journal* was brought into existence as a medium for bringing engineering papers and Institute news to the engineers of Canada. In that quarter century the *Journal* has kept pace with the growth of engineering in Canada and the membership of the Institute.

"Unlike engineering societies in the United States, The Engineering Institute of Canada serves the entire engineering profession of the Dominion. On the basis of population, the Institute is larger than the combined Founder Societies of the United States. These members are spread out over a relatively narrow strip of country lying just north of our border and more than 3000 miles long; *a mari usque ad mare,* as the armorial bearings of the Dominion phrase it. The task of holding together the interests of engineers so widely separated is accomplished by local organizations and *The Engineering Journal.* The Journal, therefore, supplies the need of a means of publishing technical papers covering a wide field of technical interests and also a medium through which news of the numerous local groups can be brought to the attention of all. This diversity of interest, technical as well as professional, makes the Journal unique among engineering periodicals on this continent.

"During the last quarter century the development of engineering in Canada has been rapid and varied. The war is accelerating engineering, and particularly industrial, developments. With close ties to Great Britain and the United States, Canadian engineers have made an enviable record for themselves. Possibly because they are grouped in a single professional society, they appear to exert a more powerful influence with their government than engineers do in this country. This condition is not fortuitous; it arises from qualities of leadership and service and a dominant professional organization which they possess.

"Relations between The Engineering Institute of Canada and The American Society of Mechanical Engineers are becoming closer every day. Bound with ties of a common language, generations of amicable relationship across an unguarded international border, dedication to a common cause in the present war and to common ideals and methods of workmanship in times of peace and war, the engineers of these two great societies look forward to even greater friendship and co-operation. With the coming of peace, the reconstruction of the world, and the advancement of the engineering profession, may *The Engineering Journal* continue to grow in usefulness and influence, to the greater glory of the engineers of Canada."

## CIVIL DEFENCE IN THE WEST

John E. Armstrong, chief engineer of the Canadian Pacific Railway Company and chairman of the Institute Committee on the Engineering Features of Civil Defence will be going West next month on a business trip.

Tentative arrangements have been made for him to meet with certain of the branches and discuss with them the work of his committee.

## PRESIDENTIAL TOUR

The maritime members extended a splendid welcome to the president upon the recent inauguration of his tour of the Institute branches. Starting at Moncton on April 14th, the president visited every branch, finishing up at Sydney on April 21st. He also spoke to the engineering students at the University of New Brunswick at Fredericton, the Nova Scotia Technical College at Halifax, and St. Francis Xavier University at Antigonish. A regional meeting of Council was held at Saint John.

The attendance, the cordiality and the enthusiasm at every meeting were encouraging and the indications on all sides were that the affairs of the Institute are in good condition.

### MONCTON

At Moncton an unusually successful dinner meeting was held under the chairmanship of H. J. Crudge. It was the best attended meeting that the branch has had in several years. Besides the president, the programme included short talks by Past-President H. W. McKiel, Councillor N. B. MacRostie, and the general secretary. An enjoyable innovation was the introduction of vocal numbers by two members of the R.A.F. accompanied by the secretary-treasurer of the branch, V. C. Blackett. Thus the president's first branch visit was a happy augury for the balance of the trip.

### FREDERICTON

On Thursday, the fifteenth, the party arrived at Saint John, but left almost immediately for Fredericton, accompanied by Vice-President G. G. Murdoch, Councillor J. P. Mooney, Chairman D. R. Smith, Alex. Gray, V. S. Chesnut, F. A. Patriquen, J. T. Turnbull, G. M. Brown, C. D. McAllister and A. O. Wolff. Here a luncheon was held attended by twenty-five engineers and fifty senior students at the University of New Brunswick. After lunch the party was shown over the campus and the president spoke to the students in Memorial Hall. This meeting was presided over by B. H. Downman, president of the engineering society. The speakers were introduced by Dr. E. O. Turner, professor of civil engineering and president of the Association of Professional Engineers of New Brunswick. It is interesting to note that every member of the graduating class in engineering is a Student member of the Institute.

After this meeting a large group was entertained at tea at the home of Dr. and Mrs. Turner, where the visitors had an opportunity to meet Mrs. Norman MacKenzie, wife of the president of the university. This concluded a very full day and a most delightful experience.

### SAINT JOHN

On Friday evening, the Saint John Branch, under the chairmanship of A. O. Wolff, entertained the president at dinner. Among the distinguished guests were the Mayor and representatives of the Navy, the Army and the Air Force. The president spoke on Institute affairs and on post-war problems. Councillor MacRostie presented greetings from the Ottawa Branch. J. N. Flood gave an excellent exhibition of oratory in his motion of thanks to the president. The general secretary dealt with the work of some of the special committees.

A successful regional meeting of Council was held on Saturday. Every councillor for the region with the exception of one was present, along with Past-President H. W. McKiel and Councillors R. E. Heartz of Montreal and N. B. MacRostie of Ottawa. The meeting started at 10.00 a.m. and adjourned at 4.30 p.m., and much interesting and important business was transacted.

### HALIFAX

On Monday morning in Halifax the president and the general secretary spoke to the students at the Nova Scotia Technical College and visited the laboratories. The president presented to R. B. Wilcox the certificate for the award of the Institute prize. Dr. F. H. Sexton, president of the college, introduced the guests and M. A. Eisenhauer, president of the student body, thanked them on behalf of the students. At noon the party lunched with the Council of the Association of Professional Engineers of Nova Scotia, under the chairmanship of Dr. Alan E. Cameron, president of the Association, remaining to participate in the Council meeting of the Association after lunch. This was a very pleasant occasion and as President K. M. Cameron said "It was hard to tell whether this was a meeting of the Association or the Institute."

In the evening the branch met for dinner at the Halifax Hotel under the chairmanship of A. E. Flynn. One hundred and twenty-five members and guests heard the president speak of the post-war problems and of the planning that is being done by the government-appointed bodies to meet these problems. A very fine talk on the importance of the engineer's work and an appeal to him to take a greater interest in national affairs was given by the Hon. L. D. Currie, Minister of Mines for Nova Scotia. The mayor was represented by Alderman Kinley who welcomed the visitors to Halifax. The general secretary outlined the activities of the Institute with particular reference to the work of the special committees.

This was the best attended meeting of the tour, and gave stimulating evidence of the effectiveness of the co-operative agreement between the Association and the Institute.

### ANTIGONISH

The president and the general secretary, accompanied by O. S. Cox and G. T. Clarke, of Halifax, stopped at Antigonish to speak to the pre-engineering students at St. Francis Xavier University and to partake of the hospitality of the faculty. The meeting with the students was presided over by Father Clark, but subsequent informal meetings with the faculty included Dr. P. J. Nicholson, Dr. Coady and Father Tobbin.

### SYDNEY

In Sydney the party met with the branch at dinner on Wednesday evening under the chairmanship of Councillor Dr. F. W. Gray. This was a well-attended function and gave every indication that the branch has expanded considerably, not only in number of members but in activities.

The party left Sydney on Thursday, April 23rd, and returned directly to Montreal and Ottawa.

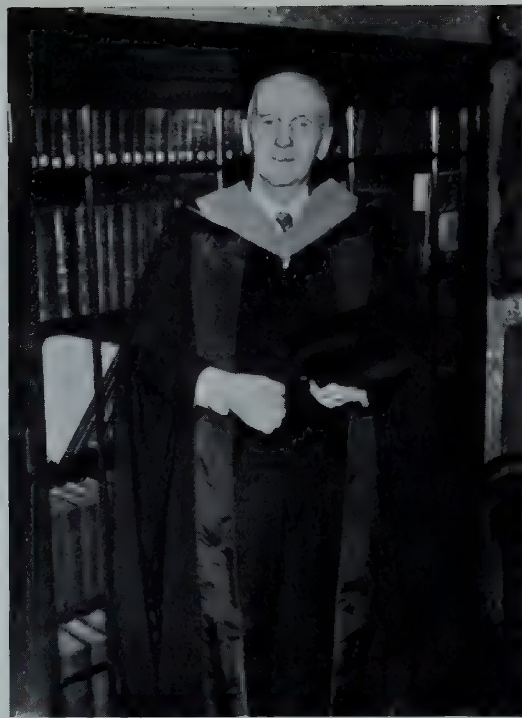
Many good camera shots were taken but it has not been possible to prepare them in time for this number of the *Journal*. They will appear in June.

## CO-OPERATION — 100 PER CENT

An interesting and extreme example of co-operation between a provincial association and the Institute is afforded by the engineers in the province of Saskatchewan.

The president of the Association of Professional Engineers of Saskatchewan is chairman of the Saskatchewan Branch of The Engineering Institute of Canada. He is also the Association's representative on the Dominion Council and councillor of the Institute.

This busy gentleman is A. M. Macgillivray, district engineer of the Canadian National Railways, Saskatchewan District, Saskatoon. In his quadruple capacities he should have an intimate knowledge of what is going on, and will surely be in a position to speak with confidence and authority.



Dr. C. R. Young

## HONOURS TO DEAN C. R. YOUNG

Engineers throughout Canada will be happy to learn that a prominent institution of learning in the United States has honoured the immediate past-president of the Institute, C. R. Young, Dean of Engineering at the University of Toronto.

The Stevens Institute of Technology at Hoboken, N.J., on Saturday, May 1st, conferred on Dean Young the honorary degree of Doctor of Engineering. Not many persons in Canada more justly deserve such a reward, and it is gratifying to see that his character and attainments are known and appreciated in the nation to the south, as they are in Canada.

In presenting Dean Young, President H. N. Davis, of Stevens Institute of Technology read the following citation: Mr. Chairman of the Board of Trustees:—

I present to you

Clarence Richard Young

Dean of the Faculty of Applied Science and Engineering and Professor of Civil Engineering at the University of Toronto, and President of The Engineering Institute of Canada for 1942.

A man of many talents and outstanding achievements, esteemed not only as an engineer but as a writer, public speaker and landscape artist in pastels, his professional experience has been mainly as a consultant in the field of civil engineering. In 1937-38 he was a member of a Royal Commission on Transportation, dealing with the economics of commercial motor transport in Ontario. He has been consulting structural engineer to the government of Ontario for hospitals and prisons. He served on an international board appointed to pass on the original plans of the Detroit-Windsor bridge. As a member of the American Society of Civil Engineers he has served on a number of its technical committees.

Author of many technical and scientific papers and of a number of books including a standard text on structural engineering, he is also joint author of a widely used booklet on Engineering Law.

During the first World War he was second in command of the Polish Army Camp at Niagara, where over 20,000 Polish soldiers were trained and sent to France and later

**Recipients of honorary degrees at Stevens Institute of Technology are seated in the front row. *From right to left:* Wallace Clark, C. R. Young, Vannevar Bush, President H. N. Davis and Robert C. Stanley, chairman of the Board of Trustees at Stevens, B. F. Fairless, A. W. Harrington.**

to Poland. For this service he was decorated by both France and Poland.

As a visitor from a country allied with us again in this present World War he is symbolic of that international friendship and co-operation so essential in the building of a better, more peaceful world.

I recommend him, Sir, as a worthy candidate for the degree of Doctor of Engineering, *honoris causa.*

Other gentlemen honoured at this same ceremony include Wallace Clark, consulting engineer, Benjamin Franklin Fairless, president of the Carnegie-Illinois Steel Corporation, Andrew Wells Robertson, chairman of the Board of the Westinghouse Electric & Manufacturing Company, and Vannevar Bush, vice-president and dean of engineering of the Massachusetts Institute of Technology, president of the Carnegie Institution at Washington, and director of the Office of Scientific Research and Development, also in Washington.

## ENGINEERING FEATURES OF CIVIL DEFENCE

No written progress report from this Institute committee was submitted to the March 13th meeting of Council, but the chairman reported on a very cordial meeting President Cameron and he had had with Dr. Manion in Ottawa on March 1st, the continuing lack of action by the War Committee of the Cabinet in connection with the joint submission to the Prime Minister, and the decision of the presidents of the three organizations subscribing to that submission to seek an interview with the Hon. C. D. Howe in regard to the matter. He also reported on newspaper items in regard to an enemy plane over Sydney, Australia, and in regard to protection of our own east coast, which he had sent to branch committee chairmen, and on the activities of the sub-committees of this committee and of the branch committees.

On March 23rd the three presidents, accompanied by the chairman of this committee, called on the Hon. C. D. Howe and went over with him the joint submission of November 3, 1942, to the Prime Minister. He agreed that an unorganized field exists between A.R.P. and military fields of responsibility, and that the suggestions submitted in regard to that field seemed reasonable. He undertook to give prompt study to the submission, to see to it that the matter is laid clearly before the War Committee of the Cabinet, and to write President Cameron about the matter in due course.

There has been issued to all branch committee chairmen, and to the chairmen of branches which have not yet set up branch committees, some suggestions as to how their organizations, preferably in full co-operation with local members of the R.A.I.C. and the C.C.A. may be helpful to local and provincial A.R.P. organizations. Accompanying these suggestions was a pertinent letter, prepared from the experience of his committee, by Mr. H. F. Bennett, chairman of the London Branch Committee, as to how results along this line might perhaps best be secured.

There has also been sent to the same addresses copy of an advice notice issued by the secretary of theOntario Provincial Committee on Civilian Defence to secretaries of C.D.C. Municipalities in Ontario, directing their attention to the services the Ontario joint E.I.C., R.A.I.C., C.C.A. Technical Committee is prepared to offer them. This advice notice was instigated by the Toronto Branch Committee, and the reaction to it appears to have been favourable. It was suggested that the Vancouver, Montreal, Halifax-Cape Breton and Saint John Branch Committees contact their respective provincial A.R.P. organizations with a view to having similar advice issued in the provinces of British Columbia, Quebec, New Brunswick and Nova Scotia, these being the provinces other than Prince Edward Island in which Dr. Manion has set up provincial A.R.P. organizations. The Montreal Branch Committee has now made this contact and the matter is under way for the province of Quebec. The other branch committees have not yet reported on the matter.

The work of Mr. G. MacL. Pitts' sub-committee has reached a stage which justifies the expectation that in the very near future appropriate information will be issued in connection with homes, in connection with multiple story buildings and in connection with industrial plants and utilities. When issued this information is expected to constitute a final report of this sub-committee on these features of its assignment.

The work of Mr. I. P. Macnab's sub-committee has reached a stage which justifies the expectation that in the very near future appropriate information will be issued in connection with separate air-raid shelters as distinguished from air-raid shelters or refuge areas in buildings. When issued this information is expected to constitute a final report of this sub-committee on this feature of its assignment.

## WASHINGTON LETTER

*It is a pleasure to welcome back to our pages our Washington correspondent. Mr. E. R. Jacobsen,* M.E.I.C., *has been away to Australia for over two months on a special mission. He is Engineering and Technical Assistant to the Director, Commonwealth of Australia War Supplies Procurement at Washington.—Ed.*

Towards the end of January, two of us left Washington on a special mission to Australia. At the time of writing this letter, we have only been back about a week and this first deadline finds us too busy to give much thought to putting our impressions down in an orderly fashion. As we travelled extensively in Australia and as quite complete arrangements were made for us to visit Australian war industries, we hope, in the near future, to find the time and the permission to describe in some detail the splendid contribution which Australia is making to the general war effort. In the meantime, this letter will confine itself to general impressions which will form a background for material of more direct engineering interest which we are at present assembling from our notes.

The trip itself was most interesting but, unfortunately, it is not permissible to say very much about it. We flew from Washington to San Francisco where we took the opportunity of inspecting the Kaiser Shipyards at Richmond—comprising twenty-seven ways or basins and employing some 85,000 workers. We were also fortunate enough to be taken aboard a completed ship which was undergoing engine tests. The Pacific crossing was made in both directions by Army plane except the last hop on the return trip. We stopped off for several days at Honolulu. We had several matters to discuss with Naval Authorities there who arranged for us to complete the trip by Navy Clipper. At Honolulu we stayed at the "Moana" on the famous Waikiki beach and were introduced to the art of surf riding, quite by chance, by Duke Hokamou, the well-known Hawaiian Olympic swimming champion. As we had had enough flying and as we had several jobs to do en route, we returned by train and took the opportunity of stopping to see the Grand Canyon. This is a great scenic experience but it is also an awe inspiring lesson in geology. I was surprised to be told that the Colorado carries through the Canyon about a million tons of silt a day which is now being deposited in Boulder Dam Lake at a rate which will render the great dam obsolete in less than a century unless some solution is found.

The objectives of our mission fall into four categories. We had a number of specific problems in connection with the procurement of supplies to discuss with Australian authorities. We also took with us a considerable quantity of technical information and drawings in connection with plants and processes needed in Australia and we have brought back specific instructions regarding further investigations. The general problems of implementing and improving an increasing technical liaison between Australia and America was also considered. Lastly, in order to have better first-hand knowledge in presenting Australian cases in Washington, we were taken in hand by the authorities and sent on a quick tour of Australian industrial and war plants, munition annexes, agricultural developments, and so on.

Our tour of Australian war industries was arranged through the good offices of the Director General of the Ministry of Munitions—Mr. Essington Lewis. In each State, our visit was planned by the chairman of the State Board of Area Management. Itineraries were arranged, cars placed at our disposal, railway and hotel reservations made and meetings planned. It was a wonderful privilege to make such a trip and we owe a great debt to the efficiency and thoroughness of our hosts. In the pursuance of our several tasks we visited Brisbane, Newcastle, Sydney, Port Kembla, Canberra, Melbourne and Adelaide. Because of the dispersion of industry necessary in Australia, we had to travel quite widely in the surrounding areas of most of these centres. Australian distances are very great. We must have covered between four and five thousand miles by train, plane and car. Also in pursuance of our mission, we met the heads and technical staffs of the twelve governmental departments, a number of very interesting people in both Service and industrial circles and, during a most informative visit to Canberra, we met most of the members of the War Cabinet.

Life in Australia has settled down under the many wartime restrictions and regulations and one soon falls into line with the pervading Australian cheerfulness. The times you may eat and the amount, governed by ceiling prices which may be paid for any meal, are strictly regulated. More noticeable is the shortage of drinks and the resultant restrictions. Bars close at six and the mournful cry of "Time, Gentlemen, Time" brings the war home each night to many Australians and Americans. Of course, you can't get clothes as they are rationed to a point well below replacement level and people are being forced to drastic economies. Gasoline for private motorists is limited to three or four gallons a month. Travel is very restricted and sleeping coaches are very limited. There do not seem to be any taxis left. Air raid precautions are much in evidence. But, after a few days, one becomes accustomed to all these things and surrenders to the inherent attractiveness of life as lived by Australians.

The most noticeable thing in Australia, of course, as it is all through the southwest Pacific, is the presence of the U.S. Forces. More numerous as one goes North, they are nevertheless a ubiquitous, colourful, cheerful and always welcome constituent of the Australian urban scene. They may have taken over the leading hotels, the leading hospitals, and large resort centres; they may take a lot of the space on "trams" and trains and monopolize the few remaining taxis; they may drink most of the beer and eat up a great deal of food; and they are very popular with Australian girls. But these are things of small moment. Australia remembers how glad she was to see them over a year ago and now refers to them affectionately as the "Yanks, God Bless 'em." The "Yanks," on their part, are extremely well behaved—always cheerful and willing to enter into the life of the country with sympathy and understanding.

One of the interesting features of such a trip is the cosmopolitan nature of one's contacts. Many of the people with whom we had dealings had either recently returned from England, America or the Middle East or expected to depart shortly. Australia is so isolated that her technical and business people must travel widely. Of course, in war, this is true in all countries. It seems the most natural thing to meet in Melbourne or Sydney people we last saw in New York, Washington, San Francisco or Toronto. Take the case of Mr. Leonard W. Brockington, the well-known Canadian now doing such splendid work for the British Ministry of Information. He told me of his projected trip when I met him on a pullman to Ottawa just before Christmas. We next met in an elevator in San Francisco. In Australia we were invited to join staff officers and visiting missions to view some confidential documentary films of fighting and conditions in the Islands. Mr. Brockington was there. Later we saw him at "Menzies" in Melbourne and the "Australia" in Sydney. During our short visit I received word that a man who had entertained us when we first arrived in Sydney had later had dinner at my own home in Washington. Before we left Washington, I had cocktails with Mr. 'R' at the Shoreham. In Melbourne, we found him on the point of leaving for New Caledonia but he returned in time to invite us to lunch before we left. One of my first appointments on my return was to meet him at the Washington Airport. He is an Australian whose letterhead reads "London and New York". We were disappointed because we missed seeing Dr. Coombs, Director General of Post-War Reconstruction, at both Melbourne and Sydney. However, just three weeks later it was my privilege to be engaged in the pursuance of a joint task with him in Washington. One could go on indefinitely. The company of "Short Snorters"—people who have flown an ocean—is a rapidly expanding company. I met a ferry pilot who had been in Australia six times and never spent a night there. I met an Australian who had over four hundred thousand air miles behind him. All is movement. If you have been a day on some of the Pacific Islands you are an old timer. On one, I could not find anyone who had been there long enough to tell me where Barrack Number Six was. I finally asked one of the occupants of what seemed to be Number Six and he replied, "Don't ask me, Bud, I live in Michigan".

This was my first trip back to Australia since I left at the tender age of four. Consequently, it was a great privilege and experience for me. I have seen a number of cities from the air, but none has impressed me more than Sydney with her marvellous harbour—great bridge—residential suburbs nestling in the harbour's inlets—modern factories and well-laid out centres. When I first sighted the white surf rolling up on an Australian beach and again as we flew over Sydney, I found myself involuntarily calling to mind Scott's "Breathes there the man . . . ."

E. R. Jacobsen.

## CORRESPONDENCE

### Engineering Experience in the Army

No. 1 C.E.R.U.
C.A. Overseas
Feb. 19th, 1943.

Secretary,
The Engineering Institute of Canada,
Montreal, Que.

Dear Sir,

I am now on overseas service with the Royal Canadian Engineers. I am enjoying the work and the training, and I would like to take this opportunity to point out an important fact about the army—one which should be realized to a greater extent in Canada. I have noticed that both senior and junior engineers in civil employment have a tendency to regard military engineering as a sacrifice of time, a period technically wasted from the point of view of those seeking new knowledge in their profession. This may be true in the case of some senior engineers of wide practical experience. I venture to state very definitely that this is not generally true. There are many lessons of importance to learn from military engineering. For reasons of security, I cannot state what they are, but they are there. In the army I have, I consider, learned many things which will be useful in civil life in any branch of civil engineering. In addition, I have carried on my studies, and have had opportunities to talk with and compare notes with fellow officers who are drawn from every branch of the engineering profession.

The purpose of this letter is to appeal to you, and to other engineering bodies interested in re-establishment after the war, to exert your influence for greater recognition of the value of military engineering experience. My suggestion is that, at the end of the war, competent summaries of military engineer knowledge be published in the *Journal*. At the present time, it could be pointed out in the *Journal* that the young engineer fresh from university, who entered the army directly after graduation, may be a better and more experienced engineer than he was at the time of enlistment. If he is anxious to learn, and has retained his keeness throughout army life, he will be experienced in many phases of engineering generally unknown to young engineers. He will compare very favourably with those who have remained in civil life.

I ask you on behalf of the many young engineer officers of the Royal Canadian Engineers to give this matter your attention. We are a part of young Canada, and we look to you, the senior body of our profession, to point out the road back.

Thanking you,
Yours truly,
(Signed) E. V. Polley, S.E.I.C., LIEUT., R.C.E.

## MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Admiral Beatty Hotel, Saint John, New Brunswick, on Saturday, April 17th, 1943, convening at ten o'clock a.m.

*Present:* President K. M. Cameron (Ottawa) in the chair; Vice-President G. G. Murdoch (Saint John); Councillors G. L. Dickson (Moncton), R. E. Heartz (Montreal), J. R. Kaye (Halifax), N. B. MacRostie (Ottawa), J. P. Mooney (Saint John), C. Scrymgeour (Halifax), and General Secretary L. Austin Wright.

There were also present by invitation—Past-President H. W. McKiel (Sackville); Past-Councillors V. C. Blackett, of Moncton, T. C. Macnabb, A. R. Crookshank, Alex. Gray, S. Hogg, A. A. Turnbull and F. P. Vaughan, of Saint John; E. O. Turner, president, Association of Professional Engineers of New Brunswick, and C. C. Kirby, past-councillor of the Institute and secretary of the Association; A. E. Flynn, chairman of the Halifax Branch; A. R. Bennett (Moncton), member of the joint finance committee, and the following members of the Saint John Branch: A. O. Wolff, vice-chairman and past-councillor of the Institute, F. A. Patriquen, past chairman, G. W. Griffin, secretary-treasurer, V. S. Chesnut, past secretary-treasurer, C. D. McAllister, member of the executive, G. M. Brown and J. N. Flood.

President Cameron expressed his pleasure at this opportunity of holding a regional meeting of Council in the maritime provinces. It was a great satisfaction to see such a representative gathering, and he thanked the various members for their attendance.

*Affiliations with Sister Societies*—The president reminded Council that following discussions at the Annual Meeting of Council in Toronto in February last, he had been asked to select a committee to study the whole question of the Institute's relations with sister societies. At his request, the Institute's Committee on Professional Interests had undertaken this duty, and he had received the following progress report.

(I) The Engineering Institute of Canada is the only purely professional, Dominion-wide, engineering organization in Canada that caters without fear or favour to all classes of engineers. By reason of its service to the profession, the numerical and technical strength of its membership, the high character of its objectives, its flexible organization and its fine traditions, it is recognized, both at home and abroad, as the national engineering society of Canada. For this and other reasons, the preponderant majority of Canadian engineers, whether members of the Institute or not, expect that it will not only lead in all movements to promote the solidarity of the profession, but that it will itself be and become the centre of a simplified and coordinated organization that eventually can represent and speak for all branches of the profession in every province of the Dominion.

(II) There are two distinct and separate classes of professional engineering organizations in Canada:

1. The compulsory or legal associations in each province which, under provincial statutory authority, control admissions to practise;
2. The several voluntary organizations which cater more particularly to the social and educational interests of special branches of the profession.

(III) As to the provincial professional associations, they came into being very largely on the initiative of the Institute and most of them were nurtured under its encouraging influence. For this reason, there has been, and it is earnestly hoped there always will be, a close affinity between the Institute and the eight associations. This affinity has been, and doubtless will continue to be, fostered enthusiastically by succeeding councils of the Institute, pursuant to the wide authority given by the Institute's By-law No. 78. The advocates of this epoch-making by-law built far better than they knew, for, in the short space of five years, Council has completed four agreements with the associations in the provinces of Saskatchewan, Nova Scotia, Alberta and New Brunswick. A fifth agreement for the province of Manitoba will probably be completed during 1943, and a sixth for the province of Quebec is now under discussion. Surely this splendid record of achievement in six of the provinces presages ultimate success in the remaining two. If Council continues its policy of frank, friendly and free co-operation with those in authority in the registration movement in Canada, it is only a matter of time when there will be achieved, for all practical purposes, a common membership between the Institute and all the eight provincial associations. This achievement will usher in a new era of usefulness and prestige for the Institute.

(IV) As to the several voluntary organizations that cater to special branches of the profession, they consist of three main classes:

1. A few purely Canadian bodies like the Canadian Society of Forest Engineers and the Canadian Society of Chemical Engineers.
2. Groups of members of the several British institutions of engineers like the Institution of Civil Engineers, the Institution of Mechanical Engineers and the Institution of Electrical Engineers—none of them well organized, but all of whose members enjoy a very high professional status.
3. Groups of members of the several American engineering bodies like the A.S.C.E., the A.S.M.E. and the A.I.E.E., etc., and most of whom are not organized but some of whom, as for instance the Ontario Section, of the A.S.M.E. and the Toronto Section of the A.I.E.E., have been well constituted for some years.

It is as to these three classes of voluntary professional engineering societies and the relation thereto of The Engineering Institute of Canada that the Council of the Institute has requested advice from the Committee on Professional Interests.

(V) It is the considered opinion of the Committee on Professional Interests—

(a) That it is in the best interests of the engineering profession in Canada that there should be effected as soon as practicable an *entente cordiale* between the membership of The Engineering Institute of Canada and the members resident in Canada of the other aforementioned voluntary bodies.

(b) That The Engineering Institute of Canada should be and become the centre of the *entente*.

(c) That preliminary unofficial exploratory discussions with officers of several of the Founder Societies of the United States indicate more than a friendly interest in a contractual arrangement which would permit reciprocal privileges regarding membership, publications, joint meetings, etc.

(VI) The Committee on Professional Interests therefore recommends:

(a) That Council agree to sponsor an appropriate new by-law similar in general scope and intent to No. 78, and which will authorize Council to enter into cooperative agreements with other professional engineering organizations having members resident in Canada for the purpose of advancing the best interests of the engineering profession in Canada through reciprocal privileges regarding membership, publications, joint meetings, etc.

(b) That early steps be taken to have such a by-law drafted which, when finally approved by Council, will be sponsored by Council and submitted as soon as possible for the endorsement of the corporate members of the Institute.

(c) That in the meantime the Committee on Professional Interests be authorized by and with the co-operation of the president and the general secretary, to continue, as opportunity offers, the exploratory discussions with the Founder and other Societies—Canadian, British and American.

As a member of the Committee on Professional Interests, Dean McKiel stated that although his connection with the work of the committee had been entirely by correspondence, he was heartily in agreement with the findings of the committee as outlined in the report.

The general secretary explained that he had attended the meeting of the committee at which this matter had been discussed, and it had been the general feeling that any discussions regarding closer co-operation with sister societies should not be confined to any one society, but should include discussions with all of the American and British societies who had members in Canada. Recent conversations with the secretaries of some of the American societies had indicated that those societies would be very much interested in such discussions.

Following a full discussion in which Messrs. Kirby, Flynn, Heartz, Scrymgeour, Turner, Dickson and the president took part, it was unanimously resolved that the report be accepted and approved and referred back to the Committee on Professional Interests for further action, and that the thanks of Council be extended to the committee for their efforts.

*The Dominion Council of Professional Engineers*—A recent communication from the Dominion Council of Professional Engineers had been referred to the Committee on Professional Interests for consideration and report. For the information of members present, the general secretary outlined briefly the proposals of the Dominion Council which had been sent to each of the following organizations:

The Engineering Institute of Canada,
The Canadian District of the American Institute of Electrical Engineers,
Canadian Sections of the American Society of Mechanical Engineers,
The Canadian Institute of Mining and Metallurgy,
The Canadian Institute of Chemistry,
The Royal Architectural Institute of Canada,
The Canadian Society of Forest Engineers.

Each of the organizations named had been requested to appoint a representative to attend a conference to be held in Vancouver in May next, at the time of the Annual Meeting of the Dominion Council.

The proposals included the setting up of a Council similar to the Dominion Council, representing the above voluntary organizations. It was hoped that the Dominion Council and the new Council would later co-operate to form one central body, which would be recognized as the all-inclusive voice of the engineering and allied professions in Canada.

The committee reported that after due consideration it had thought that the complexities of such a proposal made it necessary that anyone representing the Institute should be familiar with all details and as no person so qualified was available to attend the meeting it had been felt that it would not be possible to accept the invitation.

In the discussion which followed, the opinion was expressed that the Institute would be well represented at the Dominion Council meeting inasmuch as the vice-president for the maritimes would be there representing the province of New Brunswick Association. Under such circumstances the meeting felt that the Institute could indicate its interest in proposals for co-operation and would be in a position to discuss the subject in greater detail at a time and place where one or more of the members of the committee could participate. The general secretary was directed to explain to the Dominion Council the difficulties which faced the Institute in complying with their invitation and suggesting that an opportunity for further discussion be made available at a later date.

*Association Representation on Institute Council*—The general secretary read the next item of the report of the Committee on Professional Interests which made the following suggestion to Council:

> "That it consider the advisability of according the governing bodies of all provincial associations who have agreements under By-law 78 the privilege of naming a representative who shall be a member of both the Association and the Institute, and who shall, perhaps for a limited period, say, two years, be a non-voting member of the Institute Council. Such an arrangement, if approved by Council, could easily be effected for the four associations in Saskatchewan, Nova Scotia, Alberta and New Brunswick through suitable amendments to existing agreements.
>
> "The Committee on Professional Interests in submitting this suggestion visualizes the time when the Council of the Institute will have a non-voting representative from each of the eight associations, and also from the voluntary associations with whom agreements are effected pursuant to the new by-law suggested above. By such a development the Council of The Engineering Institute of Canada would in truth become a real unifying representative agency for the entire profession in Canada."

From the discussion which followed, it was evident that all persons present approved of the suggestion but it was felt that such representatives should be given full voting powers. Accordingly, it was unanimously resolved that Council heartily approves of the suggestion contained in the report of the Committee on Professional Interests regarding representation on the Institute Council from the professional associations with whom the Institute has a co-operative agreement. However, in view of the expressed opinions of those present that the purpose of this proposal might be hampered by limiting such representation to non-voting members, it is suggested that this phase of the proposal be referred back to the committee for further consideration, and that the committee be asked to make a further report to Council in the near future.

Council also approved of the committee's suggestion that steps be taken to bring prominently before the members of the Institute the significance of the Institute's membership in the Engineers Council for Professional Development. The general secretary pointed out that, recently, copies of the 1941 and 1942 annual reports of E.C.P.D. had been distributed by the Institute to members of Council, branch chairmen, presidents, deans of engineering and the heads of engineering departments in the various universities.

*Report of Joint Finance Committee in New Brunswick*—The secretary of the Saint John Branch drew the meeting's attention to the fact that discussions had been underway with the Association of Professional Engineers of New Brunswick relative to the amount of the grant to be made by the Association for the financing of the Institute branches. An endeavour had been made to arrive at a fixed amount per joint corporate member rather than using the rebate basis as established in the Institute by-laws. An amount had been determined which was acceptable to the branches and to the Association. It had also been recommended that the proportion of fees from Juniors and Students, formerly remitted by the Association to the Headquarters of the Institute, should in future be paid direct by the Association to the branches.

A report was presented from the joint finance committee in which it was stated that the committee accepted the principle outlined above, but felt that in accordance with the terms of the agreement it could not specify a definite per capita rate until the final financial returns from the Association were available. It was understood that the minimum amount previously established for the Moncton Branch would not be affected.

Council agreed that the proposal would be acceptable to the Institute as long as it met the needs of the branches, but that the portion of the recommendation from the branches dealing with the rebates on fees paid by Juniors and Students should be referred to the Institute finance committee for decision.

*Committee on Civil Defence*—The general secretary read Progress Report No. 7, submitted by the chairman of the Committee on the Engineering Features of Civil Defence. This report commented briefly on the various activities of the committee since the Annual Meeting in February when the annual report of the committee had been presented.

Regarding the joint submission presented to the prime minister in November last, President Cameron reported briefly on the interview which he and the presidents of the Royal Architectural Institute of Canada and the Canadian Construction Association had had with the Hon. Mr. Howe. At that meeting Mr. Howe had undertaken to see that the matter was brought before the War Committee of the government, and just before Mr. Cameron left Ottawa, Mr. Howe had informed him that such action had been taken. Accordingly, the matter is now directly before the government, and it is hoped that some action will be taken at an early date.

A prolonged discussion followed during which Messrs. Gray, Kirby, Flynn, Crookshank and Kaye described the A.R.P. work being done in their various communities. Mr. Gray felt that the services of engineers were not being used to the greatest advantage by A.R.P. authorities. His committee had met on several occasions and had twice offered their services to the local authorities, but so far had not been asked to assist in any way. Mr. Kirby felt that there was a great difference of opinion as to what should be done in the case of air raids. He felt that the Institute should be taking some definite part in organizing work of this kind. In President Cameron's opinion the Institute committees should go ahead without waiting to be asked, and make surveys of buildings, etc., and prepare reports which would be available when needed. No group of persons was better able to make constructive suggestions than the engineers in a community. Following this exchange of views, the progress report of the Committee on Civil Defence was accepted.

The meeting adjourned for lunch at 12.45 p.m.

At two o'clock p.m. the Council reconvened with President Cameron in the chair.

*Committee on the Engineer in the Services*—The general secretary presented a progress report from the Committee on the Engineer in the Services.

The report was discussed at great length, and it was unanimously agreed that Council accept it and request the committee to continue its work by preparing the brief which had been recommended and presenting it to the proper authorities at Ottawa. The committee's report included a recommendation that the brief be submitted to President Cameron and Past-President Young before being presented to Ottawa.

A letter was read from Councillor Gordon M. Pitts, president of the Royal Architectural Institute of Canada, indicating that complaints had also been received from members of that Institute with reference to the treatment of technical personnel in the armed services. In order to avoid duplication he requested that the Institute committee, in making representations to the government, should speak for the R.A.I.C. as well as for the Institute. This suggestion was noted with appreciation and was accepted.

*Committee on Industrial Relations*—The general secretary read the following letter from the acting secretary of the Committee on Industrial Relations:

> "At a meeting of the Industrial Relations Committee held on October 16th the Sub-Committee, consisting of Professors Cameron, Coote and Allcut, was appointed to draw up a syllabus of a course of instruction on the subject of industrial relations which could be used for the purpose of advising the authorities of the Canadian universities on the desirable features to be incorporated in any course of instruction on this subject.
>
> "At a meeting of your Committee held to-day in Toronto it was moved by Professor Allcut, seconded by Professor Cameron, and carried, 'that the syllabus as prepared by the Sub-Committee be approved by this Committee and forwarded to the Council for their approval. If approved by the Council it will be forwarded to the presidents of the various universities as the proposed basis for a course of instruction in industrial relations.'
>
> "I am therefore attaching a copy of the syllabus for the consideration of the Council, and would appreciate it very much if it could be considered at the earliest possible moment.
>
> "If the Council approves of the syllabus as submitted, this Committee will be glad to draw up a suggested letter of submission for the Council to be addressed to the presidents of the various universities."

As the proposed syllabus had been drawn up by three professors who were particularly well qualified to prepare such a document, it was unanimously agreed to accept the recommendations.

At the suggestion of the chairman of the committee, it was unanimously resolved that Mr. W. H. Munro, of Ottawa, be appointed a member of the committee.

*Financial Statement*—It was noted that the financial statement to the end of March showed that the net position was substantially better than at the same time last year.

*Legal Action by Architects against an Engineer*—The Finance Committee reported on a case where the Province of Quebec Association of Architects had taken action against Brian R. Perry, consulting engineer, and a member of the Institute for having designed an industrial building which it is claimed was in contravention of the architectural legislation of the province. The committee commented on the seriousness of this restriction on the profession of engineering and recommended that Council support Mr. Perry in his defence, making available the services of its solicitor, if necessary or desirable. The Council unanimously approved of the recommendation as the case appeared to be against the entire profession and not just against one member.

*Committee on the Young Engineer*—A progress report was presented from Mr. H. F. Bennett, chairman of the Committee on the Training and Welfare of the Young Engineer, from which it was noted that in accordance with Council's instructions, additional copies of the booklet, "The Profession of Engineering in Canada" had been supplied to the various universities in order that all applicants for admission to an engineering school could be presented with a copy. The chairman of the committee had addressed an enthusiastic meeting of the newly formed Junior Section of the Toronto Branch of the Institute. In his opinion the establishment of this section indicated a definite step forward in the Toronto area. The committee recommended that a paper on "The Engineer in Industry" be prepared for presentation at the various branches.

Some time ago through the good offices of Past-President Challies, the Institute had been presented with three thousand pamphlet reprints of the paper, "Standards of Professional Relations and Conduct," by Dr. D. W. Mead, a Past-President of the A.S.C.E. It had been decided to present one copy of this pamphlet to each engineering graduate. These were now being distributed with a special letter to the deans of engineering at the various universities and a printed letter to each graduate.

Following some discussion on the work of the local counseling committees, the report of the Committee on the Young Engineer was accepted and approved.

*Transfer of Students and Juniors*—A letter was presented from the secretary of the Peterborough Branch, drawing attention to the number of Students and Juniors who remain in those classifications for many years after they have become eligible for transfer to a higher classification and, in many cases, after they cease to be eligible for their present classification. It was suggested that making certain changes in the by-laws, the transfer of such Students and Juniors to their proper classification should be made automatic.

The general secretary stated that this proposal dealt with a real problem. At Headquarters thousands of letters were written in an endeavour to get over-age Students and Juniors to transfer. While there had been a good response during the past winter, there were still a large number who should be in a higher classification.

Professor Flynn thought it would be unwise to make such a radical change during the war, and Mr. Kaye suggested that this proposal might be referred to the proper committee for investigation. Following some discussion it was decided that the general secretary be asked to examine the proposal submitted by the Peterborough Branch, and submit a report to Council.

*Engineering Journal to all Students*—The general secretary read the following letter from the secretary of the Montreal Branch:

"At the last meeting of the Executive Committee of the Montreal Branch, the chairman of the Junior Section Mr. W. W. Ingram passed a suggestion made by his executive that all Students be made to subscribe to the *Journal* at a nominal charge, (when restrictions on paper are over) in order to better acquaint future engineers with the activities of the profession, technical and social. He also stated that if a section in the *Journal* was expressly devoted to the activities of Students and Juniors, the proposal would meet wide spread approval by the student body.

"The executive of the Montreal Branch heartily approved the suggestions since it considers this would be one of the most efficient ways of showing the young engineer the usefulness of the Institute and inducing him to carry on his membership after graduation. I was directed to pass on these suggestions for consideration by Council."

Members present were entirely in sympathy with the proposal, and it was unanimously agreed that Council approves in principle of the suggestion that all Students should subscribe to *The Engineering Journal* at a nominal charge, and that the matter be referred to the Finance Committee for consideration and report.

*Students and Juniors Prizes*—A letter had been received from Vice-President Murdoch suggesting that it might be desirable to make the closing date for the submission of papers for the Students and Juniors prizes later in the season. Mr. Murdoch now advised that after discussing the matter with the general secretary he realized that it would not be practicable to make any change. Discussion followed regarding the difficulty in securing papers from Students and Juniors. President Cameron reported that the branches in Ontario from which most of the papers were received, advised that it was necessary to keep constantly in touch with these young men in order to get them to submit papers. Dr. Turner found that at the present time the undergraduate, with his C.O.T.C. work in addition to his regular studies, had very little time to write a thesis. Professor Flynn reported that the Halifax Branch had contacted every engineering college in that locality advising the students of these prizes. As a result of their efforts they expected to have only three papers for submission.

*Elections and Transfers:* A number of applications were considered and the following elections and transfers were effected.

*Elections*

| | |
|---|---|
| Members | 26 |
| Juniors | 8 |
| Students | 27 |
| Affiliate | 1 |

*Transfers*

| | |
|---|---|
| Juniors to Members | 7 |
| Student to Member | 1 |
| Students to Juniors | 7 |

In expressing his appreciation of the good attendance at this Council meeting, President Cameron thanked the various persons for their constructive contributions to the discussions, which would be definitely helpful to Council. On behalf of himself and the other visitors he extended sincere thanks and appreciation of the many courtesies and the splendid hospitality of the Saint John Branch.

In reply, Vice-President Murdoch stated that the Saint John Branch and the other maritime branches were greatly honoured by such visits, and were grateful to the president and the other officers of the Institute who had accompanied him.

## ELECTIONS AND TRANSFERS

At the meeting of Council held on April 17th, 1943, the following elections and transfers were effected:

*Members*

**Adamson, Francis Stanley,** B.Sc., (Univ. of Man.), asst. engr., City of Winnipeg, Winnipeg, Man.

**Beaudoin, Maurice,** B.A.Sc., C.E., (Ecole Polytechnique), divn'l engr., Quebec Roads Dept., Longueuil, Quebec.

**Brodie, LeSueur,** B.Sc. (McGill Univ.), Major, R.C.O.C., TS02, Dept. of Mech.Mtce., N.G.O. Branch, Dept. National Defence, Ottawa, Ont.

**Cameron, William John Duncan,** B.Sc. (Univ. of Man.), supt., Anthes Foundry Ltd., Winnipeg, Man.

**Chagnon, Jean-Christophe,** B.A.Sc., C.E. (Ecole Polytechnique), engr., Quebec Streams Commission, Montreal, Que.

**Christmas, Lynwood MacDonald,** B.Sc. (Univ. of N.B.), chief engr., Dibblee Construction Co. Ltd., Ottawa, Ont.

**Ellis, David Edward,** B.Sc. (McGill Univ.), asst. district engr., Commercial & Distribution Dept., Shawinigan Water & Power Co. Ltd., Trois-Rivières, Que.

**Floyd, Edward** (City & Guilds of London Inst.), consltg. mining engr. to the West Coast Collieries, Vancouver, B.C.

**Fournier, Emmanuel Joseph,** B.S. (Univ. of Michigan), consltg. engr., Quebec, P.Q.

**Fraser, Kenneth Walker,** B.A.Sc. (Univ. of Toronto), Montreal district mgr., Canadian Westinghouse Co. Ltd., Montreal, Que.

**Hare, Wilfred Almon,** B.A.Sc. (Univ. of Toronto), exec. partner, Sawyer-Hare Furnace Co., Detroit, Michigan.

**Hough, Ayton Lloyd,** B.Eng. (McGill Univ.), asst. supt., Distribution Stations, Shawinigan Water & Power Co., Montreal, Que.

**Howley, James Thomas,** B.Eng. (N.S. Tech. Coll), asst. engr., Electrical Dept., Defence Industries, Ltd., Montreal, Que.

**Jackson, Clyde Bruce,** B.Eng. (Univ. of Sask), district engr., Aluminate Chemicals, Ltd., Toronto, Ont.

**Johnson, Robert Ernest Lacey,** B.Eng. (McGill Univ), supervising management engr., Stevenson & Kellogg Ltd., Toronto, Ont.

**Kellett, Wilfred Melvin,** B.A.Sc. (Univ. of Toronto), prod'n. engr., Small Arms Ammunition Administrative Dept., Defence Industries Ltd., Montreal, Que.

**Mainguy, William Francis,** B.Sc. (Queen's Univ.), personnel coordinator, Shawinigan Water & Power Co., Montreal, Que.

**Moss, Francis, W.,** B.A.Sc. (Univ. of Toronto), mgr., Ready Mix Concrete, Ltd., Montreal, Que.

**McGee, George Leslie,** B.A.Sc. (Univ. of Toronto), supervising engr. of Aerodromes, Dept. of Transport, Ottawa, Ont.

**Paquette, Georges,** B.A.Sc., C.E. (Ecole Polytechnique), hydro elect'l operation divn., City of Montreal, Montreal, Que.

**Pearson, Arthur,** B.Sc. (Glasgow Univ., Scotland), consltg. engr., Vancouver, B.C.

**Peck, Esmond Hastings,** B.Eng. (McGill Univ), junior engr., Water Resources & Statistical Dept., Shawinigan Water & Power Co. Ltd., Montreal, Que.

**Salisbury, Ernest Alexander,** B.A.Sc. (Univ. of Toronto), asst. engr. and dftsmn. with G. L. Wallace, consltg. engr., Toronto, Ont.

**Smith, Ernest Albert,** B.A., M.A. (McMaster Univ.), professor of industrial chemistry, University of Toronto, Toronto, Ont.

**Thomasson, Harry,** welding engr., Canadian Westinghouse Co. Ltd., Hamilton, Ont.

**Veale, Frederic James,** B.Sc. (Queen's Univ.), supt. of waterworks, City of Hamilton, Hamilton, Ont.

**Webster, Gordon Burville,** B.Sc. (Queen's Univ.), chief field engr., A. G. McKee Co., Sault Ste. Marie, Ont.

**Wyatt, Digby,** B.A.Sc. (Univ. of Toronto), regional representative, Wartime Bureau of Technical Personnel, Toronto, Ont.

*Juniors*

**Boultbee, James Greer,** B.A.Sc. (Univ. of Toronto), wing fittings supervisor, Federal Aircraft Ltd., Montreal, Que.

**Feiffer, Fred,** B.Sc. (Univ. of Sask.), optical shops tool engr., Research Enterprises Ltd., Toronto, Ont.

**Keil, Hugh Douglas,** B.A.Sc. (Univ. of B.C.), elec'l engr., Canadian Industries Ltd., Windsor, Ont.

**Perry, Frederick Lloyd,** B.Sc. (Queen's Univ.), asst. engr. of process control, Imperial Oil Co. Ltd., Imperoyal, Halifax, N.S.

**Reynolds, John Windley,** B.Sc. (Mining), (Univ. of Alta.), Lieut., R.C.E., Suffield, Alta.

**Wong, Walter James,** B.Eng. (McGill Univ.), reinforced concrete designer, General Engrg. Dept., Aluminum Co. of Canada, Montreal, Que.

*Affiliate*

**Breese, Rupert Walter,** of 245 Elm Ave., Westmount; now R.C.A.F. Station C.A.P.O. No. 4, Overseas.

*Transferred from the class of Junior to that of Member*

**Craig, Carleton,** B.Eng., M.Eng. (McGill Univ.), tech. asst. to Director-General, Army Engrg. Design Branch, Dept. of Munitions and Supply, Ottawa.

**Davidson, Arthur Campbell,** B.Sc., E.E. (Univ. of Man.), Captain, Royal Canadian Engineers, Toronto, Ont.

**Gale, Frederic Tyner,** B.Sc. (Univ. of Alta.), engr., Calgary Power Co. Ltd., Calgary, Alta.

**Lawson, George Whytall,** B.A.Sc. (Univ. of Toronto), mtce. engr., Defence Industries, Ltd., Brownsburg, Que.

**Nesbitt, William Paul,** B.Sc. (Queen's Univ.), mech. supt., Howard Smith Paper Mills, Cornwall, Ont.

**Rettie, James Robert,** B.Sc. (Univ. of Man.), constrn. engr., Fraser Brace Ltd., LaTuque, Quebec.

**Simmons, Herbert John,** B.Sc. (Queen's Univ.), supt. and production mgr., General Steel Wares Ltd., London, Ont.

*Transferred from the class of Student to that of Member*

**Park, Fillmore Robert,** B.Sc. (Univ. of Alta.), junior research engr., National Research Council, Ottawa, Ont.

*Transferred from the class of Student to that of Junior*

**Bateman, Leonard Arthur,** B.Sc. (Univ. of Man.), junior engr., City of Winnipeg Hydro Electric System, Winnipeg, Man.

**Harding, Herman,** B.Sc. (Univ. of Saskatchewan), engr., Foundation Co. of Canada, Shipshaw, Que.

**Lancefield, Harold Allan,** B.Sc. (Univ. of Sask.), Pilot Officer, R.C.A.F., Aeronautical Engrg. Branch, Montreal, Que.

**Lee, John Douglas,** B.Sc. (Queen's Univ.), M.Sc. (State Univ. of Iowa), lecturer, Dept. of Civil Engrg., Queen's University, Kingston, Ont.

**Moore, John Beverly,** B.A.Sc. (Univ. of Toronto), designer, Arthur G. McKee & Co., 2300 Chester Ave., Cleveland, Ohio.

**Shisko, Nicholas,** B.Sc. (Queen's Univ.), plánt engr., Steel Co. of Canada, Gananoque, Ont.

**Tucker, Robert Norman,** B.A. (McMaster Univ.), elec'l engr., Hydro Electric Power Commission, Toronto, Ont.

*Students Admitted*

**Acker, Sydney Eugene** (Univ. of N.B.), 251 York St., Fredericton, N.B.

**Allen, James Lawrence** (McGill Univ.), McConnell, Man.

**Allin, Arthur Daniel** (Univ. of Toronto), 16 Oakview Ave., Toronto, Ont.

**Ayers, Ralph Elwyn** (Univ. of N.B.), 685 Charlotte St., Fredericton, N.B.

**Baker, Donald Blair** (McGill Univ.), 3620 Durocher St., Montreal, Que.

**Beattie, Ira MacIntosh** (Univ. of N.B.), 685 Charlotte St., Fredericton, N.B.

**Bessant, William Edward** (Univ. of Toronto), 388 Jane St., Toronto, Ont.

**Chappell, Douglas S.** (Univ. of Toronto), 40 College St., Toronto, Ont.

**Cogsley, Roscoe Cochrane** (Univ. of N.B.), 669 Scully St., Fredericton, N.B.

**Cyr, William Henry** (McGill Univ.), Grande Ligne, Quebec.

**DesLauriers, Edouard Ubald** (Ecole Polytechnique), 1430 St. Denis St., Montreal.

**Dimock, Randall Leigh** (McGill Univ.), 2150 Tupper St., Montreal, Que.

**Farmer, Alan T.** (McGill Univ.), 30 Maple Ave., Ste. Anne de Bellevue, Que.

**Garceau, J. Gilles** (McGill Univ.), 3567 Peel St., Montreal, Que.

**Hamlin, Donald Latham Blacker,** (Univ. of Toronto), 77 Stibbard Ave., Toronto, Ont.

**McArthur, Jack Llewellyn,** B.A.Sc., (Univ. of Toronto), engrg. staff, Montreal Terminals divn. of C.N.R., 891 Notre Dame St., Montreal, Que.

**Norton, Harold Arthur,** (McGill Univ.), 4165 Marcil Ave., Montreal, Que.

**Stewart, James Johnston,** (McGill Univ.), 5876 Notre Dame St. East, Montreal, Que.

**Stone, Rodney Edward** (Univ. of N.B.), 492 George St., Fredericton, N.B.

**Swarek, Martin** (Univ. of Man.), 124 Hallet St., Winnipeg, Man.

**Ward, Frank Lindsay** (Univ. of N.B.), 514 Regent St., Fredericton, N.B.

**Weintraub, Joseph Mortimer** (McGill Univ.), 136 Villeneuve West, Montreal, Que.

**Whaley, Claire Edward** (Univ. of Man.), Ste. 14, Carlyle Apts. Winnipeg, Man.

**Wildi, Theodore** (McGill Univ.), 10405 St. Vital Blvd., Montreal, Que.

**Woods, Jack** (McGill Univ.), 5990 Durocher, Apt. 8, Outremont, Que.

**Zides, Murray** (Univ. of N.B.), 246 Charlotte St., Fredericton, N.B.

# Personals

**News of the Personal Activities of members of the Institute, and visitors to Headquarters**

**R. A. C. Henry,** M.E.I.C., vice-president of the Montreal Light, Heat and Power Consolidated, has been appointed president of Defence Communications Limited, a crown company recently established to co-ordinate "certain telegraph, telephone and other communications systems in Canada on behalf of the armed forces and to provide additional equipment for such systems."

**De Gaspé Beaubien,** M.E.I.C., consulting engineer of Montreal, has been appointed a member of the board of Defence Communications Limited. Mr. Beaubien is a past vice-president of the Institute and a member of the Finance Committee.

**Past President Dr. Charles Camsell,** M.E.I.C., deputy minister, Department of Mines and Resources, Ottawa, travelled to the West recently to discuss, with the British Columbia and Alberta governments, arrangements for assembling and studying data for use in planning the future orderly development of territory adjacent to the Canadian section of the Alaska highway.

Studies along this line "are under way and will be continued during the coming spring and summer by Canadian Government officials," said a departmental announcement of Dr. Camsell's trip.

The deputy minister is head of the Canadian representation on the North Pacific Planning Projects, establishment of which was announced some time ago. James C. Rettie of Portland, Ore., is directing similar work in connection with United States territories along the highway route, and Dr. Camsell will hold conferences with him.

**Dugald Cameron,** M.E.I.C., has been appointed chairman of a Technical Advisory Committee to the Citadel Merchandising Company Limited, a crown company established early in the war for the procurement and distribution of machine tools to the various war projects. Mr. Cameron is the manager of the Toronto office of Citadel.

**Dr. Augustin Frigon,** M.E.I.C., assistant general manager of the Canadian Broadcasting Corporation, has been loaned to the Government of Jamaica by the Canadian authorities to help Jamaica to extend its radio services.

The island government has had in mind this expansion for some time and requested the External Affairs Department at Ottawa to approach the Canadian Broadcasting Corporation to see if Dr. Frigon could come to Jamaica. It was felt he could advise the authorities from both a technical and administrative point of view. To this request Canada acceded, and Dr. Frigon is now in Jamaica.

After Dr. Frigon's report has been prepared, it is anticipated the Canadian Broadcasting Corporation may be invited to participate in organizing not only a broadcasting system for Jamaica, but extending it to the West Indies.

**W. A. Winfield,** M.E.I.C., president of the Maritime Telegraph and Telephone Company Limited, Halifax, has recently been made a director of the Bank of Nova Scotia. Joining the Nova Scotia Telephone Company in 1886, Mr. Winfield became eastern superintendent in 1900. From 1903 to 1909 he was general manager of the Telephone Company of Prince Edward Island. In 1909, he was appointed district superintendent of the Cape Breton division of the Maritime Telegraph and Telephone Company and, in 1917, he became general superintendent of plant with the company. In 1935, he was appointed general manager and not very long ago he became president of his company.

**Lieutenant-Colonel H. R. Lynn,** R.C.E., M.E.I.C., has returned from England recently to take the post of G.S.O. 1 Weapons, at National Defence Headquarters, Ottawa.

Colonel Lynn, who is president of Lynn-McLeod Engineering Limited, and Steel Foundries, Thetford Mines, Que., reported for military duty at the outbreak of war to command 5th Army Troops Coy., R.C.E. He was appointed Second-in-Command of the 1st Battalion, R.C.E., and proceeded overseas in May 1940. From the date of Dunkerque, he was engaged in a great variety of military engineering work such as defence, reconstruction, etc. He was appointed president of the Trade Boards for the Corps of Engineers in England and, in this capacity, completed the classification of all such personnel and established the required system in accordance with Routine Orders. Appointed to command the 1st Battalion R.C.E., in July 1941, he carried out preliminary research work and development of secret weapons for the Canadian and the British Army. In May 1942, he relinquished the command of his battalion to give his full time to weapon development under the immediate direction of the Army Commander and the Chief Engineer, Canadian Army. In this capacity, he carried out experimental work in association with the British authorities until, after completion of the required development, he was appointed to his present post.

Lieut.-Col. H. R. Lynn, R.C.E., M.E.I.C.

It is interesting to note that Colonel Lynn is a successful painter. While in England, he produced a number of sketches in oils of London under the "blitz." One has been submitted to the War Art Exhibition in London to be, at a later date, auctioned for the benefit of maimed children in London's East End. The subject of this particular sketch is "St. Paul's Cathedral during the Blitz as Viewed from the East End."

**Charles Scrymgeour,** M.E.I.C., the newly elected councillor of the Institute for the Halifax Branch, was erroneously reported in the March Journal as being refinery engineer with the Imperial Oil Refineries Limited, at Dartmouth, N.S. Mr. Scrymgeour has been with the company since 1921. He became refinery engineer in 1929 and in 1939 he was appointed assistant superintendent. At the present time he occupies the position of acting superintendent which he took over when Mr. R. L. Dunsmore, M.E.I.C., joined the Royal Canadian Navy, last February.

**A. W. Whitaker,** M.E.I.C., chief engineer and general manager of Aluminum Company of Canada Limited, Montreal, has recently been made vice-president of the company. A graduate in chemical engineering from the University of Pennsylvania, he joined the company in July, 1913, as a research engineer. In 1926, he became superintendent of the newly built carbon plant at Arvida, Que., and in 1928 was made superintendent of the Arvida ore plant. In 1920, Mr. Whitaker became manager of the Arvida works, which post he held until 1939 when he was appointed chief engineer of the company.

Late in 1940, he became general manager which duties he has combined with those of chief engineer.

**McNeely DuBose,** M.E.I.C., manager of power, Aluminum Company of Canada, Limited, Montreal, has been made a vice-president of Aluminum Company of Canada Limited as well as vice-president of Aluminum Power Company Limited. Born in North Carolina, U.S.A., Mr. DuBose was educated at the North Carolina State College, Raleigh, where he received the degree of Bachelor of Engineering in 1912. He was with various power companies in the United States and in 1919 became superintendent of the Talassee Power Company. He came to Canada in 1925 as superintendent of the Aluminum Company of Canada, Limited. In 1926 he was made general superintendent of the Saguenay Power Company Limited, at Arvida, Que. A few years ago, Mr. DuBose came to Montreal to take charge of the power department of Aluminum Company of Canada, Limited. In 1940 and 1941, he was a vice-president of the Institute for the province of Quebec. In 1941-42, he was president of the Canadian Electrical Association.

**A. W. Whitaker, M.E.I.C.**

**McNeely DuBose, M.E.I.C.**

**Squadron-Leader D. S. Jacobs, D.F.C., S.E.I.C.**

**W. H. M. Laughlin,** M.E.I.C., was elected chairman of the Toronto Branch of the Institute at the annual meeting of the branch, last month. A graduate in engineering from the University of Toronto in the class of 1927, Mr. Laughlin has been with the Dominion Bridge Company Limited, at Toronto since his graduation. He first joined as a strutcural designer and estimator and now occupies the position of designing engineer. He is also demonstrator in civil engineering at the University of Toronto.

Mr. Laughlin has been active in the Toronto Branch for several years having been a member of the Executive Committee and having participated in the organization of the recent annual meeting of the Institute in Toronto.

**Otto Holden,** M.E.I.C., chief hydraulic engineer of the Hydro Electric Power Commission of Ontario was elected president of the Royal Canadian Institute at the annual meeting held last month in Toronto.

**Flight Lieutenant K. Y. Lockhead,** M.E.I.C., is now attached to the Directorate of Aeronautical Engineering at the Royal Canadian Air Force headquarters, Ottawa. He was previously located at Alliford Bay, B.C., as chief engineer officer of the station.

**Flight Lieutenant C. M. Brant,** M.E.I.C., is at present signals officer with the R.A.F. Atlantic Transport Group at Bermuda. He came to Newfoundland from England, in 1937, as technical superintendent of the Trans-Atlantic Air Base at Botwood, Newfoundland, for the civil aviation branch of the Air Ministry, London. In March, 1942, he was transferred from the civil aviation branch of the Air Ministry to the Royal Air Force as signals officer at Gander, Nfld. In November, 1942, he was posted at Bermuda with the Royal Air Force Ferry Command, now the Atlantic Transport Group.

**Pilot Officer R. H. Ransom,** M.E.I.C., is at present visual Link trainer instructor at No. 3 Initial Training School, R.C.A.F., Victoriaville, Que.

**W. A. Messenger,** M.E.I.C., has recently been appointed director of operations of the Barrett Company Limited, in charge of plants located at Joliette, Montreal, Toronto, Winnipeg and Vancouver. He was formerly superintendent of the Montreal plant having joined the Barrett Company in 1940. He is a graduate from McGill University, in the class of 1922. Mr. Messenger's headquarters are at the Montreal plant.

**Major F. J. Delaute,** O.B.E., M.E.I.C., of Sarasota, Florida, is doing voluntary work for the U.S.A. Coast Guard Auxiliary, teaching junior members the use of navigation instruments. Before retiring to Florida a few years ago, Mr. Delaute was located in Montreal. For a great many years previously, he was employed in the Department of Marine and Fisheries at Ottawa.

**Second-Lieutenant D. S. Estabrooks,** M.E.I.C., is at present in training at the Officers Training Centre at Brockville, Ont. Before enlisting, Mr. Estabrooks was employed with Price Brothers & Company, Limited, at Riverbend, Que. He was secretary-treasurer of the Saguenay Branch of the Institute.

**John Lovell,** M.E.I.C., has joined the staff of Defence Industries Limited, Montreal, as a mechanical draughtsman. He was employed previously with the Hamilton Bridge Company, Limited, at Hamilton, Ont.

**Squadron-Leader J. S. Motherwell,** Jr.E.I.C., has been transferred from No. 17 Aeronautical Inspection District, Moncton, N.B., and is presently located at No. 11 Aeronautical Inspection District, at Montreal. Before the war, he was employed with the Dominion Engineering Company Limited, Montreal.

**Flight-Lieutenant André Aird,** Jr.E.I.C., has been posted at No. 4 Air Training Command R.C.A.F., at Calgary, Alta. He was previously stationed at No. 9 Repair Depot, St. John's, Que.

**Second-Lieutenant F. W. B. Shaw,** Jr.E.I.C., has joined the Royal Canadian Ordnance Corps and is at present training at the Officers Training Centre, Brockville, Ont.

**Flying-Officer M. C. Edwards,** Jr.E.I.C., of the R.C.A.F. is at present stationed at Seattle, Wash.

**Paul Cadrin,** Jr.E.I.C., is now assistant superintendent of production with Dominion Rubber Munitions, Limited, at Cap-de-la-Madeleine, Que. He was previously employed with Sorel Industries Limited, Sorel, on the manufacture of 25 pr. guns. Mr. Cadrin spent a three-week training period in Des Moines, Iowa, with U.S. Rubber Company, before taking his present position. He is a graduate from the Ecole Polytechnique in the class of 1936.

**Leslie Wiebe,** Jr.E.I.C., has left the employ of MacDonald Aircraft Limited, Winnipeg, Man., where he held the position of chief draughtsman in charge of the engineering department, and is now employed with Neon Products of Western Canada Limited, Vancouver, B.C. He has been temporarily placed in charge of design in the Toronto office of the company.

**Squadron-Leader, D. S. Jacobs,** s.E.I.C., has recently been awarded the D.F.C. The citation reads as follows: "Squadron-Leader Jacobs has a fine operational record. He has participated in attacks on the enemy's most heavily defended targets, including Essen, Bremen, Hamburg, and Cologne. On one occasion during an operational sortie against a target in Italy, his rear turret became unserviceable when far across France.

"With his aircraft almost defenceless this officer proceeded on his mission and successfully bombed the target. Again on another occasion when crossing the coast on the outward journey to Hamburg, Jacob's aircraft was engaged by anti-aircraft fire for forty minutes. With great determination he flew on and completed his mission. This officer by such exhibition of courage and skill has set a splendid example to other crews."

Squadron-Leader Jacobs was born in Winnipeg and educated at McGill University, Montreal, where he graduated in 1937. He did post-graduate work in France for a year and, returning to Canada, joined the Canadian Liquid Air Company, at Toronto. He enlisted soon after the war broke out. After training in Winnipeg and Toronto, he received his wings at Camp Borden in 1940. He was an instructor in Calgary and took advance training at Trenton before going overseas in March 1942. He is the son of L. C. Jacobs, M.E.I.C., director of the Defence Projects Construction Branch of the Department of Munitions and Supply, Ottawa.

**Major Guy Savard,** s.E.I.C., of the First Armoured Regiment (Royal Canadian Dragoons) has been overseas since November 1941. Before enlisting, Major Savard was with Canadian Liquid Air Company, in Montreal. Graduating from Royal Military College, Kingston, in 1937, he went to France and did post-graduate work in welding. Major Savard enlisted shortly after the outbreak of war.

**Captain R. W. Morris,** s.E.I.C., is a Canadian Liaison Officer in the Royal Canadian Ordnance Corps overseas. He graduated in electrical engineering from the University of Manitoba in 1940.

**Lieutenant J. K. French,** s.E.I.C., is now overseas with the Royal Canadian Ordnance Corps. The son of Professor R. De. L. French, M.E.I.C., he is a graduate in mechanical engineering from McGill University, in the class of 1940.

**Alex. F. McLean,** s.E.I.C., has joined the staff of Canadian Vickers Limited in the electrical department, at Montreal. He was previously employed with Defence Industries Limited, at Winnipeg, Man. He is a graduate of the University of Toronto in the class of 1940.

**D. L. Mackinnon,** s.E.I.C., of Foundation Company of Canada Limited, is now in the Montreal office of the company having returned from Shipshaw, Que.

In the list recently issued by the National Research Council, of bursaries awarded for post-graduate work appeared the following names of members of the Institute who will specialize as indicated: **A. R. Auger,** s.E.I.C., from the Ecole Polytechnique, in mechanical engineering; **C. E. Brunette,** s.E.I.C., from Ecole Polytechnique, in chemistry; **Francis Chadillon** s.E.I.C., from Ecole Polytechnique, in chemistry; **Fernand Labrosse,** s.E.I.C., from Ecole Polytechnique, in electrical engineering.

**John B. Moore,** s.E.I.C., is now chief field engineer for Arthur G. McKee & Company, at Port Arthur, Texas, on the construction of a refinery for the manufacture of 100-octane gasoline. He graduated from the University of Toronto, in the class of 1940.

**Lucien Bélanger,** s.E.I.C., joined the staff of the Dominion Rubber Company, Limited, Montreal, last February. He graduated from the Ecole Polytechnique in 1942.

**Robert W. Kraft,** s.E.I.C., is now with the Aluminum Company of Canada Limited, at Arvida, having been recently transferred from Aluminum Laboratories Limited, Kingston.

## VISITORS TO HEADQUARTERS

**Gilbert G. Murdoch,** M.E.I.C., consulting engineer, Saint John, N.B., vice-president of the Institute, on April 7th.

**D. M. Stephens,** M.E.I.C., deputy minister, Department of Mines and Natural Resources, Winnipeg, Man., on April 7th.

**Bruce B. Shier,** M.E.I.C., assistant to the sales manager, Canadian Telephones and Supplies Limited, Toronto, Ont., on April 10th.

**C. H. S. Venart,** M.E.I.C., Toronto, Ont., on April 13th.

**A. A. Turnbull,** M.E.I.C., New Brunswick Telephone Company, Saint John, N.B., on April 14th.

**Past President E. A. Cleveland,** M.E.I.C., chief commissioner, Greater Vancouver Water District, Vancouver, B.C., on April 14th.

**Robert W. Angus,** M.E.I.C., head of department and professor of mechanical engineering. University of Toronto, Toronto, Ont., on April 16th.

**M. J. McHenry,** M.E.I.C., director, sales promotion, Hydro-Electric Power Commission of Ontario, Toronto, Ont., on April 16th.

**E. C. Hay,** M.E.I.C., electrical engineer, Army Engineering branch, Department of Munitions and Supply, Ottawa, Ont., on April 16th.

**C. F. Morrison,** M.E.I.C., assistant professor of civil engineering, University of Toronto, Toronto, Ont., on April 19th.

**E. M. Nason,** M.E.I.C., St. John, N.B., on April 21st.

**Gilbert Manseau,** Jr.E.I.C., Aluminum Company of Canada Limited, Arvida, Que., on April 21st.

**Paul Vincent,** M.E.I.C., chief, technical section, Department of Colonization of Quebec, Quebec, Secretary Treasurer, Quebec Branch of the Institute, on April 24th.

**E. E. Wheatley,** M.E.I.C., Grand'Mère, Que., on April 28th.

**H. Harding,** Jr.E.I.C., Foundation Company of Canada Limited, Shipshaw, Que., on April 28th.

**F. L. Black,** Jr.E.I.C., Consolidated Paper Corp., Shawinigan Falls, Que., on April 29th.

**T. Walter Houghton,** Jr.E.I.C., Canada Paper Company, Beauharnois, Que., on April 30th.

**R. de B. Corriveau,** M.E.I.C., Ottawa, Ont., on May 1st.

**J. R. Rettie,** M.E.I.C., Fraser Brace Limited, La Tuque, Que., on May 3rd.

# Obituary

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

**G. J. William Campbell,** M.E.I.C., died suddenly at his office in Halifax on March 30th, 1943. Born at Dartmouth, N.S., on July 31st, 1870, he studied engineering at the Ohio Northern University where he graduated in civil engineering, in 1914. Before going to college he had been engaged in municipal engineering work with the town of Sydney Mines, N.S. In 1914 and 1915 he was engaged in land surveying in Nova Scotia. In 1916 he was with the Royal Canadian Engineers on construction work. In 1917, Mr. Campbell was with the Nova Scotia Tramway & Power Company in Halifax on designing and construction work and in 1917 and 1918 he was on the staff of the city engineer of Halifax. He was appointed town engineer at Truro, N.S., in 1918 and remained in this position until 1929 when he joined the Halifax Harbour Commission. In 1935 he was appointed a resident engineer of the Department of Highway of the province of Nova Scotia at Sydney.

At the outbreak of war, Mr. Campbell joined the engineering staff of the Department of Defence for Air and at the time of his death he was stationed at Eastern Air Command Headquarters at Halifax.

**G. J. William Campbell, M.E.I.C.**

Mr. Campbell joined the Institute as an Associate Member in 1905 and he was transferred to Member in 1925. He was a member of the Association of Professional Engineers of Nova Scotia.

---

## URBAN TRANSPORTATION

*(Continued from page 263)*

to take care of the abnormal increase in passenger traffic. It was soon realized that staggering the hours of work of part of the population had become necessary.

During certain periods, morning and evening, transit companies have to carry 40 to 50 per cent of their passengers. Before the war these rush-hour periods were quite short, about two hours in the morning and two hours at night, and, in some cities, even shorter; transit vehicles were even then loaded to capacity. To carry the large increases in the number of passengers in the same lapse of time, with a relatively small increase in the number of vehicles, was simply impossible. Staggering hours of work in order to spread the rush hours over longer periods had to be arranged.

Soon after the outbreak of war, transit companies endeavoured to make arrangements with new war plants to select hours of shift changes so that they would not conflict with the peak hours of the system. Industrial establishments generally showed an excellent spirit of co-operation in this respect.

During the year 1941, the Canadian Government, viewing with great concern the situation confronting urban and suburban transportation companies, appointed a Transit Controller for the whole of Canada. An Associate Controller and deputy controllers were also appointed to act in different parts of the country. One of the duties of the Controller is to regulate hours of work when he deems it necessary. Since then, the working hours of large numbers of employees in many cities of Canada have been so re-arranged to improve traffic conditions. These changes cover industrial plants, departmental stores, insurance companies, banking firms, public utility companies, schools, and many others. In all cases, the co-operation of the people affected was willingly given.

Such staggering of hours of work has to be done with great care, and only after extensive studies covering each case. As an example, in one city a complete survey was made of the travelling habits, working hours and residence of 110,000 workers in 257 plants. With this information, it was possible to determine in advance, with reasonable accuracy, the effect of changing working hours in any of these plants.

What further difficulties transit companies will have to meet in the future is difficult to predict. In spite of the all-time record year of 1942, monthly passengers carried during the early months of 1943 show an increase of 15 to 20 per cent over the same period last year. Additional staggering of working hours will have to be put in force. In order to enable transit companies to provide transportation of the workers, specially those engaged in war work, every citizen that can do so, will have to avoid travelling during rush hour periods.

The public deserves thanks for its co-operation in helping to overcome present difficulties and will, no doubt, continue to assist in this way. Transit companies, on their part, will spare no effort to furnish the population of Canada with the best service possible under present circumstances.

---

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## BORDER CITIES

W. R. Stickney, m.e.i.c. - *Secretary-Treasurer*
J. F. Blowey, m.e.i.c. - *Branch News Editor*

The monthly dinner meeting of the Border Cities Branch was held February 19th at the Prince Edward Hotel.

Twenty-nine members and guests were present for the dinner and 10 additional members and guests for the meeting.

Mr. Medlar called on Mr. Wilson to introduce the speaker for the evening, Mr. A. G. Turnbull, commercial engineer in charge of industrial control, Canadian General Electric Company. His topic for the evening was **Electronics in Industry,** and he illustrated his talk with many interesting slides of control equipment and devices.

Mr. Turnbull introduced his subject by saying, "The science of electronics, although new to the public, is not new to the engineering profession; its fields of use are many and varied. Electrical controls are often called the brains of industry. It makes possible new methods of industrial control. Photo-electric relays, for example, are so numerous they can scarcely be listed." Slides were shown of weighing, inspecting, sorting and testing control relays. Burglar alarm systems and intruder controls, lighting controls, and cloth straightening machines controlled by photo-electric relays were also shown. Very ingenious methods of printing and pasting labels on packages of any description were explained and described with the help of slides.

The speeds of electric motors can now be controlled most accurately by electronic devices. Electronic rectifiers and converters are now on the market. These make a very neat and compact installation and are in great demand in the electro-metallurgical industries.

One of the latest developments—the electronic microscope, will measure one millionth of an inch. This has proven of inestimable value in determining the structure of various compounds.

Mr. Turnbull pointed out that with a good imagination and an elementary knowledge of electronics, there was practically no limit to the types of electronic control an engineer could devise.

## CALGARY BRANCH

K. W. Mitchell, m.e.i.c. - *Secretary-Treasurer*
J. N. Ford, m.e.i.c. - - *Branch News Editor*

The annual meeting of the Calgary Branch held at the Renfrew Club on Saturday, March 13th, 1943, proved to be most successful. It has been the practice of the Branch to hold an afternoon business meeting annually. This year a combined business, dinner and social evening was held with the result that a new attendance record was set.

The meeting began with a general discussion of the reports submitted by the various committees acting throughout the past year. This discussion was followed by the election of officers for the coming season. The list appears at the beginning of this issue.

J. McMillan expressed the appreciation of the members to the outgoing officers and committees for the excellent work done during their term of office.

## HALIFAX BRANCH

S. W. Gray, m.e.i.c. - - *Secretary-Treasurer*
D. C. V. Duff, m.e.i.c. - *Branch News Editor*

The regular monthly joint dinner meeting of the Halifax Branch of the Institute and the Association of Professional Engineers of Nova Scotia was held in the Halifax Hotel on Monday, April 19, 1943. Professor A. E. Flynn, chairman of the Branch, presided.

This year's president of The Engineering Institute of Canada, K. M. Cameron, Chief Engineer of the Dominion Department of Public Works, accompanied by General Secretary Dr. L. Austin Wright and E.I.C. councillors, were guests of the branch. The Hon. L. D. Currie, Minister of Mines and Labour, was present to welcome the president and his party on behalf of the Government of Nova Scotia. Deputy-Mayor G. S. Kinley extended welcome on behalf of the City of Halifax.

The president addressed Institute members on the present and post-war problems of engineers. He reviewed in brief the various committees that already are active or in status of organization in an effort to effectively solve and prepare for the many problems that Canada will face in the period of transition as well as the post-war years. For this great task ahead he stressed the need for engineers, not only in technical capacity but in every way that will serve our country best. "If there is anything that we, as engineers, can do to serve our country, we are here to do it," he remarked. He paid tribute to the work being done by our universities and congratulated Dr. F. H. Sexton, president of Nova Scotia Technical College, on the splendid work he had done there. The entire province may well be proud of that work.

The president concluded his address by a statement of faith in the future of Canada—that she will continue to grow and that engineers will play a vital part in the post-war reforms.

The general secretary, Dr. L. Austin Wright, spoke to members on the activities of the Institute. Committees on Civil Defence, Post-War Problems, Industrial Relations and Status of Engineers in the Services have all been formed and are active.

Honourable L. D. Currie, Minister of Mines and Labour, welcomed the Institute members on behalf of the Government of Nova Scotia, and stated that the Government was fully conscious of the part played by engineers in the life of the province and of the community. He was of the opinion that engineers should take more interest in public life because their training develops orderly habits of mind not present in most professions or trades.

Deputy-Minister G. S. Kinley welcomed the members and he stated that Halifax as well as the rest of the Dominion would depend on the ability of the engineers after the war.

The meeting was attended by one hundred and forty members. The Nick Shoester Ensemble rendered musical selections during the dinner period.

The president and his party, together with the Council of the Association of Professional Engineers of Nova Scotia, were guests of the Halifax Branch Executive at a luncheon meeting held in the Nova Scotian Hotel earlier in the day.

## HAMILTON BRANCH

W. E. Brown, m.e.i.c. - *Secretary-Treasurer*
L. C. Sentance, m.e.i.c. - *Branch News Editor*

At a joint dinner meeting held on April 7th, at the Royal Connaught Hotel, 150 members of the American Water Works Association, and the Hamilton Branch of the Institute were privileged to hear a comprehensive and instructive address on **Welding—A Conservation, Salvage and Reclamation Tool** by Mr. H. Thomasson, welding engineer, of the Canadian Westinghouse Company.

The speaker qualified his use of the word "welding" to include all methods of joining metals except the mechanical ones—bolting and rivetting. Five separate sections covering various metals to be joined, were treated by Mr. Thomasson who made liberal use of slides and actual exhibits of the welder's art.

In the case of low carbon steels, the art has advanced to such an extent that, at present, problems encountered are chiefly those of economics and ingenuity. A conservation of such materials by reduction of machining losses has been made possible by a comparatively recent development, furnace brazing, wherein parts are brazed together in a controlled atmosphere furnace, which produces a joint comparable in strength to the parent material.

In his remarks on non-ferrous metals, Mr. Thomasson stressed the value of the carbon arc process in the welding of copper alloys. He also outlined in some detail the technique of both reaction soldering, and arc welding of that strategic material, aluminum.

The joining of cast irons has been accomplished satisfactorily by several methods, but the use of manganese bronze brazing by means of the oxyacetylene process was advocated for the majority of problems. Where repairs must be made without dismantling a machine, the electric arc method could be used to advantage.

Recent developments in the art of welding medium carbon and alloy steels, such as used in the production of high grade machine parts, have proved so successful that a powerful production and reclamation tool has become available to users of such steels. A thermal cycle involving preheating, welding, cooling, and stress relieving or tempering must be rigidly followed, however, to ensure success.

The repair of high speed cutting tools was dealt with in three sections, and the speaker outlined each in detail, exhibiting many interesting and ingenious examples of tool salvage. The first group, broken tools of slender section, could be satisfactorily repaired by the low-temperature silver soldering process. The second group, involving tools which have broken at some distance from the cutting edge, were simply repaired by welding on shanks or tangs. The third group, tools requiring repairs to the cutting edges, could be built up by the electric arc process, using a high speed steel welding rod.

Mr. Thomasson concluded his remarks with a description of a method for eliminating welding rod stub end losses. This method, employed on work under the speaker's supervision, has shown savings of critical welding rod in the amount of 15,000 to 20,000 lbs. per year.

---

Friday, April 16th, marked the occasion of the Annual Joint Meeting of the Toronto Branch of the American Institute of Electrical Engineers, and the Hamilton Branch of the Institute. As in former years, the Canadian Westinghouse Company was host to the gathering, which numbered 165.

An excellent supper was served in the company's West Plant Cafeteria, and the meeting was subsequently called to order by T. S. Glover, chairman of the Hamilton Branch of The Engineering Institute.

E. M. Coles, vice-president of the Canadian Westinghouse Company, welcomed the assemblage on behalf of the company. T. S. Glover for the Institute, and D. W. Callander, chairman of the Toronto Branch of the A.I.E.E., spoke briefly; Mr. Callander introduced the speaker of the evening, Dr. D. R. Kellogg.

Dr. Kellogg, assistant to the manager, Engineering Laboratories and Materials Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., spoke at some length on **Developments in Materials for Electrical Equipment.** Eminently qualified for his task, Dr. Kellogg related to the audience the progress of his company, since the war began, in the field of substitution for and conservation of strategic materials.

In particular the speaker stressed the present and future importance of plastics, both in the field of non-metals, and as a substitute for metals.

The excellent properties of the National Emergency Series of Steels, which were formulated to conserve scarce alloying elements, would, in the opinion of the speaker, assure their continued use after the war. Similarly, success achieved with low tin, and tin-free babbitts and solders and special soldering fluxes would warrant their retention in the post-war field.

The successful solution of many insulation problems involving the use of porcelain, glass, shellac and numerous varnishes was attributed to a programme of intensive research work along those lines.

At the conclusion of his talk, Dr. Kellogg retained the floor for a half-hour question period.

W. J. W. Reid moved a vote of thanks to the speaker and to the Canadian Westinghouse Company.

## NIAGARA PENINSULA

J. H. Ings, M.E.I.C. - *Secretary-Treasurer*
J. W. Brooks, Jr.E.I.C. - *Branch News Editor*

The local Branch and the Foster Wheeler Engineering Society held a joint meeting on Tuesday, March 23, at the Foster Wheeler Limited plant in St. Catharines. The first part of the evening was spent in an inspection trip through the plant, guides being furnished through the courtesy of the company. At the conclusion of the tour, the meeting was adjourned to the Foster Wheeler auditorium, where the guests were privileged to attend a lecture given by Mr. N. I. Battista, manager of the Chemical Division of Courtauld's (Canada) Limited. Mr. Battista spoke on **Synthetic Fibres,** and in view of the nature of the subject, ladies were invited to attend. This latter feature added, in no small measure, to the success of the evening.

The trip through the plant included visits to the pattern shop, foundry, machine shop, and the assembly building, where corvette boilers were being fabricated. One of the highlights of the pattern shop was the examination of workmens' scales, which were calibrated to take care of shrinkage in the castings; thus there were different scales for each metal, in order to allow for the varying coefficients of expansion. The assembly plant was indeed a hive of industry —from one end of the building to the other were boilers in various stages of completion, presenting an excellent panoramic view of mass production applied to boiler manufacturing.

At the subsequent lecture, Mr. Battista opened his talk with an explanation of the difference between the truly synthetic manufacture of fibres and other types of processing, whereby a material is merely changed into a desired physical form by chemical manipulation. At this point, the speaker remarked that commercial threads are designated as to size according to their denure number, and defined a denure as being the weight in grams of nine thousand metres of yarn. Several commercial processes used in the manufacture of artificial silk were discussed, including the cellulose acetate process and the viscose process, in which the incredibly short period of only four and a half minutes elapses during the transition of a particle from a viscose solution to a finished fibre. Mr. Battista continued with interesting facts and figures on the properties and uses of some of the more common artificial fibres, and concluded his comprehensive lecture with a series of slides on the manufacture of rayon at Courtauld's.

In the discussion period following the lecture, the speaker was harried by his feminine audience with such brain-twisters as:

1. "Why do silk stockings run, and isn't there something you chemical engineers can do about it?"
2. "Why do my nylon stockings stretch so much?"

## OTTAWA BRANCH

A. A. Swinnerton, M.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

At a noon luncheon at the Chateau Laurier on April 1, P. Lebel, asphalt technologist for the Imperial Oil Company Limited, Montreal, presented a sound-colour film **Bouncing Molecules** showing some of the hidden wonders revealed by modern scientific research. In the absence through illness of the regular chairman, T. A. McElhanney occupied the chair. The film was viewed with a great deal of interest by the audience.

### PETERBOROUGH BRANCH

A. R. Jones, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, S.E.I.C. - *Branch News Editor*

A paper entitled **The Metal Magnesium** was presented before the Peterborough Branch, on March 25th, by Dr. L. M. Pidgeon of Dominion Magnesium Ltd.

The speaker introduced his subject by discussing the background of the light metals, aluminum and magnesium. During the last century, good design was associated with great weight in structures and machines. Ponderous locomotives and huge steel buildings exemplified this disposition to sheer mass. Progress, in the present century, has been towards lighter and at the same time stronger design. To this end, the light metals have contributed much.

Magnesium is one of the commonest metals, occurring as it does in magnesium chloride, magnesite, dolomite and other combined forms. Electrolysis of magnesium chloride was the first and still is the predominant process in obtaining pure magnesium. The Hansgirg process developed in Europe and in use at Permanente, California, derives magnesium from magnesia. Magnesia and carbon react in a furnace at high temperatures to form magnesium and carbon monoxide. The gaseous magnesium is shock chilled with cold hydrogen or natural gas to prevent a reversal of the reaction. The fine magnesium dust is recovered by means of a cyclone separator and remelted.

Dr. Pidgeon's method eliminates much of the hazard and some of the objectionable features of other thermal or electrolytic processes. Selected dolomite is crushed, roasted and briquetted. It is loaded into stainless steel retorts with ferro-silicon and heated to a high temperature in an electric furnace. A low vacuum is maintained during the reaction. End products are gaseous magnesium and refractory materials, not volatile at the furnace temperatures. Crowns of magnesium accumulate at the cool end of the retorts and are recovered by shutting down the furnace and removing the contents of the retorts. It is said that a considerable economy of strategic materials and power is effected.

Dr. Pidgeon anticipates that magnesium will survive the end of this war much better than the last one and will become a common and valuable peace-time material. In general, magnesium has high strength when compared with other metals on a weight basis but is particularly advantageous when stressed in compression or where parts must have a substantial section for other reasons. Housings, crank cases, and brackets for example, may be excellent applications. Magnesium has remarkably good machining properties and in this connection the fire hazard from machining

Dr. L. M. Pidgeon

has been grossly exaggerated. It is even possible to weld it. Extruded sections, sheets and indeed most of the standard shapes are available for fabrication. A few precautions must be observed in this connection—for instance it is frequently necessary to apply a protective finish to retard destructive oxidation just as it is with steel.

The general terms and descriptive character of Dr. Pidgeon's paper will enable those who heard it to better understand the many references made to magnesium in the news.

**The accompanying picture shows the decontamination unit of the Peterborough A.R.P. organization. This unit is lead by Mr. D. J. Emery, branch chairman and the personnel are nearly all members of the branch. The unit holds regular meetings and has participated in two practice black-outs to-date as well as exercises in gas filled chambers.**

### SAGUENAY BRANCH

Alex. T. Cairncross, M.E.I.C. - *Secretary-Treasurer*

During March, the Saguenay Branch of the Institute held two meetings in the Arvida Protestant School.

March 11th, Chairman, Mr. C. Miller. Flight-Lieut. C. W. Johnson, R.C.A.F., spoke on **Fighter Operations over Britain,** with permission of Group Captain V. S. Parker, D.F.C., A.F.C., Bagotville.

Lieut. Johnson served two years overseas with the Fighter Command, and he explained in some detail how fighter sweeps are organized and briefed. The talk was illustrated with diagrams and official government sound films.

Mr. B. Bauman moved the vote of thanks to the speaker.

---

March 18th, Chairman, Mr. C. Miller. Mr. L. C. Harris, Manager, Power Products, Industrial Division, Canadian Johns-Manville Co., Limited, Montreal, spoke on **Transite.**

"Transite," Mr. Harris explained, was an asbestos fibre and cement mixture that was first developed by an Italian engineer at Milan about 1895. During the years, improvements in the product have been made, but basically the process of manufacture has remained the same. The asbestos mixture is pulped and formed wet to make sheet or pipe. The speaker said that pipe in sizes up to 36 inches is now being used on water transmission lines and for many industrial processes.

Two excellent technical sound films were shown, entitled **Heat and Its Control,** and **The Design and Construction of a Water Collection Transmission System.**

Following the films there was considerable open discussion, and Adam Cunningham moved a vote of thanks to the speaker. Mr. Cunningham especially thanked companies in general who have made available educational films for showing before organizations.

## SAULT STE-MARIE BRANCH

O. A. Evans, Jr.E.I.C. - *Secretary-Treasurer*

The third general meeting for the year 1943 was held in the Grill Room of the Windsor Hotel on Friday, March 26th, 1943, when 22 members and guests sat down to dinner at 6.45 p.m.

The chairman called upon P. P. Martin to entertain the members for a few moments. Mr. Martin told stories which illustrated the difference between wit and humour. These were enjoyed by all.

The chairman asked A. E. Pickering to give a short talk on the general meeting of the Institute. Mr. Pickering said that the Sault Branch was very well represented at the meeting and remarked that while the war had placed restrictions on the type of papers presented, there were some very good ones given at the general meeting. He particularly mentioned the one dealing with the Alaskan Highway.

The main feature of the evening was then shown by G. W. MacLeod, which was a moving picture film showing, "Construction of the hydro-electric power development at La Tuque on the Upper St. Maurice River."

## TORONTO BRANCH

S. H. de Jong, M.E.I.C. - - - *Secretary-Treasurer*
G. L. White, Affiliate E.I.C. - *Branch News Editor*

The third meeting and the first annual meeting of the newly formed Junior Section was held in Hart House on March 24th as a dinner meeting. The meeting was conducted by R. Hewitt and the guest speaker, Harry F. Bennett, was introduced by Prof. R. F. Legget.

Mr. Bennett spoke on **The Engineer of Tomorrow,** emphasizing the probable important position of the engineer in the post-war period. He spoke also on the place of the Institute in the engineering profession in Canada. The speaker suggested that this group should confine its meetings and discussions to general technical and economic questions and not get off onto controversial political problems.

Dean C. R. Young, also in attendance at the meeting, spoke on the present work of the E.I.C. in the interest of the young engineer.

The results of the elections for the Executive for next year were as follows:

| | |
|---|---|
| Chairman | J. VanWinkle |
| Vice-Chairman | H. Self |
| Secretary-Treasurer | D. D. Stiles |
| Committee for Two Years | 1. R. Hewitt |
| | 2. R. Millman |
| | 3. S. Segsworth |
| Committee for One Year | 1. Dr. F. Noakes |
| | 2. A. Davis |
| | 3. W. Fotheringham |

Approximiately 90 persons attended this meeting and all were unanimous in the opinion that another meeting should be held this spring by the Junior Section.

A very successful Annual Meeting of the Toronto Branch of the Institute was held at the Granite Club on April 1st in the form of a dinner. Retiring Chairman, Col. W. S. Wilson, presided over a programme which included Committee reports, a discussion of future policy for the Toronto Branch, a brief word from President K. M. Cameron, the installation of new officers of the Branch, and motion pictures.

Head table guests introduced to the audience included the president of the Institute, Mr. K. M. Cameron; the immediate past president, Dean C. R. Young; Stanley Glover, recently elected chairman of the Hamilton Branch, E.I.C.; and W. J. Jakimuik, chief designer, DeHaviland Aircraft of Canada, Ltd., who sang several Polish songs, providing his own accompaniment.

In a brief address, Col. W. S. Wilson outlined the work of the Branch during the year, making special reference to civilian defence and the formation of the Junior Section. He paid tribute to the work of Prof. R. F. Legget in the organization of the Junior Section and also referred to the time and effort expended by many members of the branch in important committee work.

President K. M. Cameron spoke of the work of his predecessor, Dean Young, in directing the affairs of the Institute with such success during a very important year of its life. He expressed his pleasure at being present and his anticipation of profiting from the discussions of the annual meeting of the Branch.

The secretary's report and the financial statement gave a very good picture of branch activity during the year, and the financial position.

Professor R. F. Legget outlined the events leading up to the formation of the Junior Section of the Toronto Branch and the programme which the junior group has followed since its inception.

Introducing the discussion of branch policy, Prof. R. F. Legget pointed out that it was about seven years since the Branch had thoroughly reviewed its activities. The discussion which followed this introduction centered around the desirability of including some work on business management in the activities of the Branch. Diverse opinions were presented but the general idea would appear to be very much in favour of some attention to business management without interfering with the technical activities of the branch.

The officers for the coming year were installed.

Motion pictures were shown through the courtesy of the Ford Motor Company of Canada, Ltd.

## VANCOUVER BRANCH

P. B. Stroyan, M.E.I.C. - *Secretary-Treasurer*
A. Peebles, M.E.I.C. - - *Branch News Editor*

A meeting of the branch was held on Thursday, March 25th, in the Medical-Dental Building when Mr. C. K. McLeod and his assistant, Mr. Richardson, presented a paper on **Old Time Pieces.**

This subject, though a little off the beaten track of engineering topics, proved extremely interesting and informative. The speaker read a prepared paper after which the discussion became informal. He dealt first with the relation of time to civilization, showing how smaller divisions of time were required as civilization progressed. In different countries at the present time, the day is divided into different periods. The Chinese use twelve divisions, each equal to two hours. The Italians still count the hours from one to twenty-four, as used in the army. Formerly the Romans divided the day into four divisions only. Our present standard time was introduced by Sir Sanford Fleming in the 1870's to avoid the discrepancies of mean time which was used then. He described briefly some of the devices used by the Egyptians, Romans and early Britons to indicate the passage of time. These included water clocks in which falling drops of water filled a small vessel containing a float, which gradually rose with the water level and indicated the time on a graduated column. Others had small paddle wheels which the falling drops caused to turn, thus actuating an escape wheel. The use of jewels for orifices, the principle of the siphon and the first use of ratchet and pinion in timepieces was found in these early water clocks.

The first sundial dates from about 730 B.C. and the early ones were made of hemispherical plates. Later the flat plate came into use. The Romans and early Britons used sand glasses and candle clocks. Planetariums were also made in England at an early date. The date of the first wheeled clock is not certain but is believed to be during the sixth century. It was first described in writing by Henry de Wyck. The oldest wheeled clocks in England are those of St. Paul's and Westminster. The early clocks had only one hand, an indication of the coarser division of time only. Around 1600 a second hand was added to give smaller divisions of time, and a century later the third hand was added to denote the smallest divisions. Although the action of the pendulum was discovered by Galileo it was not adapted to time keeping devices until long after his time.

The outstanding developments in the evolution of modern watches and clocks were the invention of the fusee by Harrison, who also invented the chronometer; also the dead beat escapement which Graham invented around 1700 in England. These principles were illustrated by drawings on paper and on the blackboard and by a large wooden model of a modern watch escapement. Many questions were asked regarding the relative accuracy of watches and their adjustment for balance in all positions, compensation for temperature, etc. Although the audience was small, those present enjoyed a most interesting and educational evening.

W. N. Kelly, branch chairman, presided.

---

## STEEL

(*Continued from page 280*)

plant and equipment have been made in recent years, and to-day it is making an important contribution to Canada's war effort.

In the January, 1943, issue of *Industrial Canada*, some facts and figures of the steel industry in Canada are given which are eloquent of the extent to which this industry contributes directly and indirectly to employment and to the national income. In direct relation to the industry, in 1939, "the gross output value of 1,394 establishments of this group was $553,468,880 and the number of employees 121,041." This, it should be noted, was a year in which over nine months were occupied in the usual peaceful pursuits of the industry. The conditions of to-day, though of an exceptional and non-permanent character in extent of output and employment, will, in themselves, it is believed, create wider opportunities and new fields of industrial enterprise for the years of peace which lie ahead.

It is by no means an exaggeration of its importance to consider the steel industry as the basal stone in the economic structure of Canada's manufacturing industries. Steel, in its varied uses, supplies the instruments necessary for our civilized existence and makes possible the maintenance and progress of every form of industrial activity among our people in war or peace. Verily, it reaches into "the Heavens above, the earth beneath, and the waters under the earth." All those modern nations which have grown great in commerce have fostered and encouraged their steel industries. If, as a people, possessing a wide concept of our national future, we fully recognized the significance of those things which make for national greatness and security, we would realize that steel occupies a preferred position in our national economy; transcendant in its economic value and fundamental in its security value. As such, it should be jealously guarded by a national interest in its welfare, so that it may be prepared, at all times, to answer effectively the two urgent questions which will always confront us as a nation in times of crisis; a sufficiency of steel for our consuming industries, and steel for our protection in the event of attack, when we need to "make two blades of 'steel' grow where only one grew before."

It is to the engineering profession that we must credit the unfolding of the mysteries and values of steel in its manifold qualities and uses. The next quarter-century will be a challenge to the progressive ingenuity and enterprise of engineers in the field of steel research and experiment.

## AN ENGINEERING RENAISSANCE

(*Continued from page 303*)

An outstanding feature of the changes brought about by the report of the committee, in addition to the appointment of a full time secretary, was the decision to hold professional meetings in various parts of Canada as well as the establishment of a monthly magazine. The first issue of the *Journal* contained a complete report of the first professional meeting held in Toronto and this meeting together with the published report drew the members together in a common bond such as no previous event had done.

Reference should be made of the fact that branch secretaries were made associate editors of the *Journal* from the first issue and the regular contributions received from all branches were of outstanding importance in arousing the interest of members everywhere in Institute affairs. The co-operation of the branches whose prestige was greatly enhanced during the year was of inestimable value to the progress of the Institute as they became a great tower of strength, as their own activities were greatly increased particularly in promoting professional meetings in their respective districts. Regular visits from the secretary were a stimulant. Shortly, nine new branches were established and one, dormant, revived.

The move for legislation to control the practice of engineering was born at the second professional meeting held at Saskatoon in August, since when the movement has spread with general acceptance to every part of Canada. Three well-attended and successful professional meetings were held during the year, the first in Toronto, the second at Saskatoon and the third at Halifax, each and all of them making a real contribution to engineering progress, to professional pride and to harmonious relations.

It is doubtful if the engineering profession in Canada appreciates what it owes to the Committee on Society Affairs for from its work stems all the broadening of objectives, all the improvement in organization and all the revitalizing of personnel which has transformed a prosaic but potentially valuable society into an institute that in the short space of a quarter of a century enjoys a professional prestige and an opportunity to serve engineers second to no other similar body on the continent.

Tribute should be paid to the stalwart and able officers of that day, many of whom have passed away, for their ability, their foresight and their courage in making such radical changes which proved so successful.

Thus, the older, conservative, self-centered, self-satisfied society was energized within a single year to an institute vibrant and progressive. Why? Simply because its objective had been broadened; its organization modernized and last, but by no means least, because it became articulate through its own *Journal*.

---

# Library Notes

## Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications

### ADDITIONS TO THE LIBRARY

#### TECHNICAL BOOKS

**Introduction to Reinforced Concrete Design:**

*2nd ed. Hale Sutherland and Raymond C. Reese. N.Y., John Wiley and Sons, Inc. (c. 1943). 6 x 9¼ in. $5.00.*

**Analytic Geometry:**

*Edward S. Smith, Meyer Salkover and Howard K. Justice. N.Y., John Wiley and Sons, Inc., (c. 1943). 6 x 9¼ in. $2.50.*

**Economy Loading of Power Plants and Electric Systems:**

*Max J. Steinberg and Theodore H. Smith. N.Y., John Wiley and Sons, Inc., (c. 1943) 6 x 9¼ in. $3.50.*

**Reconstruction in Canada:**

*Lectures given in the University of Toronto, edited by C. A. Ashley. Toronto, The University of Toronto Press, 1943. 6 x 9 in. $1.00.*

**Hardness:**

*A critical examination of hardness, dynamic hardness, and an attempt to reduce hardness to dimensional analysis by D. Landau. N.Y., The Nitralloy Corporation, 1943. 106 p.*

**Nitriding Furnaces:**

*A practical exposition of their constructional features, capacities, operation and instrumentation with notes on ammonia, its handling, etc., collected and arranged by D. Landau. N.Y., The Nitralloy Corporation, 1943. 99 p. (Copies of this and the above booklet may be obtained without charge, by writing to the company at 230 Park Avenue, N.Y.)*

#### REPORTS

**Index to A.S.T.M. Standards:**

*Including tentative standards as of December, 1942. 198 p. (Copies of this publication are furnished without charge on written request to A.S.T.M. headquarters, 260 South Broad Street, Philadelphia, Pa.*

**American Institute of Consulting Engineers:**

*Constitution, by-laws and list of members as of March, 1943.*

**U.S.—National Research Council—Highway Research Board:**

*Wartime road problems No. 5—Granular stabilized roads. Feb. 1943.*

**Association of Iron and Steel Engineers:**

*Specifications for electric overhead traveling cranes for steel mill service. August, 1942. $1.25.*

**Association of Iron and Steel Engineers:**
*Report of Crane girder tests.*

**Canada—Dept. of Labour:**

*Thirty-first annual report on labour organization in Canada.*

**Ohio State University—Engineering Experiment Station—Bulletin:**

*No. 113—Salt glazes on structural clay building units.*

**Edison Electric Institute:**

*Furnace tube corrosion. Publication No. K-3, March, 1943.*

**Bell Telephone System—Technical Publications:**

*Monograph B-1355: Order in the alloy $CU_3$, AU.—B-1356: New Frequency-modulation broadcasting transmitter. —B-1357: Regulated rectifiers in Telephone offices.—B-1358: Kiln drying southern pine poles.*

**Electrochemical Society—Preprints:**

*83-2: High temperature resistivity measurements on compressed granular refractory materials.—83-3: The Rocking electric furnace, a silver anniversary.—83-4: The Transition state theory of the formation of thin oxide films on metals.—83-5: Thermodynamic considerations in the corrosion of metals.—83-6: Chemical changes affecting the stability of cellulose insulation.—83-7: The Flexibility of the cuprous oxide rectifier for automatic control equipment in electroplating.—83-8: Studies on overvoltage—15: A Study of decomposition potentials, cathodic and anodic polarization of a platinized platinum cathode near the reversible value in hydrogen saturated acid solutions.—83-9: Studies on overvoltage No. 16: Cathodic and anodic polarization of a platinized platinum cathode near the reversible value in nitrogen saturated acid solutions.*

**The following book has been presented to the Institute library by Mr. D. M. McLachlin and is here gratefully acknowledged.**

**Properties of Glass:**

*George W. Morey. N.Y., Reinhold Publishing Corp., 1938 (American Chemical Society, Monograph Series).*

#### BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.**

**A.S.T.M. STANDARDS ON RUBBER PRODUCTS**

*Prepared by A.S.T.M. Committee D-11 on Rubber Products. Methods of Testing Specifications. February, 1943. American Society for Testing Materials, Philadelphia Pa. 301 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.75.*

This annual brings together the standard and tentative methods of tests and specifications for rubber products which the Society has approved, together with a useful bibliography on rubber testing, thus forming a convenient reference book for the laboratory. General methods, and special ones for hose, belting, gloves, matting, tape, latex, cements, sponge and hard rubbers, and for insulated wire and cables are given. Emergency alternate provisions for various standard specifications are included.

**AIR CONDITIONING ANALYSIS WITH PSYCHROMETRIC CHARTS AND TABLES**

*By W. Goodman. The Macmillan Company, New York, 1943. 455 pp., diagrs., charts, tables, 9½ 6 in., cloth, $6.00.*

The aim here is to present a comprehensive, unified treatment of the fundamentals of the art of changing the condition of air, without discussing such related subjects as refrigeration, air handling and temperature control. The material presented is developed from an elementary point of view and illustrated by numerous solved problems. Psychrometric charts with co-ordinates of enthalpy and specific humidity for a wide range of temperatures are included.

**AIR NAVIGATION**

*By E. R. Hamilton. The Ronald Press Co., New York, 1943. 175 pp., diagrs., charts, tables, maps, 8 x 5 in., cloth, $2.00.*

The aim of this book is to meet the needs of those who, with no previous knowledge of the subject, wish to acquire a working knowledge of air navigation in a somewhat limited time. With this aim in view, the essentials of the subject are described in a straightforward manner, bearing in mind the desire of the reader to become a pilot, navigator or observer. The book is based on experience in teaching men in the Royal Air Force or preparing to enter it.

**AIR NEWS YEARBOOK**

*Duell, Sloan & Pearce, New York, 1942. 264 pp., illus., 9½ x 12 in., cloth, $3.75.*

The Yearbook contains over three hundred and fifty photographs of airplanes, selected from the files of news agencies and aeronautical photographers. The photographs include specimens of the current fighting planes of the United States, Great Britain, Russia, China, Germany, Japan and Italy, accompanied by technical data on each plane and by concise accounts of the organization of the various air forces.

**AIRCRAFT PROPELLOR HANDBOOK**

*By K. H. Falk. Rev. ed. Ronald Press Co., New York, 1943. 146 pp., diagrs., charts, tables, 9 x 6 in., cloth, $4.50.*

The aim of this work is to provide engineers, draftsmen and others in the aeronautic industry with a concise, practical discussion of propeller design. The information is presented in simple form, with as little advanced mathematics as possible, and a minimum of theoretical discussion. The methods are illustrated by examples, and a chapter on propeller selection is included.

**The AMAZING PETROLEUM INDUSTRY**

*By V. A. Kalichevsky. Reinhold Publishing Corp., New York, 1943. 234 pp., illus., diagrs., tables, 7½ x 5 in., cloth, $2.25.*

This little book is a brief popular outline of the existing petroleum manufacturing processes. What petroleum is, how it is obtained and transported, and how it is transformed into useful products are told clearly in language that laymen can understand.

**The AMERICAN LEONARDO, a Life of Samuel F. B. Morse**

*By C. Mabee, with an introduction by A. Nevins. Alfred A. Knopf, New York, 1943. 420 pp., Index I-XV, illus., diagrs., tables, 9½ x 6 in., cloth, $5.00.*

Morse's career was outstanding in several fields. He was a portrait painter of distinction and founder of the National Academy of Design. He invented the telegraph and promoted it successfully. His life was a long, busy one, crowned with many honors. Mr. Mabee's biography, based on long study and access to family papers, gives a very satisfactory and interesting account of the man and his work, the most complete that has appeared.

**ANALYTIC GEOMETRY**

*By E. S. Smith, M. Salkover and H. K. Justice. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 298 pp., diagrs., tables, 9½ x 6 in., cloth, $2.50.*

A college text which aims to adjust the student to the new type of reasoning that analytic geometry calls for, by providing accurate, fully illustrated explanations of the topics commonly taught in that subject.

**BOOM COPPER, the Story of the first U.S. Mining Boom**

*By A. Murdoch. The Macmillan Co., New York, 1943. 255 pp., illus., woodcuts, maps, 9 x 5½ in., cloth, $3.00.*

The story of the Michigan copper country, from its beginnings to the present day, is graphically told in this interesting work. The growth of the large mining interests, the men who made and managed them, how the miners lived; these are described with many details. In the author's words, this is "a purely informal review" that makes interesting reading.

**(The) CHEMICAL ASPECTS OF LIGHT**

*By E. J. Bowen. Oxford University Press, New York; Clarendon Press, Oxford, England, 1942. 191 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $4.00.*

Readers who wish to know something of the theories of light and of its interactions with atoms and molecules, but who are not thoroughly versed in mathematics, will find this a helpful supplement to more formal treatises. Among the matters treated are atomic and molecular spectra from the chemical point of view, the interrelations of scattering, Raman and fluorescence radiations, luminescence and phosphorescence, photochemical reactions, chemiluminescence and photocells.

**(The) CHEMISTRY OF NATURAL COLORING MATTERS, the Constitutions, Properties, and Biological Relations of the Important Natural Pigments. (American Chemical Society Monograph Series No. 89.)**

*By F. Mayer, translated and revised by A. H. Cook. Reinhold Publishing Corp., New York, 1943. 354 pp., diagrs., tables, 9½ x 6 in., cloth, $10.00.*

The present work is a completely revised edition of the second volume of Dr. Mayer's well-known "Chemie der organischen Farbstoffe." It offers English speaking chemists a survey of the existing information on the constitution and significant chemical and physical properties of the important natural pigments, accompanied by copious references to the original literature.

**(A) COURSE IN RADIO FUNDAMENTALS, Study Assignments, Experiments and Examination Questions based on the Radio Amateur's Handbook**

*By G. Grammer. American Radio Relay League, West Hartford, Conn., 1942. 103 pp., illus., diagrs., charts, tables, 9½ x 6½ in., paper, 50c.*

This is a study guide containing examination questions and laboratory experiments, which is intended to be used with the Radio Amateur's Handbook. The course is intended primarily for self instruction, but will also be of interest to teachers. The apparatus required is simple and can usually be constructed with material that the amateur has at hand.

**DAVISON'S RAYON AND SILK TRADES, including Nylon and Other Synthetic Textiles. The Standard GUIDE, forty-eighth annual, 1943 pocket edition.**

*Davison Publishing Co., Ridgewood, New Jersey. 402 pp., maps, tables, 7½ x 5 in., cloth, $5.50.*

A directory of manufacturers of silk, rayon and synthetic textiles, and of dyers, finishers, agents, and others connected with these trades. The mills are classed geographically and also by products, with information as to capacity, officers, etc.

**DIFFERENTIAL EQUATIONS**

*By H. W. Reddick. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 245 pp., diagrs., tables, 9 x 5½ in., cloth, $2.50.*

A textbook dealing with methods of solving ordinary differential equations and with problems in applied mathematics involving them. Partial differential equations are not treated. The book is intended for both engineering and liberal arts schools.

**ECONOMY LOADING OF POWER PLANTS AND ELECTRIC SYSTEMS**

*By M. J. Steinberg and T. H. Smith. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 203 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

The problem of allocation of load to power plants and to the equipment within them so as to produce electricity at the lowest cost consistent with continuity of service has become important as large electric systems have been interconnected. In this book the problem is discussed in detail. The underlying theory of economy loading is explained, the mathematical conditions for obtaining maximum efficiency are derived, the application of incremental rates for the solution of load-division problems is set forth, the limitations in the application of the theory are discussed, and the practical solution of load-division problems is explained. There is a bibliography.

**EMPIRICAL EQUATIONS AND NOMOGRAPHY**

*By D. S. Davis. McGraw-Hill Book Co., New York and London, 1943. 200 pp., diagrs. charts, tables, 9½ x 6 in., cloth, $2.50.*

The first part of this book describes practical methods for correlating engineering data and deriving usable empirical formulas. The fundamental methods of rectification are explained together with new techniques for two-variable data and a method of correlation for equations with three variables. Part two gives an excellent account of the theory and construction of nomographic and line coordinate charts. A good bibliography is included.

**Great Britain, Dept. of Scientific and Industrial Research.**

**INDEX TO THE LITERATURE OF FOOD INVESTIGATION, Vol. 14, No. 1, June, 1942.**

*Compiled by A. E. Glennie and C. Alexander. His Majesty's Stationery Office, London, 1942. 72 pp., tables, 9½ x 6 in., paper, (obtainable from British Library of Information, 30 Rockefeller Plaza, New York, $1.35).*

The index provides excellent coverage of current literature upon all phases of food investigation, especially with relation to methods of preservation by refrigeration, canning, etc. Methods of transportation, refrigerating and air-conditioning machinery, insulating and drying equipment also receive attention. The references are well abstracted.

**INDUSTRIAL RADIOLOGY, X-Rays and Gamma Rays**

*By A. St. John and H. R. Isenburger. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 298 pp., illus., diagrs., charts, tables, 9½ x 6 in. $4.00.*

This book is intended to furnish in readable form authoritative information on the practical use of radiology in industry. The general principles governing the production and use of X-rays and gamma rays are presented, together with the techniques suitable for important classes of industrial materials. A bibliography of over 1,300 titles is a valuable addition to the book.

**INTRODUCTION TO REINFORCED CONCRETE DESIGN**

*By H. Sutherland, R. C. Reese and I. Lyse. 2 ed. based on the first edition by H. Sutherland and the late W. W. Clifford. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 559 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

In this textbook the fundamentals of the subject are presented as simply and completely as possible, with emphasis upon practical considerations. The new edition has been thoroughly revised in the light of new knowledge acquired during the last sixteen years.

**MAPS AND SURVEY**

*By A. R. Hinks. 4 ed. Macmillan Co., New York; University Press, Cambridge, England, 1942. 301 pp., illus., diagrs., charts, maps, tables, 9 x 5½ in., cloth, $3.75.*

This is intended as an introduction to the study of maps and the processes of survey by which they are made. Starting with a brief history of ancient maps, the author then describes the modern map and the methods used in producing it. Chapters are then devoted to the maps published in various countries. The second part of the book describes the various methods of surveying and its different applications, with some account of the instruments used. This edition is practically the same as the third except for a chapter of additions and corrections.

**MARINE ELECTRIC POWER**

*By Q. B. Newman. 2 ed. Simmons-Boardman Publishing Corp., New York, 1943, 238 pp., diagrs., charts, tables, 8 x 4½ in.. cloth, $2.50.*

This book provides a very clear explanation of the fundamental principles of electrical engineering as applied to marine electrical power. Mathematics is practically absent, and only the slightest knowledge of physics is required. The new edition has been considerably enlarged by six chapters on the practical application of the principles.

**MARINE ENGINE AND FIRE ROOM GUIDE**

*By R. H. Jacobs and E. L. Cady. Cornell Maritime Press, New York, 1943. 740 pp., illus., diagrs., charts, tables, 7½ x 5 in., cloth, $3.50.*

This is a handbook of information for wipers, firemen and watertenders on ships, which covers in a practical way the theory of the machinery in their care and the operation and maintenance of it. A large amount of essential information is provided for the unlicensed personnel of the engineering department of the ship and presented clearly.

**MECHANICAL HANDLING YEARBOOK AND MANUAL 1943**

*Edited by H. Pynegar. Paul Elek (Publishers) Ltd., Africa House, Kingsway, London, W.C.2, 1943, 399 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, 30s. net.*

This British handbook deals with underground machine mining, with screening, conveying and elevating, and with industrial trucks and cranes. The equipment of many manufacturers is described, as well as numerous installations.

**MECHANICS OF MATERIALS**

*By S. G. George and E. W. Rettger, revised by E. V. Howell. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 491 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.75.*

A simple, complete account of the essentials of the subject is provided, suitable for use as a college text, but containing more material than is usually covered in an elementary course. In this edition the sequence of chapters has been altered, rivet and column specifications have been revised, and an article added on the graphical solution of combined stresses.

**MECHANISM**

*By I. H. Prageman. International Textbook Co., Scranton, Pa., 1943. 296 pp., diagrs., charts, tables, 8½ x 5½ in., fabrikoid, $3.00.*

An elementary text for use by sophomore or junior students of engineering. The motions, velocities and accelerations of various machine parts are described, as are static forces that may be transmitted in some of the simpler machines, and inertia forces acting on machine parts.

**NATIONAL CONFERENCE ON PLANNING, Proceedings of the Conference held at Indianapolis, Indiana, May 25-27, 1942**

*American Society of Planning Officials, 1313 East 60th St., Chicago, Ill., 1942. 228 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

This book presents addresses and discussions at the Conference, all of which deal with real problems of the present day. Post-war planning, the problem of converting war industries to peace uses, the manpower crisis, war housing and city rebuilding after victory, state and municipal planning, are discussed by experienced men.

**PAPERMAKING, the History and Technique of an Ancient Craft**

*By D. Hunter. Alfred A. Knopf, New York, 1943. 398 pp., I-XXIII pp., illus., diagrs., tables, maps, 9½ x 6 in., cloth, $4.50.*

This is a comprehensive, readable history of papermaking, from its invention in China to modern times, written by the outstanding living authority on the craft. Handsomely printed and profusely illustrated, it offers a connected account of the methods used in countries all over the world and at all periods. A chronology of paper and a select bibliography are included.

**PATENTS AND INDUSTRIAL PROGRESS**

*By G. E. Folk with a foreword by R. L. Lund. Harper & Brothers, New York and London, 1942. 393 pp., diagrs., charts, maps, tables, 8½ x 5½ in., cloth, $3.00.*

In 1938 the Temporary National Economic Committee was created by Congress to study the concentration of economic power and among other matters, "the amendment of the patent laws to prevent their use to suppress inventions, and to create industrial monopolies." The present book is an evaluation of the testimony taken on the patent system, by an eminent patent attorney, with comments on the wisdom of the legislation recommended.

**PLUMBING PRACTICE AND DESIGN, Vol. 1**

*By S. Plum. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 308 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

This is the first section of a two-volume handbook on plumbing, which is intended to consolidate the scattered data on the subject and present them in a uniform terminology. Information is presented here on materials, pipes, fittings, valves, controlling apparatus, fixtures, pumps, fire protection and air equipment. Specifications are given in many cases.

**PRACTICAL MARINE DIESEL ENGINEERING**

*By L. R. Ford. 4th ed. Simmons-Boardman Publishing Corp., New York, 1943. 642 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $6.00.*

The construction, operation and maintenance of marine Diesel engines are explained thoroughly, from the point of view of the operating engineer. The work is limited to the makes of engines that are being most used in the types of vessels now being built, especially those developed by the U.S. Maritime Commission. Other features are discussions of Diesel tugs, of deck and electrical machinery and of shipyard engine repairs. A chapter on license requirements is included.

**PRE-SERVICE COURSE IN AUTOMOTIVE MECHANICS**

*By J. V. Frost. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 545 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $2.50.*

The subject is treated principally from the theoretical point of view in this well planned text, which is based on the outline for pre-induction training prepared by the War Department. The course is adapted to high-school students. The construction and operating principles of all motor vehicles are covered.

**PRE-SERVICE COURSE IN ELECTRICITY**

*By W. C. Shea. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 276 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $2.00.*

This book follows the outline of a basic course for pre-induction training which has been prepared by the War Department and the Office of Education. The book covers the fundamentals of electricity, including information prerequisite to work in radio, aviation, motor mechanics and other special subjects of military importance.

**PRE-SERVICE COURSE IN SHOP PRACTICE**

*By W. J. Kennedy. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1943. 337 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $2.00.*

This book is based upon the requirements of the U.S. Army for pre-induction training to be given to high-school seniors. Starting with accounts of hand and machine tools, the book proceeds to treat in more detail the tools and shop processes most used by the army. Cutting, planing, finishing, etc., are explained. A chapter is included on wiring and one on ropes and splices. Blocks and rigging are also explained.

**PROTEINS, AMINO ACIDS AND PEPTIDES AS IONS AND DIPOLAR IONS. (American Chemical Society Monograph Series No. 90)**

*By E. J. Cohn and J. T. Edsall, including chapters by J. G. Kirkwood, H. Mueller, J. L. Oncley and G. Scatchard. Reinhold Publishing Corp., New York, 1943. 686 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $13.50.*

This book is the result of many years of study of an important topic on the borderline between chemistry and biology. The evidence concerning the size and shape of molecules of the amino acids, peptides and proteins is examined, and of the number and distribution of the electric charges that they bear is examined and presented with full documentation. Especially, the authors consider the implications of the charged structure of these molecules for their physical properties, and their physico-chemical interaction with other molecules.

**QUESTIONS AND ANSWERS FOR MARINE ENGINEERS. Book IV—APPLICATIONS OF STEAM AND HEAT IN PRODUCING POWER**

*Compiled by Capt. H. C. Dinger. Marine Engineering and Shipping Review, Simmons-Boardman Publishing Corp., New York, 1943. 83 pp., charts, tables, 8 x 5 in., paper, $1.00.*

The fourth of these booklets dealing with problems that confront marine engineers deals with questions relating to evaporation, condensation and heat engine systems.

**QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book V—POWERING, FUEL ECONOMY, PROPULSION, PROPELLERS AND SHAFTING**

*Compiled by H. C. Dinger. (Marine Engineering and Shipping Review), Simmons-Boardman Publishing Co., New York, 1943. 97 pp., diagrs., charts, tables, 8 x 5 in., paper, $1.00.*

These questions and answers have been selected from those published during the last ten years in Marine Engineering and Shipping Review. They give information on the powering of ships, special methods of propulsion and control, on fuel consumption, tonnage, hull characteristics, propellers and shafting. The booklet is a handy reference for marine engineers and for those preparing for examinations.

**RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION**

*Sixth Annual Proceedings, 1942. Railway Fuel and Traveling Engineers' Association, 327 So. La Salle St., Chicago, Ill. 198 pp., tables, 9½ x 6 in., fabrikoid, $3.00.*

The papers presented to the Association and included in this volume discuss locomotive fuel economy, oil firing practice, gas turbine locomotives and similar topics. Reports of Committees are also included.

**ROEMER AND THE FIRST DETERMINATION OF THE VELOCITY OF LIGHT**

*By I. B. Cohen. The Burndy Library, Inc., 107 Eastern Boulevard, New York City, 1942. 63 pp., illus., diagrs., tables, 9 x 6 in., paper, 50c.*

This study originally appeared in volume 31 of ISIS, but owing to the loss of the original publication when Belgium was invaded, is now republished with some additions and corrections. The study discusses views previous to Roemer, the immediate background of Roemer's determination and the reception given his work. Facsimiles of his announcement and of the first account in English are included.

**THE TENNESSEE VALLEY AUTHORITY**

*By J. S. Ransmeier. Vanderbilt University Press, Nashville, Tenn., 1942. 486 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $3.00.*

The aim of this study is to contribute to clarification of the problem of cost allocation when river control is undertaken for multiple purposes. The author studies the problem as presented by the Tennessee Valley Authority. The development of the programme is presented, the various theories and problems of cost allocation are discussed critically, and the planning and policy examined.

**THE THEORY OF EMULSIONS AND THEIR TECHNICAL TREATMENT**

*By W. Clayton. 4th ed. Blakiston Co., Philadelphia, Pa., 1943. 492 pp., illus., diagrs., charts, tables, 10 x 6 in., cloth. $10.00.*

This book provides a thorough study of emulsions with emphasis on their practical treatment and industrial application. The previous edition has been out of print for some years, during which much has been done on the general theory of emulsions, which has been used in this revision. Old matter has been deleted, and the literature thoroughly covered. Copious references are provided to papers and patents. Theories of emulsions, properties of emulsions, the preparation of emulsions and de-emulsification are discussed.

**TIMESTUDY FOR COST CONTROL**

*By P. Carroll, Jr., foreword by C. D. Dyer, Jr. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 301 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

This book is intended for industrial engineers and executives interested in installing or improving a system of time study. It explains the application and advantages of time study based on predetermined standards, describes the establishment of a standards department, and outlines step by step a practical method of completing the time study measurement and control of cost without rearranging the shop.

**WILLARD GIBBS**

*By M. Rukeyser. Doubleday, Doran & Co., Garden City, New York, 1942. 465 pp., illus., tables, 9½ x 6 in., cloth, $3.50.*

This is the first full-length biography of the great American scientist whose "phase rule" has been the foundation of physical chemistry. Gibbs is shown in relation to his time and to his colleagues.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

April 29th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the June meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

**FOR ADMISSION**

ATKINSON—ALFRED LYFORD COURTENAY, of 88 Argyle Ave., Ottawa, Ont. Born at Stockton-on-Tees, England, Dec. 7th, 1896; Educ.: B.Sc. (Naval Arch'ture), Armstrong Coll., Univ. of Durham, 1924. B.Eng. (Adeundem), Univ. of Sask., 1936; Member, Inst. Naval Arch'ts., London; 1911-16, ap'tice, 1916-20, dftsman. Ropney & Sons, shipbldrs., Stockton-on-Tees; 1924-25, ship's dftsman., Armstrong-Whitworth, Naval Yard, Walker-on-Tyne; 1925-29, engrg. dftsman., power plant design and layout, Babcock & Wilcox, London, England; 1929-41, asst. prof. of mech. engrg., Univ. of Sask.; 1941 to date, Constructor Lieut. Commander, R.C.N.V.R., Naval Service Hdqrs., Ottawa, Ont.

References—C. J. Mackenzie, R. A. Spencer, I. M. Fraser, W. E. Lovell, G. R. Dalkin, E. Brown, A. C. M. Davy.

BAIRD—HUGH S., of 9807—83rd Ave., Edmonton, Alta. Born at Red Deer, Alta., Aug. 16th, 1906; Educ.: I.C.S.; 1929 to date, asst. foreman, shops, Dept. of Public Works, Edmonton, Alta. (Applying for admission as an Affiliate.)

References—G. H. N. Minkman, N. W. Macpherosn, E. D. Robertson, A. Frame, D. W. Ritchie.

BARRICK—JOHN BRUCE, of 1070 Sixth Ave., Verdun, Que. Born at Melville, Sask., Dec. 19, 1913; Educ.: B.Sc. (Elec.), Univ. of Man., 1935; 1936-37, asst. principal, Junior High School, Selkirk, Man.; 1937-38, sales engr., Dominion Sound Equipment, Toronto, Ont.; 1938-39, student engr., development lab., 1939-40, asst. purchasing agent, R. C. A. Victor Co. Ltd., Montreal; 1940-41, buyer, plant equipment, and 1941 to date, elec. dftsman., Defence Industries, Ltd., Montreal.

References—H. C. Karn, J. R. Auld, A. G. Moore, P. Varley, C. R. Bown.

BEECROFT—GEORGE WILLIAM, of Ottawa, Ont. Born at Little Britain, Ont., Jan. 26th, 1898; Educ.: B.A.Sc., Univ. of Toronto, 1923; 1914-19, overseas, C.E.F.; Summers—1920, machine shop, Willis-Overland, Toronto, 1921, rly. mtce., C.N.R., 1922, Hollinger Gold Mines, 1923, roadways dept., city of Toronto, 1924, York Twp. sewerage system; 1924-30, Tropical Oil Company and International Petroleum Co. Ltd., South America: res. engr. on town of El Centro; constrn. of pipeline for Andian National Corpn.; res. engr., on constrn. of bridges, power plant, gasoline plants, filtration plant, etc.; 1930-39, head office, Imperial Oil Ltd., and International Petroleum Co., Toronto; engrg. and gen. purchasing dept., on specification standardization and procurement of mech. and constrn. equipment for oil fields, refineries, gasoline plant, automotive equipment, etc.; 1939-40, 2 i/c No. 2 Army Field Workshop, R.C.O.C.; 1940, O.M.E. course at Military College of Science, Lydd, England; 1940-41, O.C., No. 2 Army Field Workshop, R.C.O.C., Can. Corps.; 1941-42, acting chief ordnance mech. engr., M.G.O. Branch, N.D.H.Q.; Aug. 1942 to date, military adviser, Wartime Bureau of Technical Personnel and National Selective Service, Ottawa, Ont.

References—L. A. Wright, H. W. Lea, C. R. Young, K. M. Cameron, S. R. Frost, T. S. Glover.

BROOKES—STANLEY GEORGE, of 2 Rock Ave., Ottawa, Ont. Born at London, England, Nov. 9th, 1906; Educ.: Corres. course in elec. engrg., Master Electrician's License, Ont. and Que.; 1929 to date, industrial and commercial electrical contractor, Ottawa, Ont. (Applying for admission as Affiliate.)

References—J. M. Riddell, L. T. Martin, A. N. Ball, J. W. Paterson, G. Stephenson, K. F. Wrangell.

EATON—EDWIN RUSSELL, Jr., of 57 Rosedene Ave., Hamilton, Ont. Born at Orillia, Ont., May 5, 1910; Educ.: B.A.Sc., Univ. of Toronto, 1936; with the Steel Co. of Canada, Canada Works, as follows: 1936-38, i/c fabrication and use of production tools; 1939 (Jan.-July), asst. supt., east mill; 1939 to date, supt. east mill, responsible for operation of mill on cold headed wire products.

References—W. E. Brown, J. R. Dunbar, J. J. Kelly, A. E. Allcut, T. S. Glover.

HAINSTOCK—HOWARD NELSON, of 2625 Tolmie St., Vancouver, B.C. Born at Kelloe, Man., Nov. 25, 1906; Educ.: B.A., 1928, M.A., 1929, Brandon College; 1930-31, post-grad. work on geol. leading to Ph.D. at Chicago Univ.; 1927-35 (summers), asst. on geol. survey party; 1933-34, with Granby Consldt. Mines; Central Man. Mines & Ferry Creek Syndicate; 1935, i/c 4 sub parties under Dr. B. R. MacKay in Sask. investigating ground water resources; 1935-37, writing of reports on findings of survey of 1935; 1937, i/c field party on ground water investigation in Ontario; 1938 to date, district mgr. for International Water Supply Ltd., engaged in water well installations, investigation of water supplies for towns, cities, industries, etc., and for British Commonwealth Air Training Schools.

References—J. E. Underwood, W. E. Crossley, J. G. Schaeffer, T. L. McManamna, R. S. Charles, Jr.

HARKNESS—WILFRED DICKSON, of Port Arthur, Ont. Born at Tainan, Shantung Prov., China, Nov. 17, 1918; Educ.: B.Sc. (Forest Engrg.), Univ. of N.B., 1941; with the Abitibi Power & Paper Co., Port Arthur Division, as follows: 1941-43, chief cruiser and asst. forester i/c cruising and advance surveys; 1942 to date, chief cruiser and field control man.

References—John Stephens, A. F. Baird, R. D. Harkness, D. S. Ellis.

HARRIS—ARTHUR DAVID, of Riverside, Ont. Born at Perth, Scotland, Oct. 12th, 1891; Educ.: 1904-08, London Polytechnic Institute, senior matric., 1908; R.P.E. of Ont.; 1909-14, structl. dfting., estimates and costs, Canada Foundry Co. Ltd., Toronto; 1915-19, overseas, C.E.F.; 1919, instructor, Dept. Soldiers Civil Re-establishment; 1919-22, structl. detailing, checking and designing, Canadian Bridge Co. Ltd.; 1922 to date, with Ford Motor Co. of Canada Ltd. as follows: 1922-24, design and constrn. engr., 1924-30, engr. i/c design of plant production and mtce. equipment, materials handling, machine layout, etc., 1930-35, asst. chief engr., gen. respons. for plant engrg., 1936, in New Zealand, engr. i/c design, constrn. and equipment of assembly branch (incl. steam and elec. distribution), 1937-41, asst. chief engr., and July 1941 to date, chief engr.

References—P. E. Adams, F. C. Ansley, J. B. Candlish, E. Chorolsky, G. V. Davies, W. D. Donnelly, C. M. Goodrich, A. E. West.

KEEN—CHESTER ANDREW, of Marshalltown, N.S. Born at Digby, N.S., April 14, 1913; Educ.: 1940-41, plane surveying, N.S. Tech. Coll.; 1935-36, chainman and rodman, 1936-40, instr'man., N.S. Dept. of Highways; 1940 (Aug.-Dec.), instr'man., shore defence battery, Dept. of National Defence; 1941-42, worked at bldg. trade, Digby; 1942 to date, instruman. and dftsman., Dominion Construction Corp. Ltd., Deep Brook, N.S.

References—L. S. Collison, W. L. Fraser, A. R. Moffat, J. L. Wickwire.

LOUDEN—THOMAS NEWTON, of 5762 Highbury St., Vancouver, B.C. Born at Dunfermline, Scotland, April 5th, 1904; Educ.: B.A.Sc. (Civil), Univ. of B.C., 1929; 1926 (9 mos.), instr'man., C.N.R.; 1927-28, instr'man., Dept. Public Works, B.C.; 1928-33, dfting. and design, structl. steel dept., and 1933-36, sales engr., Canadian Vickers Ltd., Montreal; 1937 to date, with the Hamilton Bridge Western Ltd., Vancouver, as follows: 1937-41, contract engr., 1941-42, acting gen. mgr., 1942 to date, gen. mgr.

References—W. N. Kelly, H. N. Macpherson, C. E. Webb, P. B. Stroyan, H. C. Anderson.

LYNDE—CARLETON JOHN, Jr., of 80 Percival Ave., Montreal West, Que. Born at Auburn, N.Y., Aug. 15th, 1906; Educ.: B.Sc. (Elec.), McGill Univ., 1929. One year post-graduate work; R.P.E. of Que.; 1925-27 (summers), paper mill constrn., Fraser Brace. Engrg. Co., substation constrn., Shawinigan Engrg. Co.; 1928 (4 mos.), statistical work, New York Edison Co.; 1929-37, Northern Electric Co. (and Dominion Sound Equipments Ltd., subsidiary), installn., mtce., and sales of theatre sound equipment, public address equipment, etc.; 1937-41, supt., Montreal plant, Coca-Cola Co. of Canada Ltd.; 1941 to date, with G. Lorne Wiggs, M.E.I.C., as res. engr. on constrn., Nov. 1942 to date, acting as assit. plant engr. at Noorduyn Aviation Ltd., Montreal.

References—G. L. Wiggs, C. V. Christie, W. G. Hunt, L. C. Jacobs, R. B. Jennings.

McLEAN—JOHN NEWELL, of Winnipeg, Man. Born at Hamiota, Man., Aug. 9, 1908; Educ.: B.Sc. (Civil), Univ. of Man., 1932; Summers: 1927-29, Man. Good Roads Bd., 1930, Man. Bridge & Iron Wks., Ltd., 1931, Dept. of Mines and Natural Resources of Man.; 1937-38, contractor's supt. on highway constrn., Ryan Contracting Co., Windsor, Ont.; 1938 (May-Dec.), Engr. and inspr. on bituminous paving constrn., Toronto & York Roads Comm., Toronto, Ont.; 1939 (Jan.-June), dftsman., Ontario Dept. of Highways; 1939 to date, asphalt engr., Imperial Oil, Ltd., Winnipeg, Man.

References—D. M. Stephens, T. E. Storey, W. P. Brereton, W. D. Hurst, Geo. R. Fanset.

MONETTE—EDDY, of Ste. Thérèse, Que. Born at Valleyfield, Que., Dec. 28th, 1909; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1935; R.P.E. of Que.; 1930-35 (summers) and 1935-36, Beauharnois Light, Heat & Power Co.; 1936-42, asst. divn. engr., and at present, divn. engr., Dept. of Roads, Prov. of Quebec.

References—E. Gohier, A. Gratton, J.-O. Martineau, J.-A. Lalonde, L. Trudel.

PATRICK—KENNETH ERNEST, of 3094 West 28th Ave., Vancouver, B.C. Born at Victoria, B.C., Sept. 14th, 1912; Educ.: B.A.Sc. (Civil), Univ. of B.C., 1936, R.P.E. of B.C.; 1931-32, instr'man., engrg. dept.; City of Victoria; 1936-37, asst. to W. G. McElhanney, cons. engr.; 1937 to date, second asst. engr., Greater Vancouver Water District and Vancouver and District Joint Sewerage and Drainage Board, Vancouver, B.C.

References—E. A. Cleveland, W. H. Powell, F. C. Stewart, G. M. Irwin, A. Peebles.

PEELING—HERBERT OLIVER, of Hamilton, Ont. Born at Saskatoon, Sask., Feb. 28th, 1912; Educ.: B.Sc. (Mech.), Univ. of Sask., 1934; R.P.E. of Ont.; 1934 (3 mos.), analysing coal and water; 1935 (6 mos.), designing and dftng. proposed extension to Saskatoon plant, Sask. Power Commn.; 1935 to date, with Canadian Westinghouse Co. Ltd. as follows: 1939-41, mech. design of elec. equipment, mech. engrg. dept., Jan. 1941 to date, asst. to plant engr., supervn. of plant engr's. dept., incl. power houses, special equipment, and control of dept. in absence of plant engr

References—C. J. Mackenzie, I. M. Fraser, L. C. Sentance, G. W. Arnold, H. A. Cooch, E. M. Coles.

PELLETIER—PAUL LUCIEN, of Montreal, Que. Born at Montreal, June 30th, 1915; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1938; R.P.E. of Que.; 1935-37 (summers), Quebec Bureau of Mines, Geodetic Survey and Dept. of Mines, Ottawa; 1938-40, asst. to chief engr., Montreal Catholic Schools Commn.; 1940-41, consltg. engr., and Jan. 1941 to date, service mgr., Montreal Coke and Manufacturing Co. (LaSalle Coke Company), Montreal, Que.

References—P.-P. Vinet, L. Trudel, A. Cousineau, S.-A. Baulne, A. Circé, A. Frigon, J. LeBlanc, R.-E. Matte, A. Collet.

RANKIN—CHARLES JOHN, of 2910 Maplewood Ave., Montreal, Que. Born at Glasgow, Scotland, Aug. 16, 1907; Educ.: 1927-31, diploma course, Paisley Tech. Coll. and Royal Tech. Coll., Glasgow; 1922-31, work on sand pumps, mech. dredges, minesweepers, and in pattern shop, foundry-mach. shop, etc., and 1931-34, designing engr., Lobnitz & Co. Ltd., Renfrew, Scotland; 1934-35, supervising engr., James Howden & Co. Ltd., Glasgow; 1935-36, plant mtce. engr., Smith & McLean, Ltd., Glasgow; 1936-37, marine engr., on shipboard, John Glen & Co. Ltd., Glasgow; 1937-39, design, process investigations and supervision of plant instllns. and mtce. schedules, Ogilvie Flour Mills Co. Ltd., Montreal; 1937-39, senior asst., design and investigation of industrial processes and new developments, Robert A. Rankin & Co., Montreal; 1938 to date, R.C.O.C., at present Captain and O.C. No. 121 Light Aid Detachments, A/OC No. 118 and No. 65, on active service overseas.

References—C. B. McRitchie, F. S. B. Heward, E. G. M. Cape, J. B. Stirling, H. J. Doran, R. E. MacAfee, F. G. Rutley.

RUBUSH—JAMES PROSSER, of Homewood, Ill. Born at Johnson County, Indiana, June 24th, 1905; Educ.: U.S. Naval Academy. Two extension courses in chem. engrg., Univ. of Wisconsin; 1927-28, asst. plant engr., Rhinelander Paper Co., Rhinelander, Wis.; 1929, supervising engr. of constrn., Proctor & Gamble Co. Cincinnati, Ohio; 1930-33, plant engr., Central Paper Co., Muskegon, Mich.; 1934-35, supt., Filer Fibre Co., Manistee, Mich.; 1936-38, chem. engr., Swenson Evaporator Co., Harvey, Ill.; 1939 to date, executive engr., Swenson Evaporator Co., and Whiting Corporation (Canada) Ltd., Harvey, Ill.

References—W. N. Kelly, J. N. Finlayson, H. N. Macpherson, R. S. Jane, L.-A. Duchastel.

SWEET—FREDERICK ARTHUR, of Ottawa, Ont. Born at Humberstone, Ont., June 27, 1911; Educ.: B.A.Sc. (Civil), Univ. of Toronto, 1936; 1936 and 1938, instrman and drainage engr., for J. W. Tyrrell, M.E.I.C.; 1937, asst. engr., Dayton Porcupine Mines, Ltd., Timmins, on development work, prospecting, etc.; 1938, Ajax Engineers, Ltd., on sign frames, radio towers, etc.; 1939, instrman. and asst. engr., City of St. Thomas; 1940 to date, asst. sec., Can. Engineering Standards Assn., Ottawa, Ont.

References—W. C. Miller, C. R. Young, W. R. McCaffrey, T. A. McElhanney, W. P. Dobson.

WILHJELM—FRITS ERIK, of Moncton, N.B. Born at Odense, Denmark, Aug. 10th, 1896; Educ.: B.Sc., Royal Technical College, Copenhagen, Denmark, 1920; 1920-22, asst. engr., Danish National Rlys.; 1922-25, asst. engr., G. Mengel, cons. engr., Odense; 1929-30, land surveying, 1930-31, constrn., 1937-38, concrete inspr., 1939 to date, asst. engr. and instr'man., C.N.R., Moncton, N.B. (1932-37 farming in Nova Scotia.)

References—H. J. Crudge, C. S. G. Rogers, G. E. Smith, E. R. Evans, A. R. Bennett, V. C. Blackett.

### FOR TRANSFER FROM JUNIOR

JARVIS—GERALD WALTER, of Montreal, Que. Born at Hamilton, Ont., Sept. 30th, 1907; Educ.: B.Sc. (Mech.), Queen's Univ., 1930; with McColl Frontenac Oil Co. Ltd. as follows: 1934-36, design work, 1936-38, design and constrn. of refinery equipment, 1938-39, shift supervisor, Montreal Refinery, 1939-42, design, constrn. and mtce., oil refinery and terminal equipment, and at present, chief engr. (St. 1931, Jr. 1938.)

References—C. P. Tomlinson, H. M. Watson, G. V. Roney, G. H. Gillette, L. H. Birkett.

ROGERS—HUBERT DAVID, of Gananoque, Ont. Born at Gananoque, Ont., July 31st, 1892; Educ.: B.Sc., Queen's Univ., 1913; 1911, geological survey of Canada; 1920, Ontario Dept. of Highways; 1920-39, supt. Gananoque Waterworks and Sewerage Comm.; at present, mtce. dept., Aluminum Co. of Canada, Kingston works. (St. 1913; Jr. 1922.)

References—H. W. Harkness, K. M. Winslow, W. L. Malcolm, D. S. Ellis, W. F. Noonan.

SCROGGIE—GEORGE NELSON, of London, Ont. Born at Guelph, Ont., Mar. 31st, 1910; Educ.: B.Sc., Queen's Univ., 1935; R.P.E. Ont.; 1930-32, and 1934 (summers), assisting City of Guelph Engineer; 1935-36, road and bridge constrn. for County of Waterloo, Ont.; 1937-38, Dept. of Highways of Ont., Chatham residence; 1939-40, and 1942 to date, junior engr. for Dept. of Public Works of Canada, London, Ont.; 1940-42, Lieut., R.C.E., constrn. of paved roads and parade grounds in England, with No. 1 Road Constrn. Co. (Jr. 1939.)

References—H. F. Bennett, H. G. Stead, W. Veitch, D. J. Emrey, H. S. Nicklin.

TAYLOR—WILLIAM RUSSELL COATES, Sqr./Ldr., R.C.A.F., of Prince Rupert, B.C. Born at Winnipeg, Jan. 24th, 1906; Educ.: B.Sc., Univ. of Man., 1929; R.P.E. Man.; 1923-24, elect. constrn. and mtce. dept., and 1924-27, trouble dispatcher, Winnipeg Elec. Co.; 1929-32, elect. designer, Northwestern Power Co.; 1932-35, operator, Ontario & Minnesota Power Co.; 1935-38, electl. engr., Greater Winnipeg Sanitary Dist.; 1938-40, radio and elect. engr., Trans-Canada Air Lines; 1940 to date, R.C.A.F. Signals, 1940-41, Montreal No. 1 W.S., 1941-42, chief instructor, Winnipeg, No. 3 W.S., 4 mos. to date, Senior Group Signal Officer, Prince Rupert. (St. 1928, Jr. 1934.)

References—E. V. Caton, D. L. McLean, J. Dyment, L. M. Hovey, W. P. Brereton.

### FOR TRANSFER FROM STUDENT

AUBRY—GERARD, of Montreal, Que. Born at Montreal, Mar. 9th, 1916; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1941; Summers—1937, city planning, Montreal Metropolitan Comm., 1938, instr'mn., Quebec Streams Comm., 1939, machine man helper, Noranda Mines Ltd., 1940, surveyor, Quebec Drainage Comm.; May-Oct., 1941, asst. res. engr., Quebec Highways Dept.; Oct. 1941 to Jan. 1942, instlln. dept., Northern Electric Co.; Jan. 1942 to date, instructor, Air Navigation Branch, R.C.A.F., rank of Flying Officer. (St. 1939.)

References—A. Circé, J.-A. .alonde, L. Trudel.

BARKWELL—STEWART, of 411 Dobbin Ave., Peterborough, Ont. Born at Dysart, Sask., Oct. 16th, 1915; Educ.: B.Sc. (Elec.), Univ. of Man., 1940; 1937-38 (summers), rodman, instr'mn. and dftsmn., Dom. Govt., P.F.R.A.; 1938-39, hoistman and boilerman, Flin Flon Gold Mines Ltd.; 1940-41, testing and design, 1941 to date, design and substitution, General Electric Co., Peterborough, Ont. (St. 1939)

References—E. P. Fetherstonhaugh, I. F. McRae, G. R. Langley, B. I. Burgess, D. V. Canning, D. J. Emery, A. L. Malby.

BUBBIS—MORRIS ISRAEL, of 187 Lisgar St., Ottawa, Ont. Born at Philadelphia, Pa., Aug. 28th, 1915; Educ.: B.Eng., (Mech.), McGill Univ., 1938; 1936 (summer), labor progress and cost records, C.P.R., Kenora Divn.; 1937 (summer), mech. dftsmn., Canadian Locomotive Co. Ltd., Kingston, Ont.; 1938-39, asst. to constrn. supt., British American Oil Co. Ltd., Regina and Winnipeg; 1939 to date, asst. mech. engr., Directorate of Works and Constrn., Dept. of National Defence, Ottawa, design and layout of high pressure central heating plants and steam distribution systems, heating, plumbing, water and sewer mains, etc. (St. 1937.)

References—D. Blair, H. B. MacCarthy, O. A. Barwick, C. M. McKergow E. Brown, N. M. Hall, G. H. Herriot.

CHANDLER—RALPH WRIGHT, of 77 Wellesley St., Toronto. Born at Calgary, Alta., Feb. 16th, 1916; Educ.: B.Sc. (Civil), Queen's Univ., 1941; Summers—1937, field dftng. and chaining, Lake Sulphite Pulp Co., 1938, operator, Thunder Bay Power system, 1939, Abitibi Power Island Falls power plant, dam repair work, 1940, struct'l detailing, Dominion Bridge Co., Lachine; 1941 to date, junior engr., Hydraulic Dept., Hydro Electric Power Commission of Ontario, Toronto. (St. 1940.)

References—M. W. Huggins, J. R. Montague, E. A. Sudden, D. S. Ellis, R. F. Legget, O. Holden.

FRECHETTE—ADOLPHE GASTON, of 268 Argyle Ave., Verdun, Que. Born at Montreal, Aug. 9th, 1915; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1940; R.P.E. Quebec; 1937-38 (summers), instr'mn. and inspection on road const., Lalonde & Valois; 1939 (summer), inventory of Montreal L.H. & P. for Prov. Bd. of Electricity; 1949 (2 mos.), res. engr., Quebec Road Dept.; 1940 to date, struct'l design and dftsmn., Dominion Bridge Co. (St. 1938.)

References—R. S. Eadie, R. M. Robertson, J.-A. Beauchemin, J.-P. Lalonde, O.-O. Lefebvre, A. Gratton.

GOODFELLOW—HODGSON, of London, England. Born at South Shields, Durham, England, June 15, 1915; Educ.: B.Sc. (Mech.), Univ. of Sask., 1940; 1937-38, survey, Dept. of Agriculture, P.F.R.A.; May, 1940, enlisted as Lieutenant R.C.E., going overseas in March, 1941; Oct.-Nov., 1941, attached to British Admiralty as Experimental Officer; Mar. 1942 to date, attached to Controller of Physical Research, British Ministry of Supply as Senior Experimental Officer. Responsible for development of non-metallic armour for purposes and uses other than Naval. Dec. 1942, promoted to Captain, R.C.E. (St. 1939)

References—C. J. Mackenzie, R. A. Spencer, I. M. Fraser, W. E. Lovell.

GUY—ROSS THOMAS, of 141 Agnes St., Oshawa, Ont. Born at St. Thomas, Ont., Oct. 2, 1915; Educ.: B.Sc., (Mech.), Queen's Univ., 1941; 1937-40, (summers), track engrg. dept., New York Central R.R., as rodman, chainman, instr'mn., and dftsmn.; with General Motors of Canada, Ltd., Oshawa, as follows: Feb.-Oct., 1941, senior detailer, Engrg. Dept., Oct. 1941 to July 1942, junior layout man, July to Dec. 1942, acting project engr., and Dec. 1942 to date, project engr. (St. 1940.)

References—A. Jackson, L. T. Rutledge, D. S. Ellis, L. M. Arkley.

JARRY—AUREL GASTON, of Quebec City. Born at Montreal, Que., Jan. 11th, 1916; Educ.: B.Eng. (Civil), McGill Univ., 1940; July 1940 to date, Navigation Instructor, R.C.A.F., with rank of Flight-Lieutenant, at Ancienne Lorette, Que. (St. 1940.)

References—R. DeL. French, G. J. Dodd, F. M. Wood, R. E. Jamieson, C. M. McKergow.

LORD—ROGER, of Beauharnois, Que. Born at St-Boniface-de-Shawinigan, Que., Aug. 31st, 1910; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1940; R.P.E. Quebec; 1935-36 (summers), Highways Dept. of Quebec; 1937-40, asst. to city engr., City of Shawinigan Falls, Que.; 1940 to date, asst. to res. engr., Power House, Beauharnois Light, Heat & Power Co., Beauharnois, Que. (St. 1939)

References—B. K. Boulton, C. H. Pigot, C. G. Kingsmill, R. Boucher, L. Trudel.

NEWBY—WILLIAM MURRAY, of Niagara Falls, Ont. Born at Chatham, Ont., Aug. 4, 1918; Educ.: B.Sc., Queen's Univ., 1940; 1938-39 (summers), hydraulic mtce., Trent system and Queenston Power Plant, H.E.P.C. of Ontario; 1940-41, test department, and 1941 (Apr.-Aug.), asst. to plant engr., Wire and Cable Dept., Canadian General Electric Co. Ltd., Peterborough; Aug. 1941-Dec. 1942, reinforced concrete design and detailing on Aluminum Co. Shipshaw Power project and Polymer Corp. rubber plant at Sarnia, Ont., and at present checking and expediting orders for equipment for power plant and pumping station, Polymer Corp., H. G. Acres & Co., Niagara Falls, Ont. (St. 1940.)

References—H. G. Acres, D. S. Ellis, W. Maclachlan, J. H. Ings, A. L. Malby.

McDOUGALL—WILLIAM ALLAN, of Fredericton, N.B. Born at Saint John, N.B., July 17th, 1920; Educ.: B.Sc., (Civil), Univ. of N.B., 1941; 1937-40 (summers), timekeeper and i/c stores, Armstrong Bros. Constrn. Co., Perth, N.B.; 1941 (2 mos.), dftng. and designing, tool room, Canada Car & Foundry Co., Airplane Branch, Amherst, N.S.; June 1941 to date, instr'man., Dept. of Transport, Civil Aviation Branch, Moncton, N.B., engaged at Sydney Airport, N.S., and Buchan Airport, Nfld., on constrn. (St. 1941.)

References—E. O. Turner, A. R. Bennett, D. C. Bowlin, A. S. Donald, J. J. Gorman.

RALPH—JOHN ARTHUR, of 57 Spencer Ave., Toronto, Ont. Born at Lachine, Que., Jan. 8, 1916; Educ.: B.Sc. (Elec.), Univ. of N.B., 1937; 1937-38, test course, 1939-41, illuminating and appliance engrg., Canadian General Electric Co.; 1941-42, sales engrg., Crouse-Hinds Co.; 1942 to date, assembly foreman, chief inspr., and plant engr., Marelco Ltd., Toronto, Ont. (St. 1937.)

References—W. T. Holgate, P. W. Doddridge, G. R. Langley, E. O. Turner, A. F. Baird.

## ELECTRICAL EQUIPMENT

(*Continued from page 290*)

56 per cent over the 1931 consumption. To-day, there are over 1½ million domestic customers on central station lines and the average annual consumption is 1438 kw.h. An average size, completely electrified home uses 6,000 kw. h. per annum.

### The Effect of the War on Electrical Equipment

Electrical manufacturers are building huge quantities of electrical equipment required by Canada's primary producers as well as for those industries fabricating these materials into the tools of war. In addition to its regular products, the electrical industry is successfully carrying on the manufacture of guns, searchlights, marine propulsion engines, marine generators, aircraft instruments, as well as plastic parts and other components for war equipment. Entirely new electrical devices, many of which are on the secret list, are also being manufactured.

To conserve the supply of critical materials, plant facilities, and labour, the Wartime Prices and Trades Board has placed restrictions on many types of electrical equipment previously manufactured.

The great progress that has been made in the development of electrical equipment in the past quarter century is being successfully applied to the prosecution of the present conflict. When peace returns, these advances will be utilized in increased measure to benefit industry, the municipality and the home, and indeed all mankind.

## PUBLIC WORKS

(*Continued from page 292*)

and description of a proposed work, investigation is made by the local engineer of the department and a report submitted on the proposed work as to its interference with navigation. Works constructed without approval under the Navigable Waters Protection Act are unlawful, and if a work not so approved is considered by the Governor General in Council to be an obstruction to navigation, he may order its removal at the expense of the owner.

Surveys, investigations and reports in connection with projects, both those which are carried out and many which are not proceeded with, are undertaken by the district offices of the Department, but it has been found advisable to place the work of carrying out test borings and diamond drilling under a special engineer at headquarters. In 1918, there were two outfits in use for testing overburden and one diamond drilling outfit for examination of rock. By 1942, these had increased to six and four drilling outfits respectively. The usual overburden drilling outfit is equipped to carry a two-inch hole to a depth of 175 ft. The diamond drilling outfits can drill some 400 to 500 ft. through rock and one machine is equipped for use to a depth of 1200 ft. Actual samples of material are obtained throughout the depth drilled. Although the Test Boring Division was primarily organized for use by the Department, its services are furnished to the other departments of the Dominion Government, and the equipment may be used at cost, if available, by outside parties. The work of carrying out test borings has been in charge of H. M. Davy, M.E.I.C., since 1905.

## ENGINEERS IN THE CONSTRUCTION INDUSTRY

(*Continued from page 293*)

contractor's experience and knowledge, which may be highly specialized, is then available. Obviously, this is only made possible by the existence of engineers in the contractor's organization.

The foregoing has indicated briefly the manner in which the influence of the engineer has increased in the construction industry, and—in many cases—a change in his position from one of minor influence to one of actual ownership and operation. This trend may be expected to continue with increasing benefit to the industry. Construction must play a large and important part in the post-war period, and the problem of securing skilled engineering personnel is bound to be a serious one—indeed, much more difficult than during the year 1941, in which the peak of war construction was reached. The industry will look to the younger engineers to fill up the ranks. The field is an attractive and promising one to the young man who will realize early enough in his post-graduate years that success in it can only be attained by the sacrifice of certain personal comforts which may perhaps be enjoyed by his fellows who have yielded to the temptation of taking an easier course. Construction is a tough job for engineers of tough fibre, and few observers will deny that construction engineers earn their living the hard way. To man this industry in the active years ahead is at once the engineer's challenge and opportunity.

## HIGHWAYS

(*Continued from page 297*)

In 1930, the width in Canada was established at 66 ft but, to-day, the figure for our main highways has reached 250 ft.

This 250-ft. width adopted for the sections of super-highways presently under construction in some parts of Canada corresponds to the standards now used in the United States.

But it is to be noted also that statistics show the accidents have increased at a greater rate on roads than in the streets of cities and towns. Since 1935, the number of accidents in the cities and towns has increased by about 35 per cent while, in highways, the increase has been 75 per cent. In fact, the number of accidents has increased in a greater proportion than the number of vehicles and the consumption of gasoline.

The figures are striking because it seems evident that such an increase in accidents is not normal, and that steps must be taken to determine their cause and to reduce their number.

In order to regulate traffic on our main highways, traffic engineers should be appointed to study traffic conditions and signalization. Pavement markings and road signs should be placed under their supervision.

The standards for road signs and pavement markings should be uniform throughout Canada and in the United States so that a tourist travelling from one state to another, or from one province to another, should be familiar with these signs wherever he travels.

Our improvements in road construction should conform to standards that suit the people who invade our territory for recreative purposes. In case of any emergency of a less peaceful character, they would be invaluable for the movement of troops, transportation of supplies and goods, and the evacuation of the larger centres of population.

The foregoing exposé of the consideration given by the different provinces to traffic requirements and how they intend to satisfy them is not exhaustive, but it will perhaps serve to show that all the provinces of Canada realize that they have great responsibilities in the fulfilment of their duties. They will undoubtedly do their best to give satisfaction to users of our Canadian highways.

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

MECHANICAL ENGINEER. Either capable of making mechanical repairs to power shovels, tractors, etc., or willing to learn. Tropical assignment. Apply to Box No. 2619-V.

EXPERIENCED TRANSITMAN for railway engineering work. Apply to Box No. 2629-V.

CIVIL ENGINEER, must be capable of supervising plant and small town house construction. Tropical assignment. Apply to Box No. 2630-V.

MECHANICAL ENGINEER, plant maintenance, important war work in the Saguenay district. Apply to Box No. 2634-V.

SALES ENGINEER AND BRANCH MANAGER required for Ottawa office of firm specializing in sale of engineering supplies. Either French or English. Permanent employment, fine prospects. References required. Apply to Box No. 2635-V.

### SITUATIONS WANTED

CIVIL ENGINEER, experienced dockyards, power, waterways and industrial buildings, etc., expediting and inspection. Apply to Box No. 183-W.

CIVIL ENGINEER, 38, experienced in all types of building construction and in industrial layout work. Wants permanent or temporary position in charge of design or construction. Present location, Montreal. Apply to Box No. 576-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., 17 years experience as production manager and factory organizer in metal and various other industries, military exempt, available on short notice. Apply to Box No. 1730-W.

GRADUATE ENGINEER of proven administrative and executive ability desires position entailing greater responsibility and scope for initiative. Presently supervising the production of precision tools. Experienced in personnel work and all phases of maintenance engineering work. Apply to Box No. 2450-W.

### SURVEYING INSTRUMENTS FOR SALE

SIMPLE THEODOLITE, Stackpole and Bros.
Telescope, 10″ long, 1¼″ dia. O.S.
Compass, 5¼″ dia.
Table, 7¼″ dia.
Scale, 6¼″ dia.
Height of C.C. of telescope above levelling table, 10½″.
Spirit levels, 3¼″ long x ½″ dia.
Levelling screws, 4.
Condition of instrument and lenses—excellent.
Complete with tripod and plumbob in wooden case.

Y LEVEL, Watts (bright brass).
Telescope, 10½″ long, 1¼″ dia. O.S.
Height of C.C. of telescope above levelling table, 5½″.
Levelling screws—4.
Base plate, 3½″ dia.
Complete in wooden case, with tripod.
Condition of instrument and lenses, good; one indexed lense appears to require cleaning.

SURVEYOR ARROWS, one set (11), 3/16″ sq. x 14″ long. Condition, new.

STADIA ROD, 12 ft. (7 ft. closed). Condition, new.

LEVELLING ROD, 16 ft. (6 ft. closed). Condition, excellent.

PICKETS, iron-shod, 2-5 ft. Condition, good.

MINER'S DIP COMPASS, W. S. Darley, in case. Like new.

SET OF 65 RAILROAD CURVES, in wooden case. Like new.

C.C. Moler-Line loss and voltage drop slide rule. Like new.

Full leather map-case, 5½″ dia. x 40″ long. Condition, good.

Matthews Teleaheight Level, in leather case. Condition, good.

*Offers will be considered.* Apply to Box No. 48-S.

### FOR SALE

Thacher Calculating Rule in mahogany case, good condition. Apply to Box No. 49-S.

### FOR SALE

ARCHITECTS COMBINED Y LEVEL AND TRANSIT, Kinkead Mfg. Co., Boston, Mass. Telescope 11″ long, 1¼″ dia. Transit reads to minutes. Levelling screws—4, Sun glass—1, Plumbob—1, Complete in wooden box with tripod. Condition of instrument and lenses—excellent. 14 ft. extension on levelling rod. Apply to Box No. 50-S.

### FOR SALE OR RENT

TRANSIT, W. & L. E. Gurley, complete with tripod, 5″ dia. horizontal circle. In excellent condition. Apply to Box No. 51-S.

### FOR SALE

Transits, theodolites, compasses, levels, clinometers, hand-levels, pickets, tapes, rods (10′, 15′ and 20′ slab), other accessories. Draughting boards and instruments; planimeters, electric-motored erasers, plan-binders, scales, etc. Apply to Ralph Kendall, M.E.I.C., 93 Maynard Street, Halifax, N.S. Telephone 4-2849.



## ENGINEERS WANTED

A Power Company located in Western Canada has vacancies for three graduate electrical engineers for permanent positions. Two as designers in power house and substation design, and one experienced in design of distribution and transmission systems.

Do not apply unless your services are available under Canadian regulation P.C. 246, Part 3, January 19, 1943, administered by the Wartime Bureau of Technical Personnel.

Applicants must not be over forty years of age, and should send full particulars of qualifications, experience, references, etc., to Box No. 2633-V.

## AN APPEAL FOR BACK NUMBERS OF THE *JOURNAL*

**The *Journal* circulation extended, before the war, to several of the countries now occupied by the enemy. It consisted partly of paid subscriptions and partly of exchanges with other publications. Since the spring of 1940, the supply of engineering literature from these countries has ceased and we have likewise discontinued sending the *Journal*.**

**With a view to completing our file of foreign publications when the war is over, we have put aside, every month for the last three years, a number of copies of the *Journal* for Exchange purposes, in the hope that foreign publishers are doing the same.**

**However, on account of urgent demands for the *Journal* in the last three years, we have had to part with some of those copies which we had laid aside.**

**In order to replenish our stock, we would be grateful to our members who could supply us with the following numbers:**

1941—JANUARY, MARCH, MAY, JULY, AUGUST
1942—JANUARY, APRIL, MAY, AUGUST
1943—JANUARY

**Parcels should be addressed to The Librarian, The Engineering Institute of Canada, 2050 Mansfield Street, Montreal, and may be sent collect.**

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### DRYCOLENE PRODUCERS

Bulletin CGEA-3525, 2 pages, Canadian General Electric Company, Ltd., Toronto, Ont. Claimed to be ideal for scale-free hardening, bright-annealing, electric-furnace brazing and sintering, "Drycolene" is a special gas produced from coke-oven or natural gas and charcoal, for heat treating steel without surface changes such as decarburization, carbonization and oxidation. Method of preparation, chemical analysis and operation are given in the bulletin along with a flow diagram.

### DISSOLVED OXYGEN TEST KIT

Worthington Pump & Machinery Corp., Harrison, N.J., have just issued Bulletin W-219-B-28, describing a portable test kit for the accurate determination, by the Winkler method, of the dissolved oxygen content of deaerated boiler feedwater. Known as the "Worthington Type 0I Dissolved Oxygen Test Kit," it provides all of the essential chemicals and apparatus for testing cooled samples of feedwater. Included in the same bulletin is a description of the "Worthington Counter Current Sample Cooler," together with diagrams of sample cooler and method of using same.

### STEP AND NIGHT LIGHTS

A leaflet being distributed by Commercial Reflector & Mfg. Company, Los Angeles, Calif., describes "The Commercialite Step Lite," a small, flush mounting unit, which is designed for the supplementary lighting of stairways, landings, corridors, passageways, elevator entrances and other uses. The "Nite-Lite" is a light adapted to hospital needs. Louvres allow the correct amount of light for convenience of nurse or attendant.

### RECENT APPOINTMENT

Mr. Arthur Hodgkinson was recently elected Comptroller and Treasurer of Canadian Car & Foundry Company, Ltd., succeeding the late Mr. P. C. McLachlan.

Mr. Hodgkinson brings to his new appointment a lifetime's experience in the accounting field. Born in London, England, he joined the Institute of Chartered Accounts of England and Wales as an Associate in 1908 and was elected a Fellow in 1916. He came to Canada in 1926, joining Price, Waterhouse & Company, and in 1939 going to the Canadian Car & Foundry Company.

**Mr. Arthur Hodgkinson**

**Mr. James I. Simpson**

### PRESIDENT, RUBBER ASSOCIATION

Mr. James I. Simpson, President and General Manager of Dunlop Tire & Rubber Goods Company, Ltd., was recently elected President of the Rubber Association, comprising the various rubber companies of Canada, all of which are devoting their major efforts to war production. Mr. Simpson is also chairman of the Rubber Advisory Committee to the Rubber Controller.

### NEW WAR FILM

Canadian General Electric Company, Ltd., has produced a fast-moving war film, "Power To Win," which not only shows C.G.E. workers at their jobs but, through the medium of dramatic news-reel shots, shows the equipment they are making actually in action on the fighting fronts. Shot in the company's plants, the film pays tribute to hundreds of C.G.E. men and women. It shows them making guns and aircraft instruments. It shows them producing marine engines and searchlights, components for tanks and ships.

Furthermore, much of the Company's war output has no direct fighting application. Generators, transformers, motors, etc., are not obviously weapons of war. By demonstrating how this industrial equipment develops electric power, distributes it to the other war plants and applies it wherever arms are made, the film reveals the importance of such equipment in the vital behind-the-front battle of "production for production."

Arrangements are being completed for the entire personnel of the Company to see the film. Prints are being provided for all offices and plants of the Company. These prints are available for use by all interested firms and organizations.

As far as possible general distribution will be sought for the picture. The film is exceptionally well produced, and every care has been taken to minimize direct reference to the Company in the film, in order to make it acceptable by the general run of exhibitors.

### LEATHER BELTING & ACCESSORIES

The Canadian Belting Manufacturers Ltd., Montreal, Que., have for distribution a 4-page folder featuring "Veelos V-Belt," quickly adjustable to any length without the necessity of tearing down machinery or disassembling bearings and shafting. The folder also lists flat and round leather belting, endless and solid woven belts, together with lacing accessories.

### TEXTILE ROLL COVERINGS

A 16-page booklet recently issued by Armstrong Cork & Insulation Company, Ltd., Montreal, Que., contains a discussion of "Which Covering?—Cork vs Leather vs Synthetic," and also illustrates and describes the "Armstrong" line of cork cots, Accotex cots, Accotex aprons, and roll shop equipment. A chart showing where to use "Armstrong" roll coverings is included.

### AUTOMATIC VOLTAGE REGULATORS

A 32-page bulletin prepared by Ferranti Electric Ltd., Mount Dennis, Ont., which is profusely illustrated with photographs, charts and diagrams, provides the answers to many problems connected with voltage regulation. Articles include one on "Good Voltage is a War-Time Necessity" and how "This Regulator Paid for Itself in One Year in Increased Revenue."

### GUIDE TO DECORATION

Gypsum, Lime & Alabastine Canada, Ltd., Toronto, Ont., have prepared a 70-page booklet, pocketsize, as a guide to anyone interested in the subject of decoration. The booklet provides useful information to both professional and amateur painters. It covers the subject in general and the company's products in particular. Describing each of the latter separately, it then deals with contrast and harmony in colours and colour schemes and a wide variety of special jobs. Some twenty-two pages of standard stencil designs are included, and the text is reproduced in French.

### INSPECTION BY OPTICAL PROJECTION

"Beyond a Shadow of a Doubt" is the title of a booklet, Form No. 431-3M, issued by Jones & Lamson Machine Company, Springfield, Vt. This booklet is intended primarily to present the advantages and possibilities of inspection and measurement by optical projection to those who are not very familiar with this subject.

### APPOINTED SALES MANAGER

Mr. Larry E. Fagan has been appointed General Sales Manager of Chatham Malleable & Steel Products Limited. Mr. Fagan has had wide experience in sales organization and industrial marketing, particularly in the heating and plumbing fields.

**Mr. Larry E. Fagan**

## INDUSTRIAL NEWS

*(Continued)*

### ALTERNATING CURRENT AND VOLTAGE RELAYS

Bulletin No. A, 1, 1943, 12 pages, loose-leaf, issued by Cansfield Electrical Works Ltd., Toronto, is a series of data sheets describing the Company's line of alternating current and voltage relays. Photographs, dimension tables, diagrams, and descriptions, cover excess current relays and over-voltage and under-voltage relays.

### INDUSTRIAL ENGINES

Chrysler Corporation of Canada Limited, Windsor, Ont., have published an 8-page booklet featuring the production of industrial engines by Chrysler and their adaptability to almost any power application. Illustrations of a number of applications, specifications and charts of net horsepower and torque are shown.

### STOCK CHAIN DRIVES

Catalogue No. 116/33, 64 pages, by Renold-Coventry Limited, Montreal, Que., gives drives for the transmission of power up to 100 h.p. The catalogue is entitled "Renold Stock Chain Drives" and contains a selection chart and provides dimensional drawings, specifications, and other data under five headings; roller chain drives; plate wheel adaptor drives; plate wheel friction adaptor drives; chaincases; and standard keyways.

### COURSE IN BOILER FEEDWATER TREATMENT

E. F. Drew & Company, Inc., manufacturers of industrial chemicals, represented in Canada by Canadian Colloids Ltd., has been assisting the U. S. Maritime Service in training civilians for merchant marine positions by donating time, services and equipment for an intensive five-week course in boiler feedwater treatment.

The course, presented at the U. S. Maritime Service Training Station at Sheepshead Bay, Brooklyn, N.Y., and supervised by Lieutenant Commander J. D. Kelly, U.S.M.S., and Lieutenant F. J. Brady of the Engine Training Division, was designed to furnish merchant marine instructors with full data regarding the treatment of boiler water on Liberty ships. This course was part of the continued training programme for these instructors.

Lectures, blackboard demonstrations and actual tests were featured in this course which included the following important aspects of boiler water treatment; sampling, testing, interpretation of analysis, application of treatment, and visual control of water conditioning.

### STEP-VOLTAGE REGULATORS

Bulletin No. 500, by Ferranti Electric Ltd., Toronto, Ont., contains thirty-two illustrations and circuit drawings and reviews the operation of the control circuit, the transformer assembly, the switching arrangement and the driving mechanism of "Ferranti" step-voltage regulators, transformers and switchgears. Instructions are also given on how to install a "Ferranti" regulator or remove it from service.

### CATALYST RECOVERY

"Catalyst Recovery" is the title of a booklet prepared by Precipitation Company of Canada Ltd., Montreal, Que., which is available to engineers, executives and technical men interested in catalytic refining processes. Based on research and development work in the field of fluid catalyst refining processes, the booklet discusses the important phases of catalyst recovery, the types of equipment best suited to each phase and their methods of operation.

### NEW DIRECTORS, DOMINION RUBBER

Five new directors were elected to the Board of the Dominion Rubber Company, Ltd., it was announced in Montreal by Paul C. Jones, president, at the company's annual meeting. The new directors are G. W. Charles, vice-president, C. C. Thackray, vice-president, M. O. Simpson, treasurer, all of Montreal; A. W. Hopton, vice-president, Kitchener, Ont., and H. S. Marlor, vice-president, United States Rubber Company, New York. Directors re-elected are Norman J. Dawes, W. S. Rugh, Col. A. A. Magee, W. A. Eden, vice-chairman of the Board, and Paul C. Jones, all of Montreal; F. B. Davis, chairman, H. E. Humphreys, jr., Herbert E. Smith, T. J. Needham and Elmer Roberts, all of New York.

It was also announced by Mr. Jones that the company had received a contract from the Department of Munitions and Supply to operate a small arms ammunition plant. The new project, to be known as Dominion Rubber Munitions Ltd., will be located in eastern Canada, and go into production shortly. The plant will operate under the auspices of Brigadier D. E. Dewar, director-general arsenals and small arms ammunition of the Department of Munitions and Supply, and when ready, will be completely equipped to manufacture cases and bullets, load and test the ammunition, and will employ approximately one thousand men and women. A. G. McKinnon, formerly of one of Dominion Rubber affiliated companies, has been appointed general manager.

### DIAMOND ASSOCIATES

On the evening of April 27th at the Mount Royal Hotel, Montreal, the Jenkins Diamond Associates held their annual dinner.

Three more employees of Jenkins Bros. Limited, having completed twenty-five years continuous service, were welcomed into the ranks of the Veterans Association. This brings the membership up to thirty, and the fact that next year nine more Jenkins employees will be eligible for membership is eloquent testimony of the long service record and satisfactory relations existing between employees and management.

The three new Diamond Associates are Joseph Blotnick, Zenophile Lapierre and Samuel F. Read. Each was initiated and presented with a sterling silver tray and a gold, diamond-studded lapel pin, following a short congratulatory address by Mr. Farnham Yardley, President of the company.

The following were elected as officers of the Jenkins Diamond Associates: Farnham Yardley, Honorary President; H. H. Gee, President; Wm. G. Burgess, Vice-President; George L. Worden, Secretary; H. E. Francis, Master of Ceremonies.

### CARE AND USE OF TOOLS

James T. Donnolly Company, Ltd., Toronto, Ont., have prepared a poster on the "how" of making tools last longer. Suitable for tacking on bulletin boards, walls of tool cribs or other convenient locations, this poster is completely devoted to furnishing mechanics with useful tips on the care of drills, reamers, carbide cutting tools, taps, cutters, tool bits, chisels and punches, etc.

### DATA FOR ELECTRICAL MEN

A 12-page bulletin by Canadian General Electric Company, Ltd., Toronto, Ont., presents a wide variety of useful information including such data as decimal equivalents, metric conversion tables, specific gravity and physical properties of metals, coefficients of friction, tables of measurement and multiples, equivalent values of electrical, mechanical and heat units, wire and cable data, synchronous speeds possible at various frequencies, fusing currents of commercial fuse wire, motor wiring, etc.

### CIRCUIT BREAKERS

Swiss Electric Company of Canada, Ltd., Montreal, Que., have prepared a preprint of an article by Armin K. Leuthold, M.A.I.E.E. The principles of design and operation of two high-voltage air-blast circuit breakers rated 150 kv. and 220 kv., installed in Canadian power-distribution plants are explained and their construction is described and supplemented by a discussion of performance tests and oscillograms.

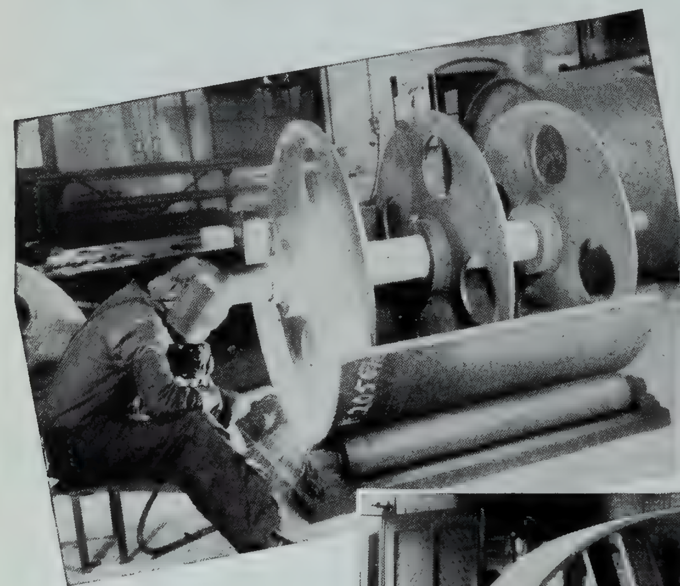
Mr. G. W. Charles

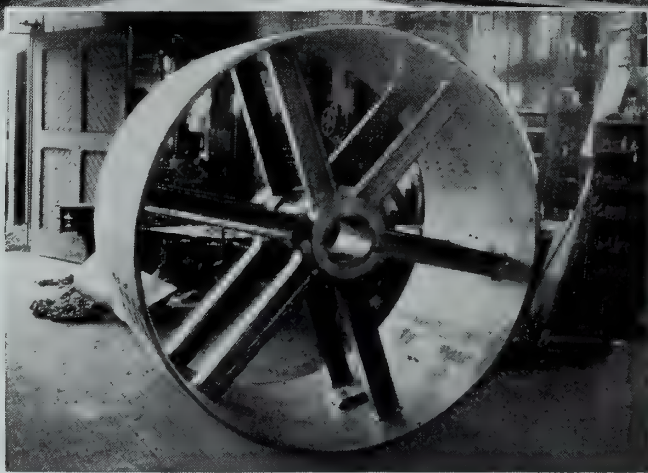
Mr. C. C. Thackray

Mr. A. W. Hopton

Mr. M. O. Simpson

# "Keep 'em Rolling" with DODGE PULLEYS





The illustrations shown here are from photographs taken in one of our plants where skilled workmanship and modern equipment are employed to serve a wide variety of Canadian industries. Here, too, the reputation for dependability established by DODGE many years ago is zealously guarded.

*Top left:* Welding a conveyor head pulley for extra heavy proportions.

*Top right:* Welding a slatted steel conveyor pulley.

*Bottom:* Specially designed pulley, 60″ diameter x 45″ face, with cast steel arms and hubs. Rim is of welded steel construction with rubber covering.

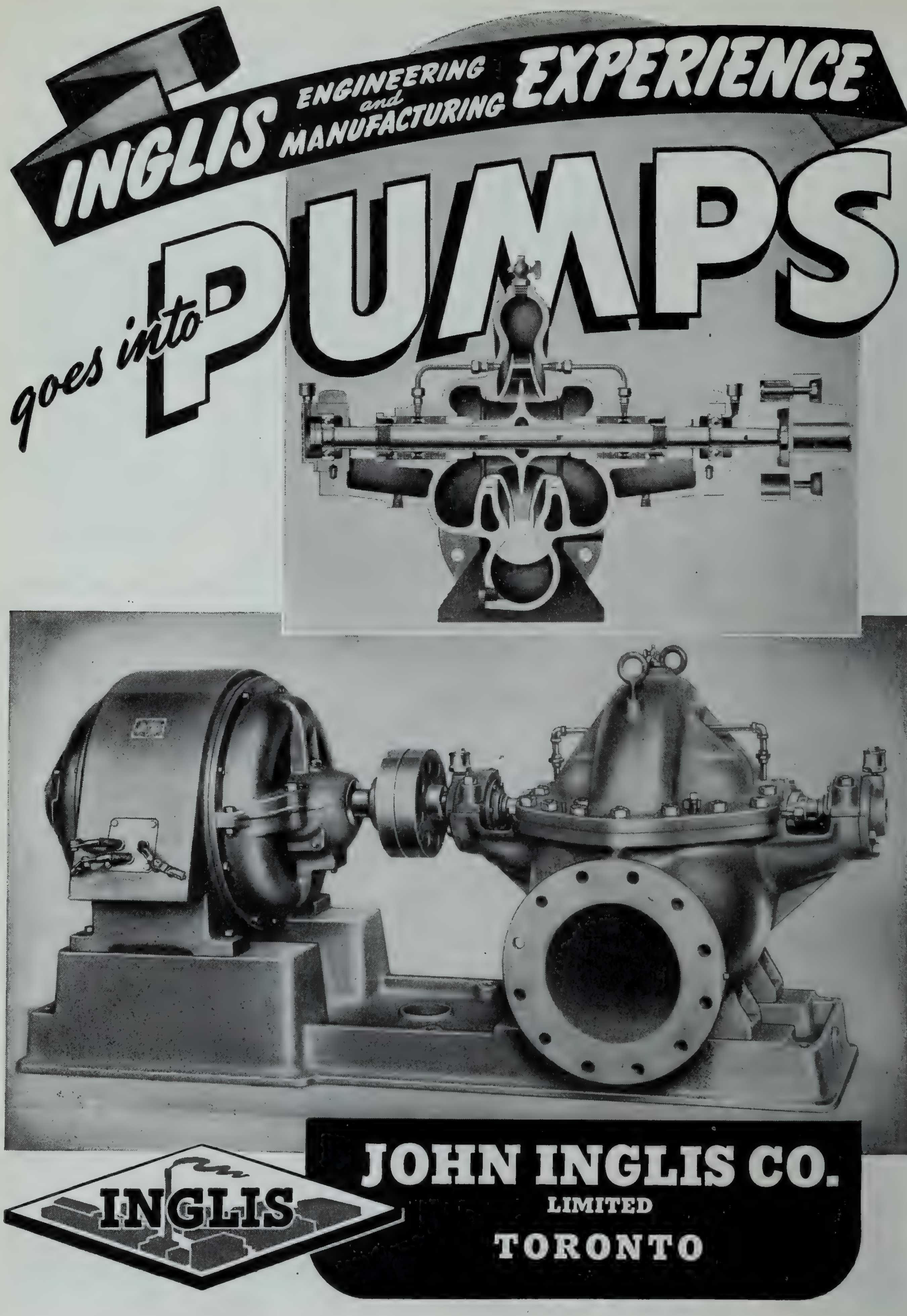
FOR many years, the name DODGE has been closely identified with the design and manufacture of various types of transmission equipment. Particularly is this true of pulleys — in connection with which, DODGE has achieved a reputation from coast to coast for its high standard of workmanship and absolute dependability. No matter what type you are interested in, it will pay you to consult DODGE.

***Designers and Manufacturers:***

**CONVEYING AND ELEVATING EQUIPMENT**
**MODERN POWER TRANSMISSION EQUIPMENT**
**COAL AND ORE HANDLING BRIDGES**
**WELDED PROCESSING EQUIPMENT**
**STEAM GENERATING EQUIPMENT**
**BALDWIN-SOUTHWARK HYDRAULIC PRESSES**

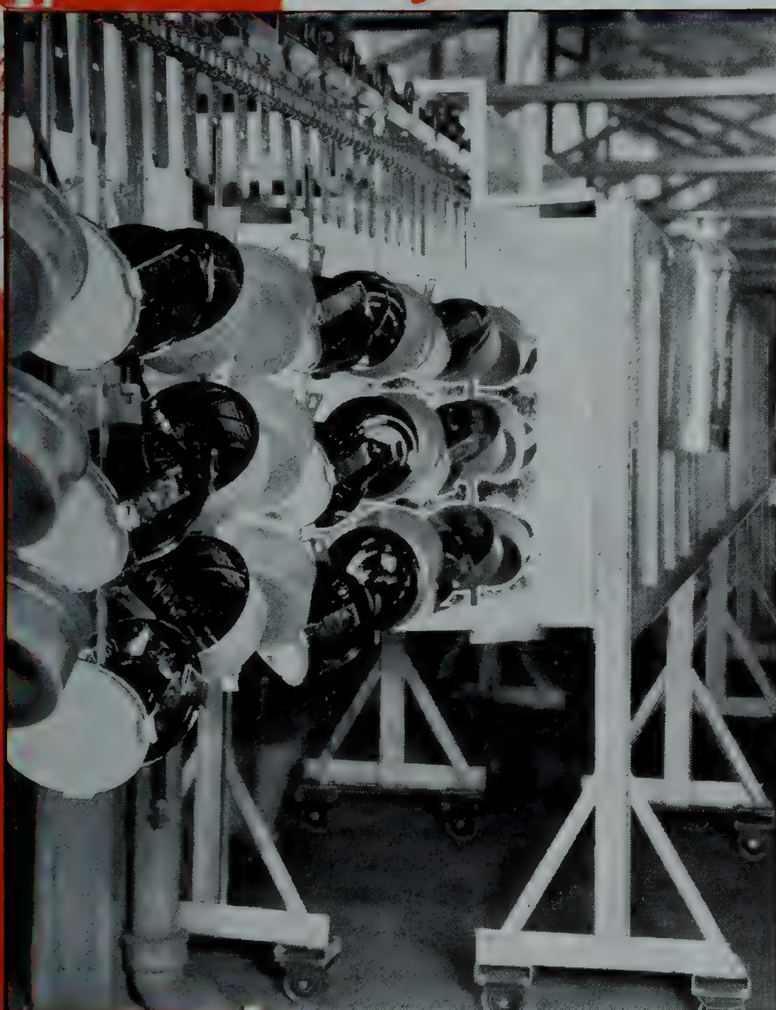
# UNITED STEEL CORPORATION
LIMITED

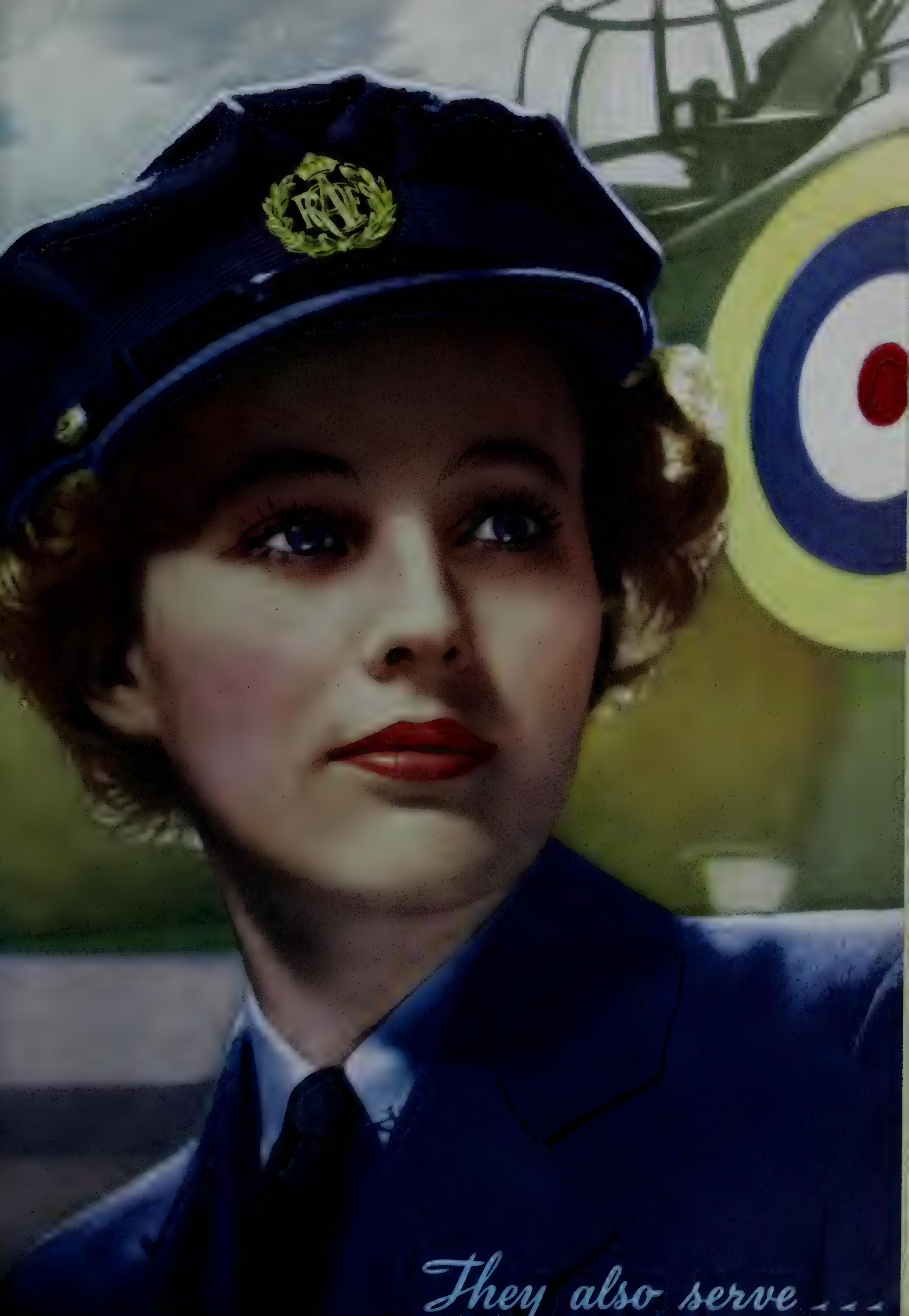
TORONTO . . WELLAND — DODGE MANUFACTURING DIVISION — CANADIAN MEAD MORRISON — MONTREAL . . WINNIPEG


INGLIS ENGINEERING and MANUFACTURING EXPERIENCE
goes into PUMPS
INGLIS
JOHN INGLIS CO.
LIMITED
TORONTO


MY PROVINCE
... IN 1943 IT'S
Our CANADA!
Eveleigh







RAF
They also serve ...

# Royal Canadian Air Force
## (Women's Division)

**THEY SERVE THAT MEN MAY FLY**

THE Canadian Women's Auxiliary Air Force was authorized by Order in Council July 2, 1941, and on January 2, 1942, became officially known as the Royal Canadian Air Force Women's Division. Her Royal Highness, Princess Alice, Countess of Athlone, is the Honorary Commandant. Headquarters are in Ottawa.

The R.C.A.F. Women's Division was founded to release physically fit men for Air Crew duties. The service now undertakes 43 occupations previously performed by men. Besides Administrative Offices, duties of members range from Bandswomen and Clerks to Pharmacists, Photographers and Wireless Operators (Ground).

Upon enlistment the women take the same oath as the men of the R.C.A.F. and agree to serve for the duration of the war, and as long as their services may be required thereafter. They may volunteer for service abroad, and many women have already gone overseas. Duty outside of Canada entitles the Airwoman to put "Canada" on the shoulders of her tunic.

The Royal Canadian Air Force Women's Division is one of the most popular branches of the Women's Services. The R.C.A.F. Women's Division is proud to share the motto of the Royal Air Force and Royal Canadian Air Force "Per Ardua ad Astra"—Through Strife to the Stars.

*Published as a Tribute to the*
*Royal Canadian Air Force (Women's Division) by*

**CANADIAN SKF COMPANY LIMITED**


**HERE IS POWER.** Power that thunders down in ten-ton wallops to shape the tools of war. In the place of hundreds of men laboriously hammering for days on end . . . this giant strikes a few times and the job is done.

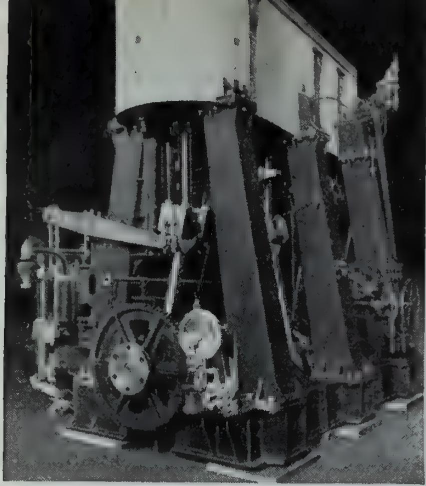
Yet the power of this huge forging hammer—and of all the complex machines on Canada's industrial front — must be guarded by a thin sheath of oil, a sturdy *film of lubricating oil.* Without this protective film, the giant would lie idle and helpless . . . its mighty mechanical muscles burned or eaten away by *friction.*

Whether your particular war job calls for the smashing power of giant hammers or the deft touch of delicate machinery, you have an ever-changing lubrication problem—and our specialists can help you keep on top of it. In Canada's greatest refineries and test laboratories, we are solving wartime lubrication problems by the thousand. Can we help you?

IMPERIAL PRODUCTS

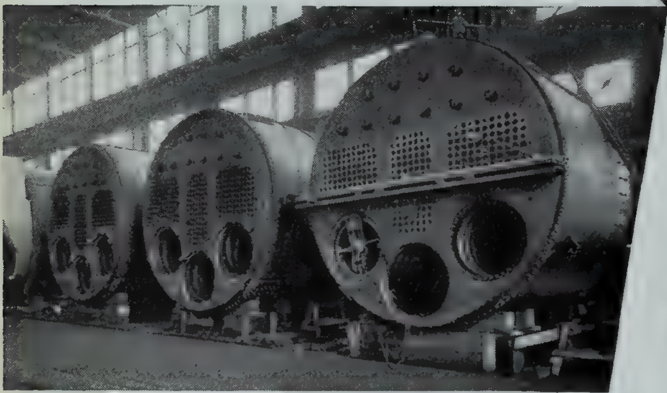
# IMPERIAL OIL LIMITED

*The right oil or grease for every mechanical operation . . . the scientific answer to every lubrication problem.*

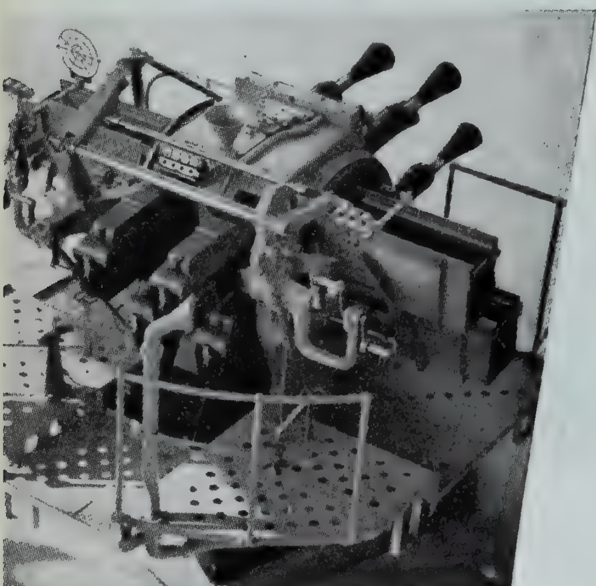


Marine engine supplied by Dominion Bridge Company Limited for cargo vessels.

One of the cargo vessels being built for Wartime Merchant Shipping Ltd., the hulls for which are being fabricated by Dominion Bridge Company Limited.



tch Marine Boilers for cargo vessels under construction in a Dominion Bridge Company Limited plant.



i-aircraft Guns produced by one of the ordnance its of Dominion Bridge Company Limited.

# IN PEACE... AND WAR.
## AND PEACE AGAIN

IN past days of peace, Dominion Bridge threw its energies and resources into building Canada by designing and constructing bridges and other heavy steel equipment for industry and transportation . . .

When war came, this Company redoubled its energies and greatly enlarged its productive capacity to build victory for Canada and the United Nations. Our plants are now contributing to Canada's war on land, sea, in the air and behind the lines . . .

When peace comes again, Dominion Bridge will be prepared with added zeal, fresh skill and multiplied resources to assist the people of this Dominion to master the problems of reconstruction.

DBCL

# DOMINION BRIDGE COMPANY LIMITED

*Head Office:* LACHINE (MONTREAL) QUEBEC

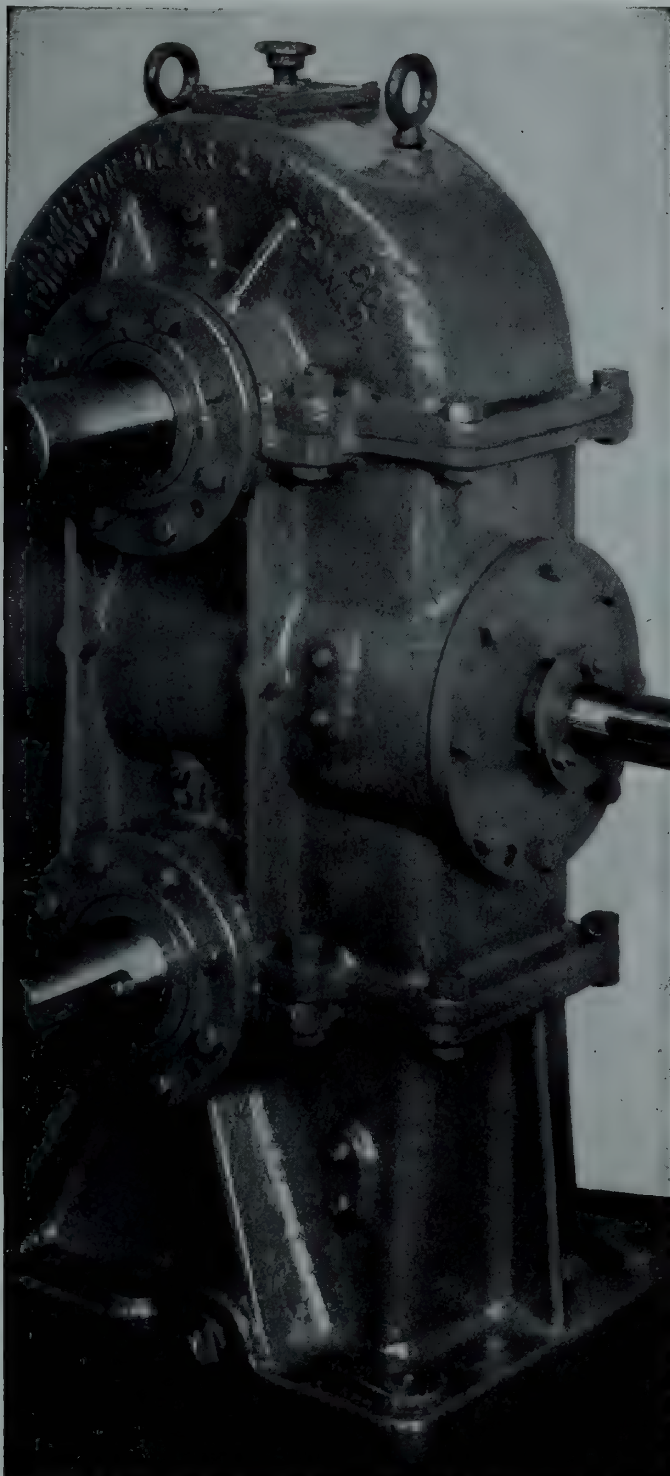
*Branch Offices and Works:* AMHERST MONTREAL OTTAWA TORONTO WINNIPEG CALGARY VANCOUVER

*Agencies:* EDMONTON REGINA

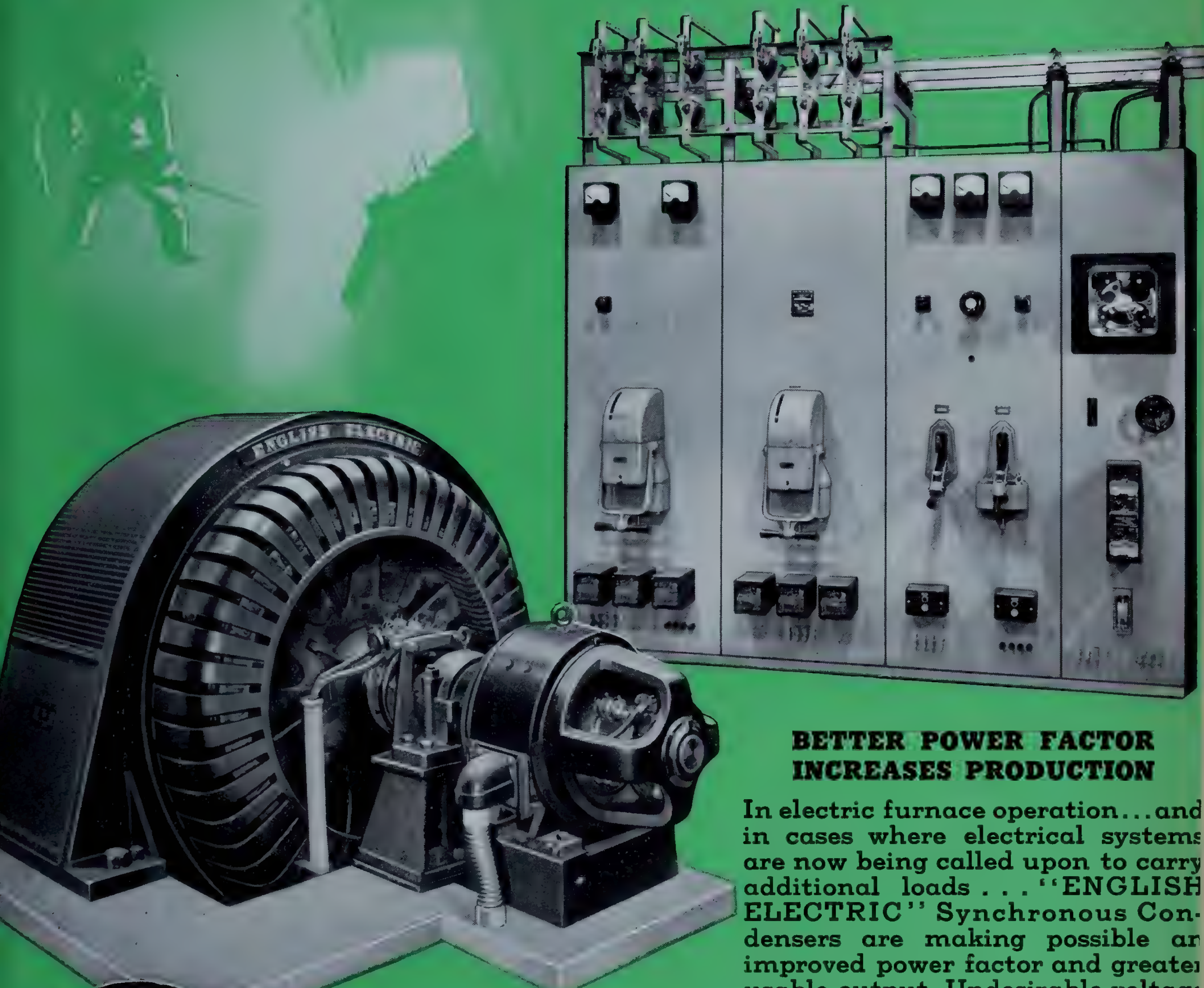
*Associate Companies:*

DOMINION ENGINEERING CO., LTD., MONTREAL, QUE.
ROBB ENGINEERING WORKS LTD., AMHERST, N.S.
McGREGOR-McINTYRE IRON WORKS LTD., TORONTO, ONT.
MANITOBA BRIDGE & IRON WORKS LTD., WINNIPEG, MAN.
RIVERSIDE IRON WORKS LTD., CALGARY, ALTA.

DOMINION HOIST & SHOVEL CO. LTD., MONTREAL, QUE.
EASTERN CANADA STEEL & IRON WORKS LTD., QUEBEC, QUE.
SAULT STRUCTURAL STEEL CO. LTD., SAULT STE. MARIE, ONT.
MANITOBA ROLLING MILL CO. LTD., WINNIPEG, MAN.
STANDARD IRON WORKS LTD., EDMONTON, ALTA.



# ENGLISH ELECTRIC



## BETTER POWER FACTOR INCREASES PRODUCTION

In electric furnace operation...and in cases where electrical systems are now being called upon to carry additional loads . . . "ENGLISH ELECTRIC" Synchronous Condensers are making possible an improved power factor and greater usable output. Undesirable voltage fluctuations and the objectionable "flicker" on lighting circuits are also reduced. Write for information.

"ENGLISH ELECTRIC" Synchronous Condenser at Wm. Kennedy & Sons, Limited, Owen Sound, Ont. 4160 Volt; 3-phase; 60 cycle; 1200 r.p.m.; zero power factor; 2000 KVA lead; 1000 KVA lag.

EE CANADA

*Distinguished by Service*

# ENGLISH ELECTRIC
## COMPANY OF CANADA, LIMITED

Head Office & Factory: ST. CATHARINES, ONT. District Offices: TORONTO, MONTREAL, VANCOUVER, KIRKLAND LAKE
Represented by: FOULIS & BENNETT ELECTRIC, LIMITED, HALIFAX • E. P. WATT, OTTAWA
RAILWAY & POWER ENGINEERING CORP., LIMITED, WINNIPEG • GORMANS LIMITED, EDMONTON

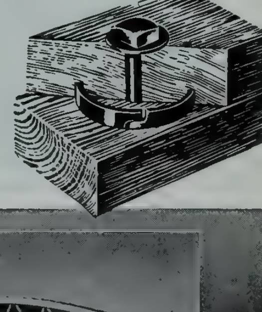


FREEDOM IS NOT FREE—IT IS PRICELESS ★ BUY WAR BONDS


# 2500 ENGINEERS AND ARCHITECTS REQUESTED THIS FREE BOOK

In "Typical Designs of Timber Structures" we have assembled the design drawings of 70 representative types of timber structures that have been engineered under the TECO Connector System of construction. It abounds in suggestions for solving design problems. One prominent architect writes: "It is one of the most useful pieces of work that I have received in 20 years." A request on your professional letterhead will bring you a complimentary copy of this most valuable reference book. Write while it is available.

*The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*



**V. H. McINTYRE, Limited**

NATIONAL MANUFACTURERS OF **TECO** TIMBER CONNECTORS AND TOOLS

**4 ST. THOMAS STREET, TORONTO, CANADA**

Manitoba Bridge & Iron Works, Ltd., Winnipeg, Manitoba • Distributor for Prairie Provinces and Lakehead

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, JUNE 1943 | NUMBER 6


"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."

★ ★ ★


PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL

L. AUSTIN WRIGHT, M.E.I.C.
*Editor*

LOUIS TRUDEL, M.E.I.C
*Assistant Editor*

N. E. D. SHEPPARD, M.E.I.C.
*Advertising Manager*

PUBLICATION COMMITTEE

J. A. LALONDE, M.E.I.C., *Chairman*
R. DeL. FRENCH, M.E.I.C., *Vice-Chairman*
A. C. D. BLANCHARD, M.E.I.C.
H. F. FINNEMORE, M.E.I.C.
T. J. LAFRENIÈRE, M.E.I.C.

**Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.**




## CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville, Ont.

**CALGARY**
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE, H. R. HAYES, A. HIGGINS, W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS, G. P. F. BOESE, H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL, 803-17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN, J. W. JUDGE, E. D. ROBERTSON, J. D. A. MACDONALD, I. F. MORRISON, H. W. TYE
*(Ex-Officio),* D. HUTCHISON, E. NELSON
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B. STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE, S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON, R. J. G. SCHOFIELD, NORMAN EAGER, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, STANLEY SHUPE, A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN, 91 Barnesdale Blvd., Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN, J. R. CARTER, J. D. LEE
*(Ex-Officio),* T. A. McGINNIS, L. F. GRANT, A. JACKSON
*Sec. Treas.,* R. A. LOW, Dept. of Civil Engineering, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* MISS E. M. G. MacGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL, R. B. CHANDLER, S. E. FLOOK, O. J. KOREEN, S. T. McCAVOUR, W. H. SMALL, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER, H. G. O'LEARY
*Sec. Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT, W. C. MILLER, F. T. TAYLOR, F. C. BALL, V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN, J. A. VANCE
*Sec. Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS, H. W. HOLE, A. GORDON, G. C. TORRENS, G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE, G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R. Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE, R. C. FLITTON, G. D. HULME, G. E. GELINAS, K. G. CAMERON, G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD, J. E. ARMSTRONG, R. E. HEARTZ, W. G. HUNT, J. A. LALONDE, G. MacL. PITTS, E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR, C. G. MOON, G. F. VOLLMER, H. E. BARNETT, J. W. BROOKS, G. MORRISON, D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 2135 Culp Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY, G. A. LINDSAY, R. YUILL, W. H. B. BEVAN, J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY, K. M. CAMERON, N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON, Dept. of Mines & Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN, A. L. MALBY, F. R. POPE, C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY, H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD, 308 Monaghan Road, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldge., Quebec, Que.

**SAGUENAY**
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER, B. BAUMAN, J. FRISCH, G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS, N. F. McCAGHEY, J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, P.O. Box 33, Arvida, Que.

**SAINT JOHN**
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN, C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH, J. P. MOONEY, D. R. SMITH, G. W. GRIFFIN
*Sec.-Treas.,* G. L. PHILLIPS, Saint John Dry Dock & Shipbldg. Co. Ltd., East Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vive-Chair.,* R. DORION
*Executive,* G. B. BAXTER, E. BUTLER, A. G. JACQUES, R. D. PACKARD, M. EATON, E. T. BUCHANAN, J. JOYAL, W. E. A. McLEISH, H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN, H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS, Shawinigan Water & Power Company, P.O. Box 190, Three Rivers, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN, E. K. PHILLIPS, J. I. STRONG, F. C. DEMPSEY, N. B. HUTCHEON, J. G. SCHAEFFER, R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG, P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK, C. R. MURDOCK, G. W. MacLEOD, K. G. ROSS, H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG, A. E. PICKERING, L. R. BROWN
*Sec. Treas.,* O. A. EVANS, 159 Upton Road, Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR, R. F. LEGGET, E. G. HEWSON, A. H. HULL, C. F. MORRISON, E. A. CROSS
*(Ex-Officio),* H. E. BRANDON, W. S. WILSON, T. H. HOGG, C. R. YOUNG, N. MacNICOL, J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD, R. E. POTTER, I. C. BARLTROP, E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT, C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD, A. N. ANDERSON, F. C. GREEN, J. H. BLAKE
*(Ex-Officio),* E. W. IZARD, A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING, 41 Gorge Road West, Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING, N. M. HALL, B. B. HOGARTH, R. H. ROBINSON, R. A. SARA
*(Ex-Officio),* W. P. BRERETON, J. W. SANGER, D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY, 55 Princess Street, Winnipeg, Man.

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**PAPERS**
L. F. GRANT, *Chairman*

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PUBLICATION**
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**PROFESSIONAL INTERESTS**
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

**STUDENTS' AND JUNIORS' PRIZES**

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# OTTAWA RIVER POWER SITES AGREEMENT

**The following statements, in connection with the agreement recently signed between the Provinces of Ontario and Quebec, have been prepared for the benefit of readers of the *Journal*, by two past-presidents of The Engineering Institute of Canada, who represented their respective provinces in the negotiations, namely Dr. T. H. Hogg and Dr. O. O. Lefebvre.**

## STATEMENT BY DR. T. H. HOGG, M.E.I.C.

*Chairman and Chief Engineer, The Hydro-Electric Power Commission of Ontario*

In January 1943 there was executed an agreement respecting power sites along the Ottawa river which is destined to have far-reaching and beneficial effects. It consists of two leases: one between the Province of Quebec and The Hydro-Electric Power Commission of Ontario; and the other between the Province of Ontario and the Quebec Streams Commission. The negotiations which led to the agreement were lengthy because there had to be a co-ordination of various points of view, but a spirit of friendly co-operation characterized the negotiations from start to finish.

Broadly, the agreement allocates to each of the provinces of Ontario and Quebec for its exclusive use in so far as power development is concerned, certain power sites on the Ottawa river which for a distance of more than 350 miles forms part of the boundary between the two provinces.

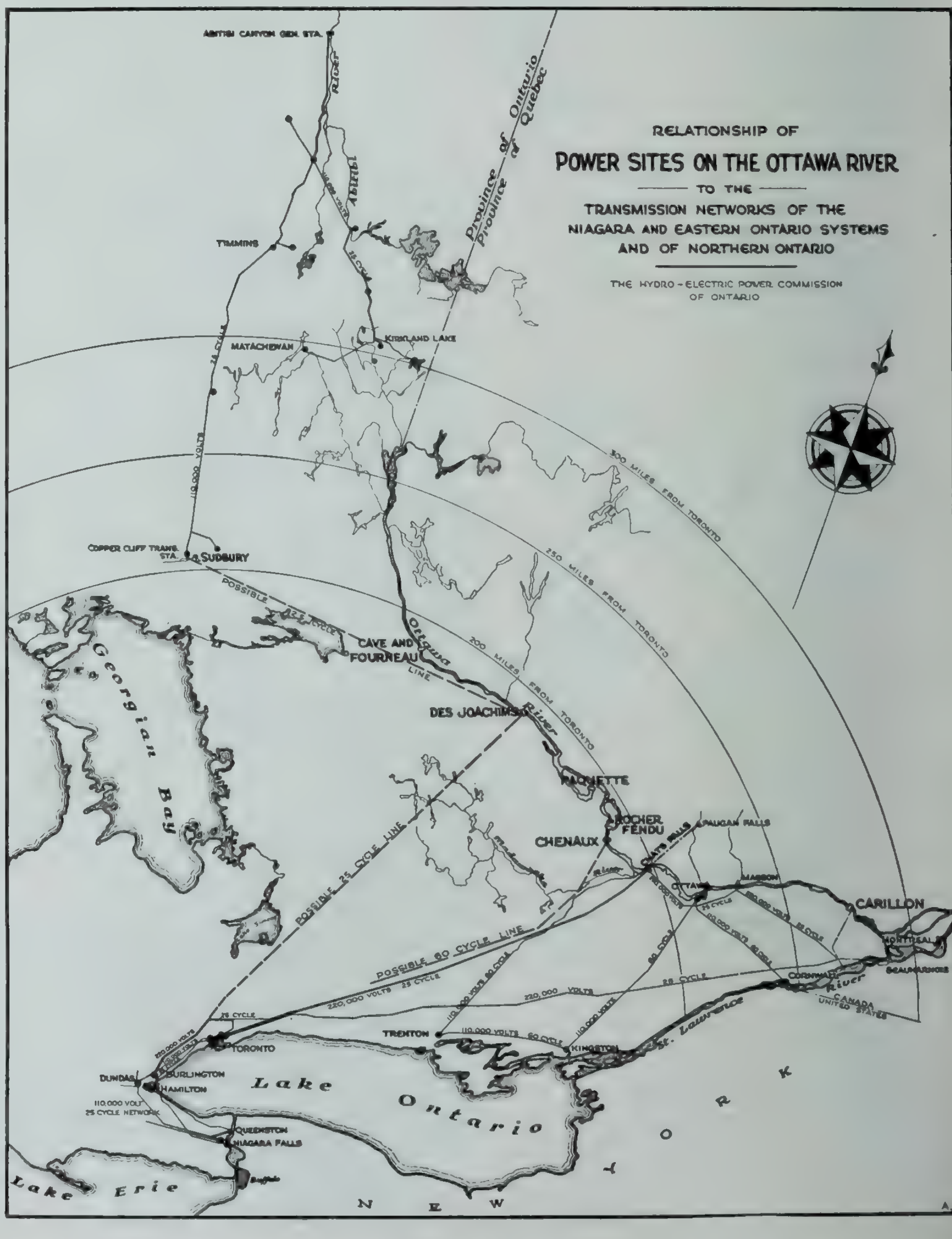
Since 1613 when it was discovered by Champlain, the Ottawa river has been a highway to the great northwest and has contributed greatly to the growth and prosperity of the two provinces. Up this river the early explorers toiled to open up the vast unknown interior, and down the river the laden birch-bark canoes of the fur hunters brought their valuable cargoes. Down the river, too, came later the huge floats of logs that year by year were required to feed the great lumber mills and the pulp and paper mills of more recent times. The Ottawa river was an important link in the proposed Georgian Bay ship canal and some years ago efforts were made to corral the power resources of the river under cover of charters for navigation works.

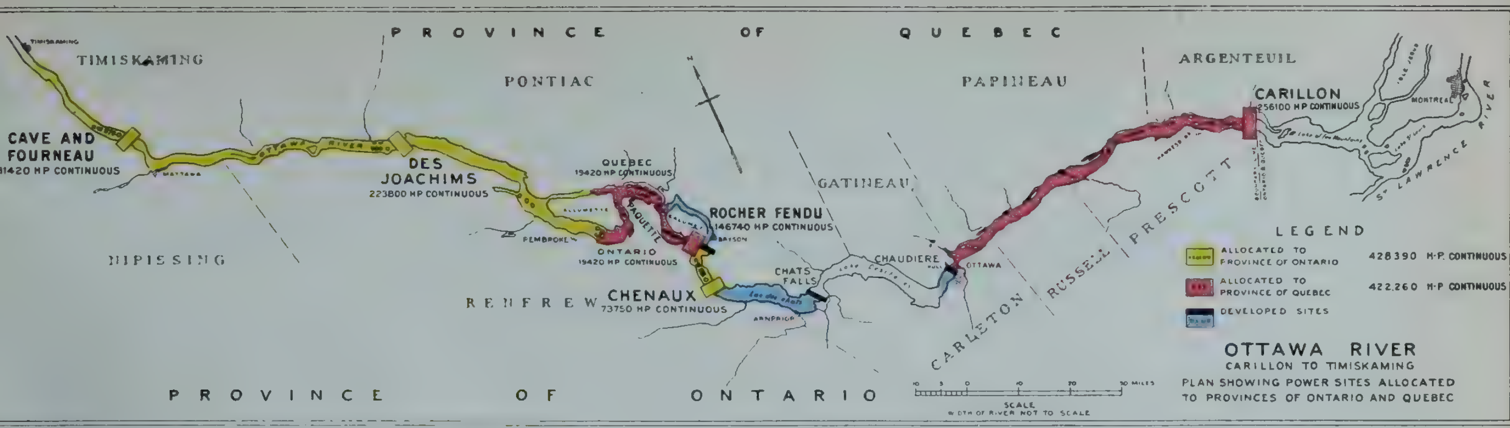
Based on the "ordinary six months' flow" of the Ottawa river, the total estimated power available to each province is about 425,000 horsepower. To Ontario are allocated the following sites:

| Sites | Approximate Continuous Capacity Horsepower |
|---|---|
| Des Joachims | 223,000 |
| Cave and Fourneau | 110,000 |
| Chenaux | 73,000 |
| Paquette (upper half) | 19,000 |
| | 425,000 |

These estimates for continuous capacity do not represent the dependable or installed capacity of the plants that might be constructed to operate under certain assumed conditions of load factor, when co-ordinated with existing system power supplies and requirements. When allowance is made for further control of the flow by additional storage reservoirs in the upper waters, for possible adjustments of head which more detailed surveys at the respective sites may indicate, and for customary spare capacity to take care of fluctuating loads, the installed capacity will substantially exceed the continuous capacity stated.

Not only does the allocation of the various sites secure to each province an almost equal division of available power, but it gives to Ontario the sites least desired by Quebec and to Quebec those least desired by Ontario. The most important result achieved by the agreement is that in allocating the sites in undivided units it leaves each province






free to develop its share of this Ottawa river power as and when it becomes most advantageous to do so. Moreover, each province can plan for the future with assurance that its plans can be carried out on a dependable time schedule.

The agreement, therefore, has particular value from a long-term viewpoint. At the same time, should changing circumstances make it desirable to construct quickly substantial additions to the developed power resources of either province, no time need be lost, because each province can now work out detailed plans for the works required at the sites allotted to it.

From Quebec's point of view, the Carillon site is regarded as the most attractive of all the Ottawa river power sites. It is situated quite close to the point where the Ottawa river ceases to be an interprovincial stream and flows only through Quebec. It is only about 40 miles from the great power markets of the Montreal district; whereas Des Joachims, the only site comparable in size, is 165 air line miles further away. At Carillon, under a head of about 63 feet, an initial development of some 340,000 horsepower can be made.

From the point of view of Eastern Ontario's market for power, the Carillon site is too large an undertaking; moreover, it is some 70 miles further away from the load centre of the Eastern Ontario system than the recently completed Barrett Chute plant and the undeveloped sites on the Madawaska river. At these sites a reserve of 150,000 horsepower is available that can be developed in units more adapted to the rate of growth in this territory. Furthermore, the Chenaux site on the Ottawa, allocated to Ontario, provides, in point of size and location, a site admirably suited to the requirements of eastern Ontario.

The largest site allocated to Ontario is that at Des Joachims where under a head of 135 feet an initial development of about 300,000 horsepower is practicable, with an ultimate installation of possibly 400,000 horsepower. If reference is made to the accompanying sketch map of Ontario, it will be seen that when related to the proved economics of long distance transmission of large blocks of power, the sites on the upper Ottawa are advantageously situated with respect to the load centres of south-western Ontario, and that a direct transmission line from Des Joachims' power site to Burlington would be well spaced from the present 220,000-volt lines bringing power from the Gatineau river developments via Chats Falls and from the line further south transmitting Beauharnois power. This spacing of the main transmission lines bringing power from eastern sources to the Niagara industrial area is important because it is unlikely that all three routes would be within a storm area at the same time. Furthermore, interconnection would be feasible with the main transmission lines traversing the Northern Ontario mining areas, and the other sites allocated to Ontario on the upper Ottawa could easily be linked in to the system.

The final agreement reached is one which crystallizes certain power development aspirations of both provinces on a mutually satisfactory basis, related both to their long-term needs and to possible war requirements of the immediate future. Furthermore, it settles important and deep-seated issues in which Ontario, Quebec and the Dominion of Canada have been concerned for many years.

## STATEMENT BY DR. O. O. LEFEBVRE, M.E.I.C.

*Vice-president, Quebec Streams Commission*

The agreement recently arrived at between Ontario and Quebec, as to the allocation of their power rights on the Ottawa river, settles to the satisfaction of both provinces the difficulties which joint ownership involved.

The Ottawa river, forming the boundary for a distance of 350 miles from the head of Lake Temiskaming to the head of the Lake of Two Mountains, has a total drop of about 500 feet. Each of the two provinces owns half of the power possibilities resulting from that head. Only in one instance, at Bryson, where the river is divided by Calumet Island, has it been possible for each province to develop its own share of the power. In every other case, the power sites could not be developed, except through an agreement by both parties, and one province could not take advantage of its power rights unless the other was agreeable to the development and was ready to participate into it. The disadvantages of this joint ownership are evident.

On the other hand, if the power rights could be allocated to each province in full sections, or units, each would be free to go ahead and develop the sections allocated to it.

This division was easily arrived at by allocating to the province of Ontario:

Cave and Fourneau,
Des Joachims,
Paquette (upper half),

being all the upper portion of the Ottawa river, and Chenaux or Portage du Fort, and to Quebec:

Paquette (lower half),
Rocher Fendu (Bryson),
Carillon.

One may ask why the Paquette Rapids have been divided vertically, the upper half being allocated to Ontario and the lower half to Quebec. It may be explained that the head available at this site is of the order of 15 feet,—the Allumette Lake, being at elevation 365, and the head-pond of the Bryson, or Rocher Fendu site at 350. This cannot be developed as a unit. There is, however, a remote possibility that the upper half can be added to the head at Des Joachims, and the lower half added to the head at Rocher

Fendu (Bryson). In the former case, the low water surface of the reach would have to be lowered by dredging, by no means a light undertaking, and in the other case, raising the Rocher Fendu (Bryson) head-pond 7 to 8 feet, would involve very heavy damages by flooding or a large expenditure for the construction of dykes. In both instances, the possibility is very remote.

From the standpoint of the Province of Quebec, the upper portion of the Ottawa river below Temiskaming is not susceptible of being used locally, and it is not anticipated that any development will take place in the near future. It does not appear that the district will afford a market for that power.

From Quebec's standpoint, the possibilities of utilizing the power available on the Ottawa river lie in the territory between the city of Hull and the city of Montreal. It seems that the natural market for the upper sites of the Ottawa river is in Ontario.

In exchanging its power rights in the upper portion of the river against equivalent rights at Carillon, Quebec is bound to save in the cost of transmission lines, as Carillon is about 40 miles from Montreal, while Des Joachims would require a line nearly 200 miles longer.

Both provinces find the agreement to be advantageous in:

1. Being free to develop the units allocated to each whenever they are ready. Each can plan for the future without having to refer to the other.
2. Both gain in shortening substantially the transmission distance to their most likely market for power.
3. A third factor, which has to be considered in this agreement, is the regulation of the flow of the Ottawa river, which results from the construction of storage-reservoirs in either of the two provinces.

Under present conditions, important storage-reservoirs are in operation and are located entirely in the province of Quebec, such as Kipawa, Quinze, and that on the Upper Ottawa above Rapid No. 7 power plant. Lake Temiskaming is used as a reservoir but it is interprovincial.

The agreement provides for suitable distribution of the cost of maintaining and operating these reservoirs according to the benefits derived by different power owners.

Anyone examining the agreement carefully will realize that it forms a most important step in the development of the Ottawa river as a source of power. It is an agreement that is advantageous to both parties to it and this is the essence of a good bargain.

# POST-WAR RECONSTRUCTION

W. L. FOSS, M.E.I.C.
*Prairie Farm Rehabilitation Administration, Calgary, Alta.*

**Discussion on paper presented at the Annual Meeting of the Institute last February and published in the April issue of the *Journal*.**

The writer was greatly interested in Mr. H. G. Cochrane's paper "Post-war Pattern." This article is so well conceived that it is bound to provoke a great deal of discussion, and that is definitely to the good; post-war conditions will shape themselves to some extent in accordance with the thoughts and desires of the average citizen.

Mr. Cochrane appears to be optimistic in his view that the federal budget will balance itself so nicely by 1949. This war has shown that capital expenditure on a large scale is required to provide full employment and good business conditions. Statistics show that the increase in our national income since pre-war days is almost exactly equal to government war expenditure. In other words, the war is not costing the people of Canada, taking us as a collective body, one dollar. The cost is terrific in labour, natural resources and blood, but financially it costs us nothing, unless imports exceed exports, and then only to that extent.

Mr. Cochrane has estimated that $35 capital expenditure is required to supply the public with buying power to purchase $65 of consumers goods. The writer takes it that this $35 capital expenditure will be financed by new credit; indeed it must be, because if it is done from reserves which have been siphoned away from the buying power of the public, the effect would be neutral. On this basis, if our national income is say 7 billions, approximately 2½ billions must be due to capital expenditure, and hence someone in Canada will be going into debt at the rate of 2½ billion dollars per year. Will private industry undertake to do this ? If it does not, then the Government will have to do so, if our national income is to be maintained.

Why choose the arbitrary figure of 7 billions as our desirable national income ? If it can be raised to 14 billions without costing us, collectively, anything financially, why not do it ? The answer probably is that capital expenditures would have to be on such a large scale that we would soon run out of public works to do. For instance, the 1943 budget would build 700,000 homes, all the highways that we would require and have enough left over to complete the 111 million dollar irrigation and water power programme submitted by the Prairie Farm Rehabilitation Administration.

It would seem to the writer that there must be some way of keeping the production mechanism of consumers goods operating to desired capacity without first doing some other work which is totally unrelated and, in the ultimate, unnecessary. The only other alternative that the writer can think of at present is for the consumer to go into debt for the goods he requires. This is what happened in the twenties, and accounted for American prosperity during that era; surely, there must be some other way.

The writer is not greatly impressed by the much discussed "backlog" of consumer demands; these demands have been always with us, but unless the public has the buying power to make these demands effective, there is no demand. The "backlog" of demand in 1933 was probably as great as at any time in history, due to the glimpse of the potentialities of plenty which we received in the late twenties; but Mr. Average Citizen did not possess the buying power to satisfy his desires; it appears that he will not have it in the future unless someone in the nation continues to go into debt at an ever increasing rate.

The rate at which new credits will be required will probably increase, because if the reason for the necessity of capital expenditure is sought, it will be found to be due to labour saving devices in industry. It is possible to conceive of our population being made up of three classes, the owning class, working class, and the unemployed. The production machine is owned by the owning class, and operated by the working class. The product of this machine can be purchased only by the two classes owning and operating it, since the third class has no purchasing power. It may even be argued that the two privileged classes are unable to purchase all of the product of the machine due to saving, replacement reserves and other fixed charges. This is the argument put forth by Douglas of social credit fame. Be that as it may, it is obvious that the third class cannot purchase any of the product unless some other means is provided, independent of and unrelated to the production machine, by which it can secure the necessary buying power. At the present time, capital expenditure financed by new credits is the only means of making up this shortage in buying power. Due to technological advance in industry it is obvious that the third class will tend to grow in number, and the necessity for an ever-increasing debt growth becomes apparent.

# TRANSIT SHED WITH CONCRETE ROOF ARCHES

## ARCH TIES HEATED TO REDUCE SECONDARY BENDING STRESSES

FRANK E. STERNS, M.E.I.C.
*Engineer, National Harbours Board, Ottawa, Ont.*

**Paper originally presented at a joint meeting of The Engineering Institute of Canada and the American Society of Civil Engineers, at Niagara Falls, Ont., on October 15th, 1942, and here brought up to date**

The harbour of Saint John, N.B., is an important unit in the transportation system of Canada, being one of the few large harbours on the eastern seaboard which is open throughout the winter. Its development has been assisted by the Federal Government from time to time since Confederation and it was established as a national harbour in 1927. Upon the creation of the National Harbours Board in 1936, it came under the jurisdiction of that Board.

In June, 1931, fire swept the west side of the harbour from Rodney slip southward, the area which at that time contained all of the berths capable of accommodating large ships. All the transit sheds and other buildings upon the wharves were destroyed and all the wharves, with the exception of the concrete wharf at the south end of the area, were burned down to mean water level. Reconstruction was commenced at once except at three berths where the complete removal of the old timber cribwork was necessary. Funds for this work were not available until 1934.

The newer wharves consist of a concrete deck structure, 17 to 18 ft. in depth, supported partly on cylindrical concrete caissons 9 ft. in dia., sunk to rock, and partly on timber bearing piles cut off near mean water level. Figure 1 shows a cross section through the wharf at berth 10. The construction of berths 8 and 9 is practically the same, with slight differences in the transverse spacing of the supports. A full description of the construction has been given in a paper by Mr. V. S. Chestnut.[1]

### Transit Sheds

The wharves were built with the intention of providing transit sheds upon them when required to meet the demands of traffic. The type of shed contemplated, shown in Fig. 2, was a single story shed 92 ft. 6 in. wide with its rear wall at the rear edge of the wharf so that the rear cargo doors would be close to the railway cars and its front wall 12 ft. back from the edge of the wharf to provide the necessary working space. The frame of the proposed shed was of structural steel with columns along the front and rear walls, and roof trusses spanning the entire width of the shed at a minimum clear height of 16 ft. above the floor. The columns were to be placed on the centre lines of the wharf bents and would therefore be spaced 20 ft. C. to C. The provision of facilities for loading grain at the wharves was to be made possible by making the columns and roof trusses of sufficient strength to support a four belt grain conveyor gallery with its trestle and movable ship loaders similar to the existing gallery over the roof of the adjoining shed 11, which might be installed in the future upon the front part of the shed roof.

The construction of a shed of the above type on berth 10 was carried out during the latter part of the year 1937, and a similar shed on berth 9 was completed in 1938. These buildings were extended at the rear to cover the loading platforms and shelter freight in transit over them. Berth 8 had been used as an open berth for cargo which does not need protection from the weather, but in the summer of 1942 it was decided to proceed at once with the construction of a transit shed upon it.

Along the west half of this berth, the railway track serving the wharf curves sharply away from it, and a triangular loading platform some 20,000 sq. ft. in area extends from the wharf deck to the track. The annex over the loading platform forms a major feature of the shed.

[1] Engineering Journal, October, 1936

Upon application to the Steel Controller, it was found that structural steel for the frame of the shed could not be made available but that sufficient bar steel for the reinforcement of a concrete structure could be released. The relative advantages of reinforced concrete and timber for the frame of the proposed shed were therefore investigated.

For reinforced concrete structures of this kind, bents of the rigid frame type have frequently been found suitable. But for this shed, as it was to be built upon an existing reinforced concrete deck, serious difficulty would have been met in installing the necessary tie rods between the feet of the columns, as they would have to be placed under the deck slab of the wharf and be brought up through it at a small angle to be connected to the columns. By using bents consisting of tied arches supported upon columns, the ties could be placed overhead and these difficulties avoided. As rough estimates based upon preliminary designs indicated that the cost of frames of these two types would be nearly the same, the tied arch type was considered preferable.

Timber roof trusses of spans approximately the same as that required for this shed have been extensively used in recent years for aeroplane hangars. A preliminary design and cost estimate was made for a shed of timber frame construction using timber treated to resist fire. It indicated that the use of timber construction instead of reinforced concrete would reduce the cost of the shed only a few thousand dollars. In view of the greater fire hazard and

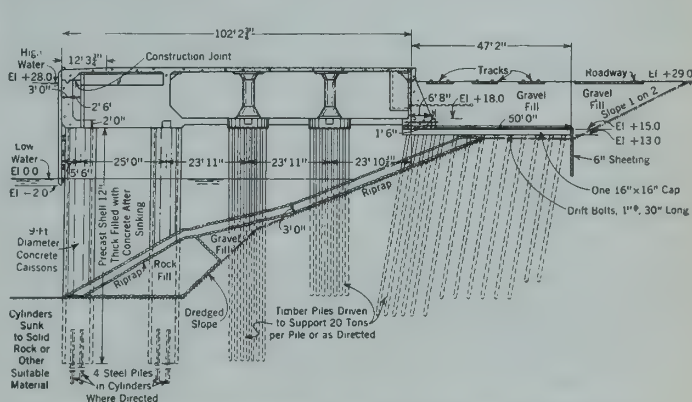



**Fig. 1—Typical section of wharf before shed was added.**

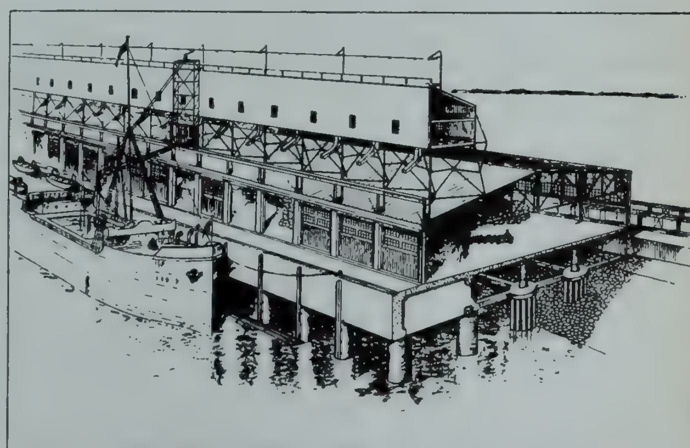


**Fig. 2—Proposed steel framed transit shed and grain gallery.**

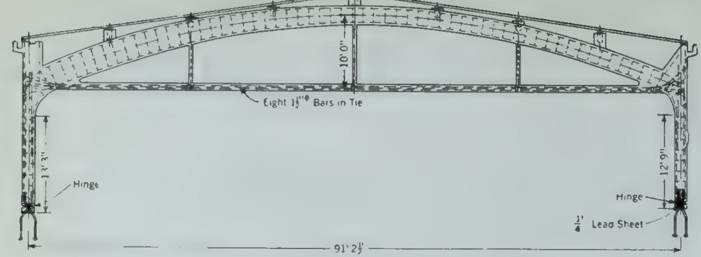



**Fig. 3—Tied arch of reinforced concrete for shed erected on wharf.**

the probable shorter life of a timber framed shed, a frame of reinforced concrete was considered preferable.

As the dead load of a shed having a reinforced concrete frame would be considerably greater than that of the steel framed shed contemplated when the wharf was built, the stresses in the wharf structure under the heavier column reactions were carefully investigated. In general, the wharf was found to be well able to carry the additional loads, but some reinforcement was considered advisable at one point in the retaining wall which supports the rear columns.

It was finally decided to adopt reinforced concrete for the construction of the frame of Shed 8 and its loading platform annex, using bents of the tied arch type for the shed (see Fig. 3). Framing of the beam and girder type was adopted for the annex, the beams being located on the same centre lines as the bents of the main shed and supported at one end upon the bents and elsewhere upon transverse lines of girders and columns. This arrangement gives a high degree of uniformity in the purlins and beams but some special framing at the curved wall of the annex was of course unavoidable. The exterior columns of the annex stand upon the top of the retaining wall which surrounds the loading platform. This wall, where it crosses the relieving platform, is supported upon framed timber bents placed upon the platform over its pile caps. Elsewhere, the wall has timber pile foundations. All interior columns for the annex are located behind the loading platform and reinforced concrete footings for them extending 5 ft. below the top of the platform were built upon creosoted timber piles.

### Loads and Stresses

The structure was designed for the same loads as were used for sheds 9 and 10, viz.:

- Snow load, 30 lb. per sq. ft.;
- Gallery load, per bent, 122,000 lb. on front column and 33,000 lb. at front quarter point of span;
- Wind load, 30 lb. per sq. ft., the wind stress in any member being reduced by ⅓ of the sum of the dead and live load stresses in the member.

Working stresses in concrete and reinforcing steel were those recommended by the Joint Committee. Concrete having an ultimate compressive stress of 4,000 lb. per sq. in. at 28 days was specified. The tie rods of the arches which had to be specially rolled to get the length of 92 ft. 6 in. required are of structural grade steel but all other reinforcing bars are of rail steel.

To guard against corrosion of the steel under exposure to moist air at the sea coast it was protected by a covering of concrete at least 2 in. thick. This also affords adequate fire protection.

### Roof

The type of roof adopted is the same as was used for sheds 9 and 10, viz., a 3 in. laminated or mill type timber roof with built up tar and gravel roofing guaranteed for 20 years. This permitted the purlins to be spaced at ⅛ of the arch span, 11.4 ft., C. to C. To expedite construction, the purlins, which are of concrete, are precast except in the bay at the east end of the shed, which is connected to the previously built shed No. 9, and elsewhere where purlins of special construction are required, such as those framing into the curved wall of the annex. The precast purlins have reinforcing bars projecting from their ends to tie them to the arch ribs and girders but were built as simple beams supported by brackets formed on the sides of these members.

The peak of the shed roof is at the level adopted for sheds 9 and 10, but to clear the arch, the slope of the roof is flatter, 1¾ in. to the foot, and the eaves higher. The roof of the annex is nearly flat, having a slope of ¼ in. to the foot.

### Main Bents

Figure 3 shows a typical bent of the shed. The arch has a span of 91 ft. 2½ in. and a rise of 10 ft. Its width is 19 in. and its depth, over the rear half of the span is 33 in. The outlines of the front half of the arch are smooth curves chosen to give the required increase in depth to 42 in. at the quarter point, where the gallery load will be applied, and to present a smoothly tapering appearance.

The columns are of the same width as the arch rib, 19 in., and their depth is 21½ in. There is a hinge joint near the foot of each column at a point 8 in. above the top of the wharf deck. When the wharf was built two 1¼ in. anchor bolts were built into it at each column location. Reinforcing bars were coupled to the anchor bolts and bent toward each other so as to cross at the centre of the hinge and extend up into the column above the joint. A sheet of lead was placed in the joint to reduce its resistance to rotation.

Each arch tie is composed of eight bars 1½ in. in diameter, as larger bars were unobtainable in the length required. The bars were placed in contact with each other in a compact group except at the ends where they are bent to flare away from each other so as to have a properly bonded connection to the concrete at the ends of the arch rib. The ties are supported at mid span and at the quarter points by sag rods connected to the arch rib. Bolted clamps are placed around the group of tie rods at the sag rods and at the points where the curves for flaring the ends begin. A short piece of 1⅛ square bar is placed in the top and bottom of the group of bars at the clamps to prevent displacement of the bars when the clamps are tightened. The ties and the sag rods are covered with concrete.

### Preheating Tie Bars

An unusual feature in the construction of the bents was the method adopted for reducing the secondary bending stresses in the columns. The rotation of the ends of the arch rib resulting from the elongation of the tie and the shortening of the rib under stress was found to produce an excessive bending stress in the slenderest columns that could safely be used, even when the point of contraflexure was brought to the foot of the column by the introduction of a hinge joint there. After careful consideration of the various expedients that might be used for overcoming the difficulty

**Fig. 4—Forms for arch.**

it was decided to heat a portion of the length of the tie rods before concreting them into the arch and to keep them heated until the concrete had attained sufficient strength to bear the stresses that would be produced by the shortening of the rods when they were allowed to cool.

Under maximum load, including the grain gallery, the computed elastic elongation of the tie was 0.566 in. and the shortening of the rib, measured along the chord at the centre line of the tie was 0.114 in. It was decided to shorten the effective length of the tie 0.45 in. by preheating and cooling. The load on the arch when the tie was allowed to cool was the dead load of the arch rib, the tie and the precast purlins. Under this load the amount of tie shortening required to produce zero deflection of the arch would be 0.296 in. The initial shortening of 0.45 in. would therefore produce a negative deflection or hogging of the rib when the tie was allowed to cool. The amount of the negative deflection at the centre of the span was computed to be 0.264 in. and the positive deflection under the maximum load, .395 in. The actual deflections of the arches, measured after the cooling of the tie rods, were found to be in close agreement with the computed figures.

For heating the rods it was decided to use electric ovens equipped with thermostat switches. Heating by passing low voltage current directly through the rods would have required for the completion of the circuits very heavy copper conductors which would have been difficult to obtain, and the connections between them and the rods would have involved difficulties and uncertainties. With steam heating the temperature could not have been so accurately controlled and regulated and the equipment for it could not have been so quickly installed and removed.

### Design of the Ovens

Figure 6 shows the details of the ovens. Each oven was a box of sheet steel having double walls, 3 in. thick filled with rock wool insulation. The box was 10 ft. long, 17 in. high and 12 in. wide inside. Openings were provided in the end walls through which the group of tie rods passed. The entire front wall formed a hinged door to which are attached the portions of the end walls in front of the openings so that when the door was open the oven could be installed upon a group of tie rods assembled in place in the work. When the oven had been placed on the tie rods and the door closed, a clearance space provided between the group of rods and the edges of the openings in the end walls was packed with rock wool. Plastic packing previously placed in the spaces between the rods at these points completed the closure of the ends of the oven against the entrance of cold air.

Heat was furnished by six 500-watt, 115-volt strip heaters mounted in the oven in a line along the bottom. To guard against unequal heating of the tie rods an inclined baffle plate was set above the heaters to protect the rods from direct radiation and to cause the air within the oven to

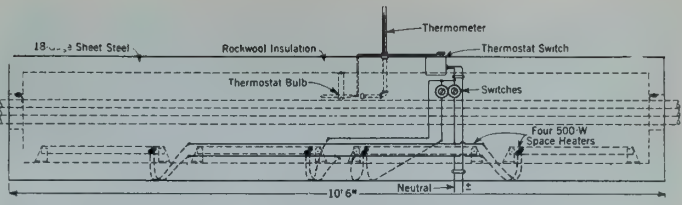



Fig. 6—Electric ovens for heating the arch ties.

circulate around them. The electric circuit passed through a thermostat switch attached to the outer rear face of the oven and connected to a temperature bulb mounted at a point within the oven where it was close to the top of the tie rods. The switch could be set for any temperature betwen 430 and 530 deg. F. and would open the circuit whenever the temperature of the bulb rose more than 6.5 deg. F. above the temperature for which it was set, and close it again when the temperature of the bulb fell to that value.

Two warning lights were connected across the circuit, one in front of, and one behind the thermostat switch. The heaters were connected in three groups of two, the two heaters in each group being in series and the three groups in parallel. Snap switches enabled two or four heaters to be cut out if desired. A mercury thermometer, passed through the top of the oven and supported by friction at the rock wool packing, enabled the temperature of the oven to be read directly.

To produce the desired elongation of 0.45 in. in the eight 1½ in. bars forming the tie, their heat content had to be increased by approximately 34,000 B.T.U. or 10 kw.h. The actual temperature required in the oven to give the desired elongation depended upon how much of the necessary additional heat was contained in the heat slopes along the portions of the bars outside the oven. To determine the proper temperature and check the performance of the ovens before placing them in service, they were tested upon a group of bars clamped at one point to a rigid frame, with reference to which their elongation could be accurately calipered. It was found that the desired elongation was produced when the temperature in the oven was above that of the atmosphere by 415 deg. F. Six ovens were provided so that the ties of six arches could be heated at the same time.

After the arch was concreted the tie had to be maintained in its heated state for some days to avoid stressing the structure before it had strength to resist. Interruption of the electric power supply during this period would have caused a gradual cooling of the tie and a gradual building up of stress in the bent which, if it went far enough, could very seriously damage the work. Power failures in Saint John, however, in the past had been quite infrequent and of short duration and new equipment had recently been installed in the transformer station which serves the west side of the harbour. It was decided that the risk of a power failure occurring at such a time and of such duration as to damage the work was too slight to justify the provision of an alternative source of power supply for emergency use.

Two short interruptions of the power supply did occur during the construction of the arches but the work was not damaged.

### Lateral Bracing

As previously mentioned, expansion joints had been provided across the wharf at intervals of 100 to 120 ft. Expansion joints were formed in the shed at every second joint in the wharf and divide the shed into three sections 215 ft., 220 ft. and 120 ft. in length respectively, the short section being adjacent to the existing steel shed No. 9. As there is an expansion joint in shed 9, only 60 ft. from its west end, no expansion joint was provided at the junction between the two sheds.

At two bays in each of the long sections of the shed and at one bay in the short section, the arch ribs at either side

Fig. 5—West end of shed 8 showing vertically sliding door at entrance from Union St.

**Fig. 7—Interior of shed 8 looking toward firewall at west end of shed.**

of the bay are connected to each other by concrete diagonals 14 by 14 in. in cross section, placed so as to form a Warren truss. To avoid interference with the purlins and their supporting brackets and with the connections between the arch rib and the tie, the points of intersection of the diagonals with the arch rib are placed approximately 3 ft. from the centre lines of the purlins, except at the centre of the span where the ridge purlin is above the arch rib. The other arch ribs receive lateral support from the braced bays through the purlins. No lateral support other than that which is furnished by the roof deck was considered necessary for the roof beams of the loading platform annex.

### Doors

The cargo doors are the most important feature of the shed from an operating point of view. The horizontally sliding type is the least expensive of the several suitable types, but in Saint John considerable difficulty is experienced in keeping the bottom guides free of ice, particularly at the front of the sheds where the guides are not clear of the deck and open underneath. Doors of the vertically sliding type and of the turnover type, which also moves vertically in opening, were used in sheds 9 and 10 and gave much less trouble from freezing at the bottom. For such doors, however, all-steel construction is desirable and a considerable amount of metal work is required in their counterweights and operating machinery. Because of the shortage of steel it was finally decided to adopt for the front and rear of shed 8 horizontally sliding doors of timber with steel frames. Windows 6 ft. high are provided in the upper part of doors 16 ft. high. There are two door leaves for each opening hung from two parallel tracks running continuously from end to end of each main group of door openings. The door at the roadway ramp from Union St., for which the horizontally sliding type is unsuitable, is a triple leaf steel door of the vertically sliding type.

### Walls

In the front wall of the shed there is a cargo door in every bay except the east end bay and the three bays at the west end which are not opposite the midship portions of ships berthed at the wharf, where the hatchways are located. The cargo doors are 16 ft. high and of the full width of the bays. In addition to the windows provided in the doors as previously mentioned, windows 6 ft. high are furnished in the bays unoccupied by cargo doors. There is also a small entrance door in the west end bay. The greater part of the wall area at the front of the shed therefore consists of windows and doors. Above the doors and above, below, and between the windows the wall consists of a reinforced concrete slab, 6 in. thick, flush with the faces of the shed columns and concreted monolithically with them. The slabs are supported laterally at the eave by a concrete eave gutter built along the outer face of the slab. At the top of the doors and windows and at the bottom of the window openings, horizontal beams are formed on the inner faces of the slabs. At the floor the slab is built into a shallow groove chipped in the top of the deck slab of the wharf.

In the rear wall of the building, which extends along the east portion of the shed proper and the curved side of the loading platform and includes the bay along the south end of the loading platform, there is a cargo door of the full width of the bay in every bay except the one at the east end of the shed, the bay at the west end of the curved wall and the bay at the south end of the platform. These doors are 9 ft. high to suit railway box cars, except the first door from the east end of the shed which is 16 ft. high to provide for the transfer of occasional large pieces of freight. Windows are provided above the low doors and in the high door as well as in the three bays in which there are no doors. The construction of the rear wall is similar to that of the front wall of the shed.

The west end wall of the building facing Union St. from the front of the shed to the south end of the loading platform is of brick, 13 in. thick, enclosing the outer portions of the reinforced concrete columns and beams which form the framework of the end of the building. Portions of this wall also serve as the west walls of two enclosures built of brick and concrete within the structure. A two-story enclosure 60 ft. long by 16 ft. wide in the shed proper provides office space, lavatories, etc., and a single story enclosure 45 ft. long by 26 ft. wide in the annex forms a longshoremen's room. The only door in the west end wall is that at the roadway ramp which leads into the shed from Union St. There are two rows of windows, but the lower row is not carried over the annex beyond the longshoremen's room.

At the west end of the previously built shed 9 there is a brick firewall 13 in. thick. This wall was carried up so as to cover those portions of the east end of shed 8 which are above the slopes of the roof of shed 9 and form a parapet wall above the roof. The traffic lane along the rear edge of the wharf passes through a doorway 14 ft. wide by 16 ft. high in the firewall. This opening, which is furnished with an automatically closing fire door, provides communication between shed 8 and the adjoining shed 9.

The Acme Construction Company of Saint John, N.B., was the general contractor for the work. The members of the National Harbours Board are R. K. Smith, chairman, J. E. St. Laurent, vice-chairman, and B. J. Roberts. F. W. Riddell is executive secretary and E. G. Cameron, chief engineer.

# PAINTING UNDERWATER STEEL

CLAUDE GLIDDON, M.E.I.C., and ARTHUR J. CHABOT
*Chief Engineer and Electrical Engineer respectively, Gatineau Power Company, Ottawa, Ont.*

This article outlines experience and practice on the Gatineau River with regard to the painting of underwater steel, and applies mainly to hydraulic turbine headgates.

On the Gatineau river whose water is very nearly neutral, having a Ph value of 6.9, (slightly on the acid side), rusting of two types is encountered on underwater steelwork, namely:

(a) On steelwork which is submerged deeply or in dark wells, such as turbine headgates and the inside of penstocks, large soft tubercles form. Under each tubercle a crater or cone-shaped depression is formed in the steel, which, after ten years, may be as deep as ⅛ in. at the apex. On a gate having a ⅜ in. thick skin plate, if two of these tubercles occur directly opposite each other then there remains only ⅛ in. of steel at this point. This type of rust can be readily washed off to the clean steel beneath, but is the more serious type because of the large amount of metal which rusts away.

(b) On steelwork which is not submerged deeply and is out in the open water, such as sluice gates, very few if any tubercles form at the shallower levels. Here the ordinary type of rusting seen everywhere on steel exposed to the atmosphere takes place. The surface is generally pitted more or less uniformly and to a very much smaller depth than in the case of the tubercle formation. This type of rust adheres to the steel and is more difficult to remove to the clean steel beneath.

Usually both types of rusting occur together, the tubercle type predominating under conditions outlined in (a) and the ordinary rusting predominating under conditions outlined in (b) above.

Gatineau Power Company's experience using the more customary methods of cleaning by wire brushing and scraping and of applying one or two coats of ordinary paint has been that under conditions outlined in (a) above, tubercles begin to appear about six months after painting while under conditions outlined in (b) no rusting appears for several years and it takes six or seven years for the whole surface to become rusted.

The tubercle condition is therefore by far the more serious and this article describes the tests made and the practice now being followed in painting where tubercles occur.

Tests were carried out on small areas of headgates and on steel test plates and on complete headgates employing different methods and materials for cleaning and painting as follows:

1. Different methods of cleaning such as sluicing with water, wire brushing, scraping, paint removers, cleaning with oxyacetylene flame, sandblasting, and steel grit blasting.
2. From one to four coats of different kinds of coatings, such as paints, greases, sprayed zinc and hot dip galvanizing were tried, also different materials for the different coats where more than one coat was used.
3. Different methods of applying coatings, such as brushing, spraying, flowing or rubbing on and melting on with blow torch.
4. Different methods of drying such as natural air drying and infra-red drying.

Over a hundred different kinds of coatings were tested and tests varied in length up to 15 years.

Of the coatings tested in the Gatineau river, the following gave the best results.

(a) Heavy red lead paints weighing approximately 30 lb. to the gallon.

(b) Thick bituminous coatings approximately 1/16 in. thick.

(c) Synthetic paints of the bakelite type and rubber base type.

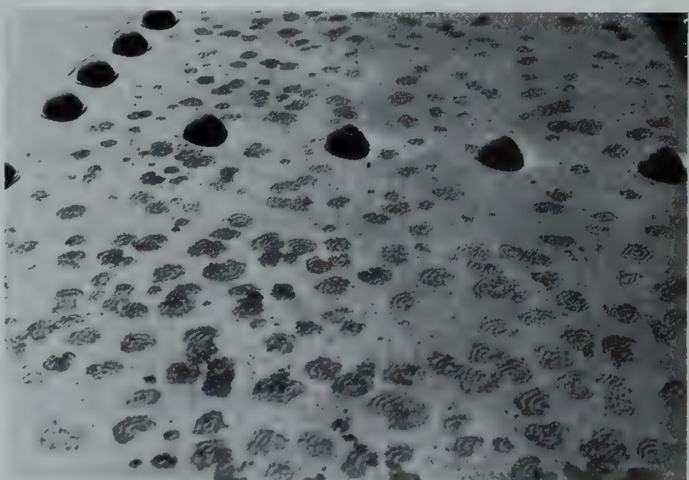
Synthetic (bakelite) paints, and thick bituminous coatings stood up well but showed a tendency to form blisters, the former small in size and the latter, large ones. If these blisters are punctured, they are found to be full of water and the metal or coat of paint beneath is found to be clean and apparently not deteriorated. The first tendency was to reject a paint because it formed blisters, on the other hand we have had test areas which, after six years under water, and although showing these blisters, appear to have given perfect protection to the surface beneath. In some of the thicker bituminous coatings (about 1/16 in. thick) on opening the blisters it was found that there was still a layer of the same material beneath which had not blistered.

Chlorinated rubber base paint tests have shown excellent results after four years under water, but on account of the fact that the materials cannot at present be purchased, they cannot be considered for use at this time. They hold promise, however, not only in view of their performance on test but in view also of the ease with which the application can be made and the drying speeded up as compared to red lead.

Red lead paints have shown less tendency to blister but more rust tubercles have appeared than with the bituminous and synthetic paints.

In the tests, the best combination of coatings consisted of red lead priming and intermediate coats and a heavy bituminous top coat. After six years under water this combination showed only a few large blisters (about 1½ in. diameter) in the top coat, and a few small blisters (about ⅛ in. diameter) in the red lead coats. There was no rusting whatever of the steel.

**Close up view of rust tubercles. (Some of the tubercles have been scraped off.)**



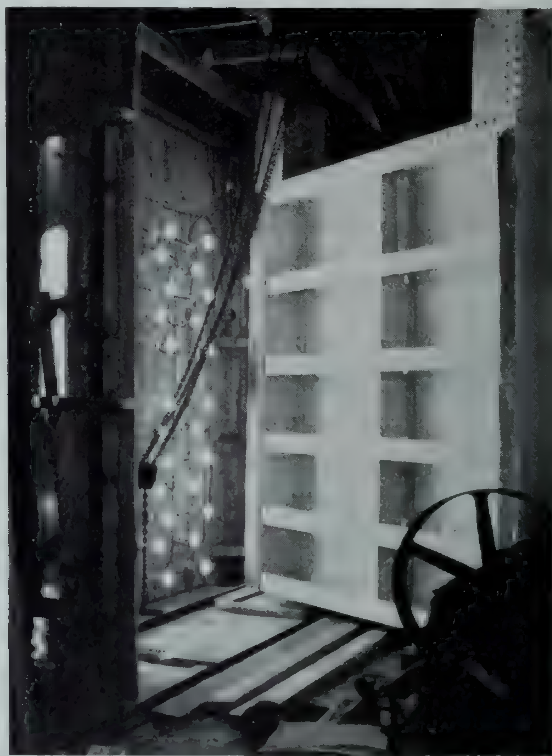
**Close up view of cone shaped depressions formed by tubercles. This view shows the steel after grit blasting.**

Based on the tests and experience to date the following is the procedure which Gatineau Power Company is using in painting of turbine headgates and deeply submerged sluicegates:

1. Slime and tubercles are washed off, using a stream of water and stiff brushes and scrapers.

2. After drying, the gate is placed in a wooden housing where electric space heaters raise its temperature to about 10 deg. F. above room temperature. This is done in order to prevent the formation of moisture which might get under the paint film and cause rusting. The temperature of the gate is maintained above room temperature continuously, from this time until the final coat of paint has been applied. The gate is then grit blasted using No. 20 angular steel grit with an air pressure of about 70 to 90 lb. per sq. in. All foreign material including mill scale is removed during the blasting process. A fan exhausts the dust laden air from the wooden blast-housing and discharges it through a water spray to outdoors.

**Turbine headgate leaving grit-blast housing.**



**Submerged sluicegate being turned in front of infra-red lamp bank.**

3. The gate is then moved out of the wooden housing to a position about one foot in front of a bank of infra-red lamps which raise the temperature of the whole gate to about 110 deg. F. While the gate is at this temperature the side opposite to that facing the lamps is given the priming coat of paint which is applied by brushing and whose main constituents are red lead and linseed oil. This red lead paint weighs about 30 lb. to the gallon. Considerable working in is required to insure the paint filling all the pit holes and careful inspection is maintained to insure complete coverage. The gate is then turned about so that the sides are reversed and the other side given the priming coat. In this manner three coats of red lead paint are applied to all surfaces of the gate. The drying time between coats averages about 32 hours with the gate at about 110 deg. F. After the third coat has been applied, the drying period is extended to about 48 hours to give a fairly hard surface. The fourth coat consists of a heavy asphalt base roofing cement coating containing asbestos fibres and applied about 1/16 in. thick. This material is heated so that it can be readily brushed on. After the fourth coat, about 48 hours' drying time at room temperature is allowed.

Keeping the gate at 110 deg. F. during the painting operation results in a fairly high covering capacity for the red lead paint, the average being 675 sq. ft. to the gallon. The covering capacity for the heavy bituminous coating is about 100 sq. ft. to the gallon.

Since all of the work is done inside the gatehouse it is not necessary to wait until the warm summer months to do this type of painting, and on Gatineau Power Company's system, some of this work is being carried out in winter when other work is not so pressing.

To summarize:

The combination of red lead under coats with a thick bituminous topcoat is the only covering which after tests of six years of continuous underwater exposure in the Gatineau river has shown no tubercles or other rust formation on the steel. Most of the many other paints and coatings tested began to show rust tubercles in six months to one year after application. The procedure now being followed in painting as outlined above includes, in addition to that used in the tests, the application of three coats of red lead instead of two, the keeping of the steel at well above room temperature during the cleaning and painting period to avoid condensation of moisture, and the use of infra-red heating for drying the paint.

In addition to the fact that the red lead-bituminous combination gave the best results compared to other paints used and tested, the following are advantages which may be claimed for the method of cleaning and painting employed:

1. The steel is cleaned of all foreign material.

2. A good "tooth" or rough surface is obtained for the paint.

3. No moisture is allowed to deposit under or between the paint films.

4. The thinner coats of red lead obtained at the temperature of 110 deg. F. can be better worked into any surface irregularities and thus have a better chance of forming a coating which is free from pin holes and free from small air pockets under the film ordinarily formed where the paint bridges over small depressions.

5. The high temperature drying gives the red lead a harder and tougher surface.

# A SIMPLE DIRECT METHOD OF DERIVING STIRRUP SPACINGS IN REINFORCED CONCRETE BEAMS

S. H. DE JONG, M.E.I.C.
*Department of Civil Engineering, University of Toronto*
*With H. G. Acres and Company, Consulting Engineers, Niagara Falls, Ontario, at the time of writing.*

There are many means of deriving stirrup spacings in reinforced concrete beams. Most of them involve the use of the shear diagram, drawn to scale, and tables; or some combination of computations, tables and diagrams.

It is desirable that the design be simplified so that it can be rapidly executed by computation only. Herewith is given such a method. The mathematics are simple enough to make it very rapid of execution, and no tool but the slide rule is required.

Consider the portion of the shear diagram shown in the figure. Let it be required to space stirrups over the section AB of the beam.

$V$ = the total shear at any point.
$V_o$ = the maximum shear on the section AB of the beam.
$V_c$ = total shear taken by the concrete.
$S$ = the distance from the point of maximum shear on the section AB to the point where the stirrup shear would be zero if the slope of this portion of the shear diagram were continuous.

In the case where uniformly distributed load only exists on the beam, $S$ becomes the distance over which stirrups are required.

$f_s$ = the allowable unit stress in web reinforcement;
$A_s$ = the total cross sectional area of steel in one stirrup;
$jd$ = the distance from the centre of compression to the centre of tension in the beam;
$d$ = the effective depth of the beam;
$b$ = the width of the beam if the beam is rectangular, or the width of the stem of the beam if the beam has a T or Γ section;
$s$ = the stirrup spacing at any point in the beam.
$s_o$ = the stirrup spacing at the point of maximum shear of the section of the beam under consideration.

The value of $S$ may be readily computed from the geometry of the shear diagram.

The shear to be taken by the stirrups at any point is $V-V_c$.

The fundamental equation for stirrup spacing is

$$s = \frac{f_s \; jd \; A_s}{V - V_c} \qquad (1)$$

$$\text{and } s_o = \frac{f_s \; jd \; A_s}{V_o - V_c} \qquad (2)$$

From the diagram, if $x$ is measured to the left from the point E, then

$$V\text{-}V_c = \frac{(V_o - V_c)\; x}{S}$$

Substituting this value in equation (1),

$$s = \frac{f_s \, jd \, A_s \, S}{(V_o - V_c)\, x} \qquad (3)$$

And substituting $s_o$ from equation (2) in equation (3)

$$s = \frac{s_o \; S}{x} \qquad (4)$$

For any particular section of a beam, when the loading, stirrup size and specifications have been established, $A_s$, $f_s$, $j$, $d$, $V_o$ and $S$ are constant, and

$$s = \frac{s_o \, S}{x} = \frac{K}{x} \qquad (5)$$

where $K$ is constant.

In the use of the above equations, $S$ should be converted to inches before $K$ is computed.

The first stirrup is usually spaced $\frac{1}{2}\, s_o$ from the face of the support. The second will then be spaced $s_2 = \dfrac{K}{S-s_1}$ from the first. The third will be spaced $s_3 = \dfrac{K}{S-s_1-s_2}$ from the second. In this manner the stirrups required may be individually spaced very rapidly, as $S-s_1$, $S-s_1-s_2$, etc. are simple mental calculations that can be computed as the stirrup spacings are read off the slide rule.

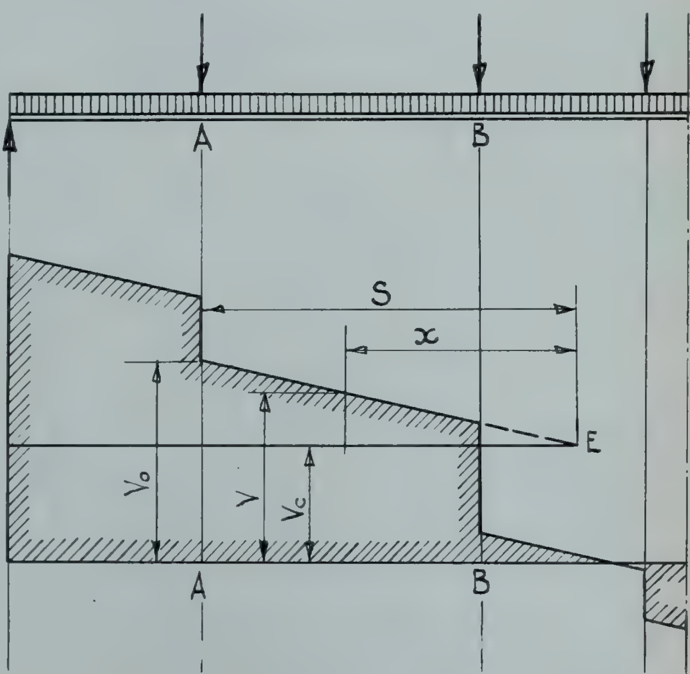
It is frequently desired to space stirrups in groups of equal spacings. If this is to be done the formula is expressed as $x = \dfrac{K}{s}$. By giving $s$ any desired values the points where these stirrup spacings commence are readily found.

The argument is frequently raised that the stirrup is not accurately designed because the maximum shear in the distance along the beam, reinforced by one stirrup is used in determining that distance, whereas the average shear should be used. It is conceded by those who raise the point that the error is small and on the safe side and therefore not worth the effort of eliminating.

By the method here presented the error may be reduced somewhat by taking $s_2 = \dfrac{K}{S-s_o}$, $s_3 = \dfrac{K}{S-s_o-s_2}$, etc. This is more precise than taking values of $s$ as before, but there is still error. The error, however, remains on the safe side. The work involved is exactly the same in either case.

By means of a single step of successive approximations the spacing of stirrups can be determined to a comparatively high degree of precision. This involves about double the work from the time that $K$ is determined and is very rarely worth the effort.

The above principles apply equally well, and the final formula is exactly the same, in the case where unit shears alone are considered. The theory as derived above is the general case. In practice it is usually a little simpler to work from the basis of unit shears.



### Numerical Example

Let it be desired to design the stirrup spacing for a rectangular section beam of clear span 20 ft 0 in.; *b*, 10 in.; *d*, 16 in.; bearing a uniformly distributed load of 2400 lb. per lineal foot, including the weight of the beam.

Using C.E.S.A. specifications for 3000-lb. concrete at 28 days:

Allowable unit shear stress that may be taken by the concrete is 90 lb. per sq. in., assuming adequate anchorage for tensile reinforcement.

Allowable unit stress in web reinforcement is 16000 lb. per sq. in.

At the face of the support:

The total shear is 2400 × 10 = 24000 lb.

The total shear that may be taken by the concrete is 90 × 10 × .875 × 16 = 12600 lb.

Total shear that must be taken by the stirrups is 24000 − 12600 = 11400 lb.

Assuming ⅜ in. diameter U stirrups, we have from equation (2)

$$s_o = \frac{16000 \times 0.875 \times 16 \times 2 \times 0.11}{11400}$$

$= 4.32$ in.

Therefore $s_1 = 2$ in.

$$S = \frac{11400}{24000} \times 10 = 4.75 \text{ ft.} = 57.0 \text{ in.}$$

$$K = S\, s_o = 57.0 \times 4.32 = 246$$

From equation (5), $s = \frac{K}{x}$:

$$s_2 = \frac{246}{57-2} = 4\tfrac{1}{2} \text{ in.}$$

$$s_3 = \frac{246}{57 - 2 - 4\tfrac{1}{2}} = 5 \text{ in.}$$

This is more easily done by writing values of $x$ in a horizontal line with corresponding values of $s$ below them, thus:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $x$ = 57 | 55 | 50½ | 45½ | 40 | 34 | 27 | 18 | 4½ |
| $s$ = 4.3 | 4½ | 5 | 5½ | 6 | 7 | 9 | 13½ | 55 |
| (2) | | | | | | | (9) | (9) |

Using the more precise value of $s_2 = \frac{K}{S - s_o}$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $x$ = 57 | 52½ | 48 | 43 | 37½ | 31 | 23 | 12½ |
| $s$ = 4.3 | 4½ | 5 | 5½ | 6½ | 8 | 10½ | 19½ |
| (2) | | | | | | | (12½) |

Figures in brackets are the actual spacings that will be used instead of the theoretical values given above them.

The above spacings have been taken to the nearest half inch and represent individual spacings. For short deep beams with heavy loads this approach to the problem is quite suitable. However, for longer and shallower beams, such as in the case above, it is more likely that arbitrary spacings would be used in groups.

Suitable spacings in this case will be 4½ in., 6 in., 8 in. and 12 in.

From $x = \frac{K}{s}$, stirrups may be spaced at:

4½ in. where $x$ = 55 in.
6 in. where $x$ = 41 in.
8 in. where $x$ = 31 in.
12 in. where $x$ = 20½ in.

Actual distribution will then be as follows, starting from the face of the support:

2 in., 3 at 4½ in., 2 at 6 in., 1 at 8 in., and 2 at 12 in.

* * *

The writer wishes to express his appreciation to Messrs. J. H. Ings, M.E.I.C. and P. A. Pasquet, S.E.I.C., of H. G. Acres and Company for valuable suggestions.

# METALLIZING IN MAINTENANCE WORK

R. S. TUER

*President, B. W. Deane & Co., Limited, Montreal, Que.*

Little need be said on the necessity of salvaging and maintaining equipment in Canada's war industries. Our war production must be maintained in the face of ever-increasing difficulty of part and equipment replacement. By virtue of its simplicity, economy, broad applicability, and proved effectiveness, metallizing has come into wide use in almost every industry for the repair and rebuilding of worn elements such as crankshafts, axles, impeller spindles, pistons, gear housings and innumerable other parts not readily replaceable. In these critical times, when replacement parts are difficult to obtain and available machines must be utilized to the utmost, metallizing equipment on the job or in the repair shop can do much toward eliminating costly delays occasioned by unexpected breakdowns. It can do much, too, towards conservation of materials required for replacements and the man-hours of labour that go into their manufacture. Usually, repairs thus effected give a service life considerably longer than that obtained from the original part.

Metallizing is a process of applying any metal in wire form to any metallic, and many non-metallic, surfaces without the application of sufficient heat to set up stresses or cause warpage in the original base material. Thus it is possible to resurface the bearings of crankshafts and similar parts without the necessity of preheating and post-annealing and straightening.

Dissimilar metals can, with due regard to electrolytic action, be applied to one another; for example, steel to bronze and brass; steel to cast iron; and brasses and bronze to steel or iron. This flexibility in application opens up many possibilities for conserving vital metals and applying hard, wear-resistant surfaces to softer base metals.

By the metallizing process, the metal is applied in a finely atomized, semi-molten state. Wire is automatically fed through a gun into the centre of an oxyacetylene flame surrounded by an envelope of compressed air at 65 lb. per sq. in. pressure which atomizes the metal as fast as it melts and projects it at high velocity on to the surface being sprayed. Figure 1 illustrates the construction of the gun nozzle and its action in spraying the atomized metal.

Surfaces to be metallized are prepared by either of two common methods. Bearings and other cylindrical shapes are mechanically prepared in a lathe by first undercutting the worn section, then grooving and roughening the tops of the sections between the grooves with a special rotary tool. These simple operations require little skill; they can be performed on any lathe. Flat surfaces, or sections which cannot be prepared in the above manner are blasted with angular steel grits, flint sand or special non-metallic abrasives.

From this brief description of the preliminary operations it will be seen that adequate surface preparation is necessary in order to obtain a secure bond for the sprayed metal. The basic requirements are:

1. A surface properly undercut.
2. A surface free from oil moisture.
3. A surface roughened mechanically or by blasting to assure the maximum keying.

### Equipment Required

The metallizing gun is a small hand tool weighing 4¾ lb. Accessory equipment, air filter and regulator, oxygen and acetylene regulators, hoses and wire control units are portable. They can be mounted completely on an ordinary gas-bottle truck or any other wheeled equipment.

Compressed air is needed in a volume of at least 35 cu. ft. per minute at 65 lb. pressure. Oxygen and acetylene or propane are required, and these gases are obtainable from regular suppliers. Figure 2 shows the maximum amount of equipment required for a metallizing outfit. The air drying unit shown next to the compressor is only required when the air supply is wet and oily.

In addition to the above a lathe is required for preparing, metallizing and finishing all cylindrical parts, and a blast cabinet or pressure-type blast machine for flat or large-area work.

### What Metallizing Can and Cannot Do

Like all maintenance processes, metallizing has definite limitations beyond which failures will certainly occur. First, it should always be remembered that the sprayed metal is not actually fused to the metal to which it is applied; therefore, it depends for its adhesion upon a mechanical bond, the strength of which is entirely dependent upon the quality of the surface preparation.

Second, sprayed metal has a granular rather than a crystallized structure, and this characteristic indicates low tensile strength. Therefore, it is not used for:

1. Cutting or shearing edges.
2. Conditions of severe impact.
3. Overcoming structural weaknesses, or
4. Joining broken or badly cracked parts.

Eliminating repair jobs that come under these classifications, we have left an enormous variety of worn parts that can be effectively re-surfaced and restored to original dimensions. All press fit diameters inside over 3½ in. diameter and outside any diameter are good applications.

The wear-resistant qualities of sprayed metal are better in most instances than those of hardened solid metal. Therefore, all bearing surfaces (except those upon which rollers operate under compression) are ideal applications. The original hardness of sprayed metal depends largely on the

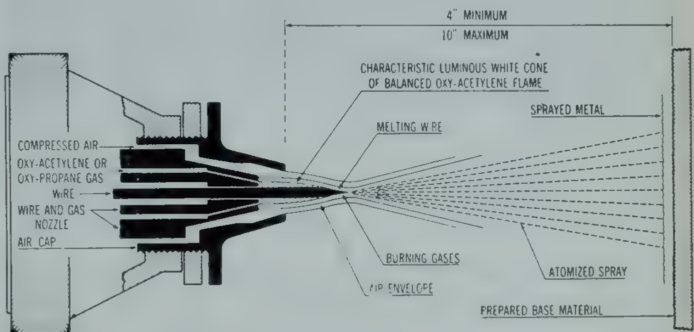



**Fig. 1—At nozzle of metallizing gun, metal wire projected at controlled rate by air turbine in gun is melted by annular flame of oxyacetylene or oxypropane. Annular envelope of compressed air atomizes molten metal and sprays it upon prepared surface set up at proper distance from nozzle.**

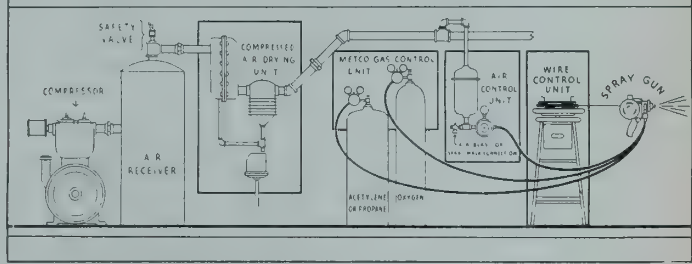



**Fig. 2—Complete equipment for metallizing work includes compressor capable of supplying 35 cu. ft. per min. at 65 lb. per sq. in. and air and gas control units. Drying unit next to compressor is needed only where air is particularly moist or oily.**

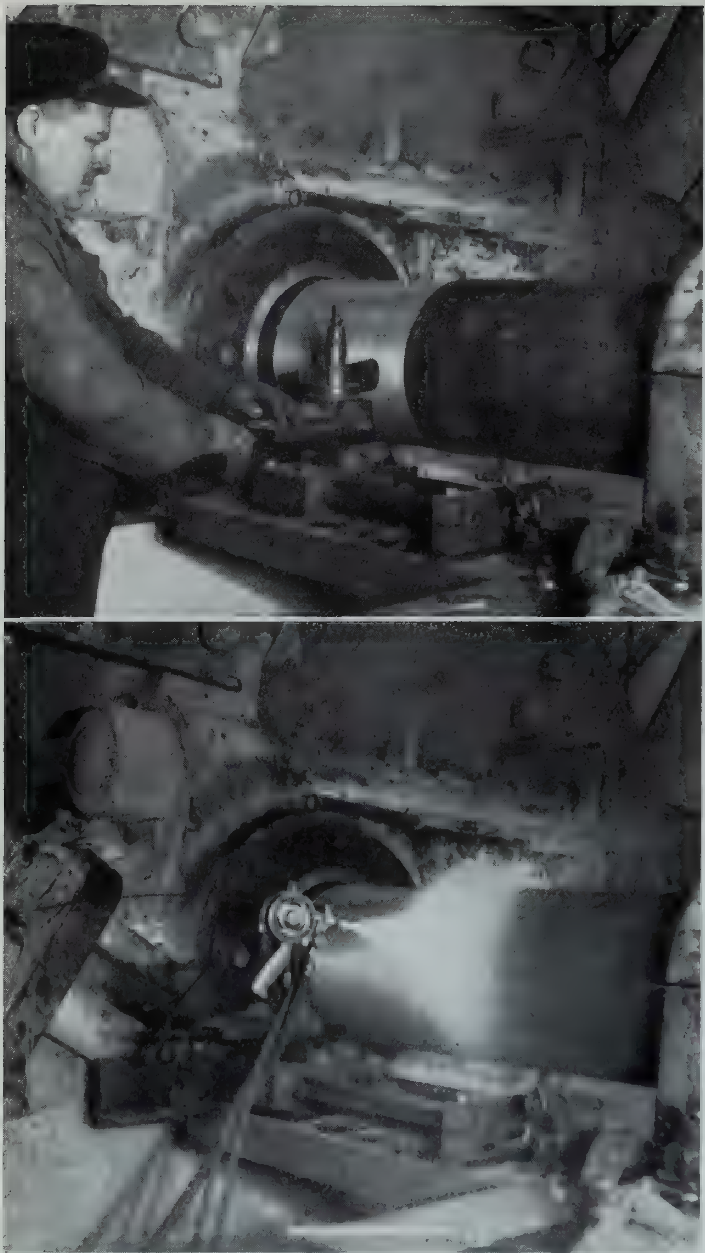


**Fig. 3—Without dismantling machine, large diameter drive shaft of roll crusher in cement mill is restored to press fit by roughening bearing section with rotary shaft preparing tool (upper picture), building it up with sprayed steel (lower picture) and grinding to finished fit. Entire job is completed in 18 hrs.**

material used. Sprayed metal differs from solid metal, in that its hardness does not indicate its wear-resistance.

The natural porosity of sprayed metal gives it special advantage for bearings, both because the porous metal has a low co-efficient of friction and because its absorption of oil makes it virtually self-lubricating.

Although metallizing is a simple process which can be performed by relatively unskilled labour, there are certain definite procedures which must be employed if uniformly good results are to be obtained. Space does not permit going into detail in this regard, particularly as metallizing operation manuals are available.

### Metallizing Applications

This covers a wide field, but the uses of the process for maintenance and salvage of machine parts could be summed up as follows:

1. *Defective* forgings and castings, rejected because of surface defects, can be successfully reclaimed to specifications.
2. *Mis-machined* cylindrical parts, on inside and outside diameters—even undersized flat surfaces—can be built up to standard.
3. *Porous* sections and blow holes in structurally sound ferrous and non-ferrous castings can be permanently filled in and sealed.
4. *Any size* parts from tiny machine spindles to mammoth chill motors can be salvaged in production with equal effectiveness.

The rebuilding of shafts and axles has been common practice for years but, many parts, either mismachined or worn, are now being successfully reclaimed instead of being relegated to the scrap pile.

### Types of Wire

The material used for metallizing is in the form of wire which is made, annealed, drawn and coiled to exacting specifications. As in welding, where the right rod for the job is a prime necessity, so in metallizing the proper wire for the work is of first importance. Low, medium and high carbon steels, tested in service over many years, are available and should be used where indicated.

### Finishing Surfaces

The finishing of treated surfaces either by grinding or by machining presents no difficulty; in most cases even high carbon steels can be machined with carboloy or a similar material.

By the metallizing process, many jobs can be done without completely dismantling a heavy piece of equipment. The Fairmont roll crusher shaft shown in Fig. 3 is an excellent illustration of how an enormous dismantling and reassembly job can frequently be avoided; this shaft was repaired and restored to operation in less than a day.

### Cost of Metallizing Repairs

To give an approximate idea of the cost of making on-the-job repairs by metallizing, assume there are three shafts of different sizes and with different sections to be resurfaced.

The metal used is Spraysteel 10, which in 100 lb. quantities costs 11 cents per lb. After including labour at approximately 85 cents per hour, oxygen at $1.00 per 100 cu. ft. acetylene at $2.50 per 100 cu. ft. and air at 10 cents per 1,000 cu. ft., we have a cost per pound actually sprayed of 29 cents. This figure is exclusive of overhead, burden and profit, and does not include any preparation of the part or finish machining.

*Job No. 1* is a shaft 1½ in. diameter, to be metallized over a length of 2 in. A thickness of 1/16 in. of metal is to be applied to the radius. A total of ¾ lb. of metal will be required.

*Job No. 2* is a shaft 2½ in. diameter to be metallized over a length of 4 in. A thickness of 1/16 in. of metal is to be applied to the radius. A total of 1.75 lb. of metal will be required.

*Job No. 3* is a shaft 4 in. diameter to be metallized over a length of 6 in. A thickness of 1/16 in. of metal to be applied to the radius will call for 2.6 lb. of metal.

Eight pounds of Spraysteel 10 can be sprayed per hour. It will be seen, therefore, that the actual spraying time on any of the above examples is negligible.

Machining time, preparation and finishing cannot be estimated as facilities and conditions vary with every job.

# FARM ELECTRIFICATION IN MANITOBA

**Summary of findings and recommendations of the Manitoba Electrification Enquiry Commission**

In June 1942 Mr. John Bracken—at that time Premier of Manitoba—set up a commission "to gather data upon the basis of which it (the government) can formulate a practicable policy for the expansion of the Manitoba hydro-electric system to serve as large a proportion of Manitoba farmers as possible." Dr. Emerson P. Schmidt, head of the Department of Economics of the University of Minnesota was appointed chairman. Dr. Schmidt is a recognized authority in the utility field, having conducted similar investigations in the United States. E. V. Caton, M.E.I.C., manager, electric utility, Winnipeg Electric Company, John W. Sanger, M.E.I.C., chief engineer, City of Winnipeg Hydro-Electric System, and Herbert Cottingham, chairman of the Manitoba Power Commission, were selected as the other members of the commission.

The report was submitted to Mr. Bracken in December 1942, and runs to two hundred and eleven pages. Doubtless many members of the Institute have read it, but for the general interest of the members at large, and without in any way commenting on the report, the *Journal* reproduces herewith the summary of findings and recommendations as they appear on pages one to six inclusive.

### Findings

1. Electricity on the farm has profound and far-reaching effects upon the social as well as economic aspects of farming. It reduces drudgery upon the farm as it has done in the factory; it increases income, reduces costs of production and by removing the disparity between the urban and the rural way of life brings a large measure of contentment to people upon the farm.
2. In few major areas in the world is town and farm interdependence as pronounced as is the case in Winnipeg and rural Manitoba.
3. To bring electric power in the post-war period to the majority of the 58,686 farmers in the province of Manitoba is entirely feasible and practical.
4. Manitoba agriculture, because of certain climatic and market difficulties, requires constant adaptation to a changing world—an adaptation which may be substantially facilitated by the use of electric power on the farms.
5. Farm electrification in a large part of the Western world is an accomplished fact, or is in process of becoming so. In the United States, for example, two out of every five farmers are supplied with electric power and Manitoba's farmers should not be forced to lag behind this movement, if Manitoba's economy is to retain its place in the world economy.
6. A man working with his own muscle-power alone never can do, in a day, the equivalent of work done by one kilowatt hour of electricity, which unit of energy rarely costs more than 5 or 10 cents. No other form of power for the farm can compare with the low cost, convenience and adaptability of central station electric service.
7. The electrification of farm areas merits a high priority as a post-war employment programme because it will be more nearly self-supporting than most other projects which might be considered, although it is recognzied that self-liquidation should not be the only test in the selection of post-war employment projects.
8. In order that farm lines may be built economically it is necessary that construction work be scheduled at a uniform rate. A construction programme of 25,000 farm services in the first ten years is considered to be a minimum initial objective.
9. The capital cost of 25,000 farm services based on 1939 prices and the attainment of 80% saturation of possible farm services, is estimated to be $16,831,687.50. At the end of ten years and after deducting sinking fund, the net debt for 25,000 farm services will amount to $14,426,800.52.
10. On the same basis, the capital cost per farm service is estimated to be $673.27. On the basis of 1942 prices the estimated cost is approximately 8% higher.
11. The ultimate capital cost of complete farm electrification beyond the tenth year is difficult to forecast. If the average prices are those prevailing in 1939, an additional capital expenditure of $10,000,000 may be required.
12. To supply farm services at a rate similar to the standard rate schedule now in effect in the towns and villages, namely, 8 cents for the first 50 kw.hr. per month and 2 cents for all additional energy (but minimum net bill $3.60) will require a bonus *rate* equal to that now paid to the Manitoba Power Commission. Owing to the relatively high capital cost of farm electrification the bonus will equal $21 per farm service per annum.
13. Under the terms of the existing water power leases there will not be sufficient water power rentals to pay the combined bonus requirements of farm electrification and the M.P.C. network.
14. Under the present system of bonus, the amount required for service to 25,000 farms in ten years will be $21,000 in the first year, increasing progressively to $526,000 in the tenth year. To provide sufficient revenue from farm electrification to meet the additional cost resulting from a bonus not being paid, the service rate would require to be increased to 10 cents for the first 50 kw.hr. per month, 4 cents for the next 50 kw.hr. per month and 2 cents for all additional energy with a minimum net bill of $4.50 per month.
15. There is adequate power, available from the Winnipeg River, to provide for a complete farm electrification system for Manitoba. It is estimated that the average peak demand per farm would be 600 watts and that the peak demand for 25,000 farms would not exceed 30,000 h.p. at the power plants. This constitutes only 5% of the total power available from the Winnipeg River.
16. It is indisputable that the high cost of electric appliances is the greatest handicap to the complete utilization of electricity on the farm; farm service for lighting only is not practical under the conditions existing in Manitoba.
17. Even though the farmer may be required to pay a minimum monthly bill of $3.60, this monthly expense to the farmer for electric power is not entirely an additional expense because over half of it replaces other existing or present costs such as coal-oil, radio battery charging, etc.
18. If the minimum monthly bill is $3.60, the Manitoba Power Commission may assume that within a few years at least half of the farmers will find electric power so beneficial that they will use energy in excess of the minimum and thus ensure the entire system adequate revenue.
19. Unless capital funds are secured at an interest cost not to exceed 3.5% it will not be possible to carry out any comprehensive farm electrification programme. It may be noted that the farmers in the United States are securing funds under the rural electrification administration for 2.46% and are anticipating a further reduction.

[1] "The experience of the past decade is conclusive evidence that unemployment relief should be a Dominion function." Report of the Commission on Dominion-Provincial Relations (Rowell-Sirois), Book II, Recommendations, p. 24.

20. That central governments through fiscal or treasury and central bank policy have it within their power largely to determine interest rates is now widely accepted by students of the problem, and therefore uneconomical high interest rates are not longer necessary.
21. Since post-war reconstruction and with it the problem of unemployment have come to be accepted as national responsibilities[1], the Government of Manitoba may anticipate the co-operation of the Dominion Government in the raising of necessary funds at low interest rates for the farm electrification programme.

#### Recommendations

1. In so far as this will not interfere with the war effort, the Manitoba Power Commission and the Government of Manitoba should inaugurate preliminary surveys, set up detailed plans and make all other preparations required to enable the farm electrification programme to go into action promptly when the war is over.
2. Because of the social and economic significance of farm electrification for the Manitoba economy, the scope of the programme should not depend exclusively upon the volume of unemployment prevailing in the post-war period.
3. The Manitoba Power Commission has planned to bring power to every town, village and hamlet of more than 20 persons and which communities are either not served at all or inadequately served; this part of the post-war programme should be completed in not more than five years, because the network of electrical circuits so developed will become basic for the distribution of energy to the farm lines throughout the province.
4. Meantime, farm electrification should commence at once after the war with a minimum of 1,000 farmers to be connected the first year, and a steadily increasing number in subsequent years, depending upon the experience gained and the state of unemployment prevailing.
5. Since farm electrification can be established only under conditions of maximum economy, farm lines should become an integral part of the Manitoba Power Commission and it is recommended that all terms and conditions of the Manitoba Power Commission Act be made to apply to farm electrification.
6. Line construction should commence first where the largest number of farmers can be supplied with a minimum amount of investment cost, estimated revenues considered.
7. Under the terms of the Manitoba Power Commission Act complete authority is given to provide customers with all necessary wiring, appliances and apparatus at the lowest possible cost. It is recommended that this policy be continued for farm electrification.
8. Since the success of farm electrification is dependent upon securing adequate revenue, and since such revenue is a function of use, every effort should be made to supply the farmers with appliances at minimum cost.

   In view of the disparity between Canadian and United States prices for electrical apparatus and appliances, it is recommended that the Government of Manitoba use its influence at Ottawa to have the duties so adjusted that prices in Canada shall be nearer to those in the United States.

   This is in line with the declared policy of Article IV of the Atlantic Charter and Article VII of the Lend-Lease Agreement signed February 23, 1942, and the exchange of notes between Canada and the United States in December, 1942, the free flow of international trade being the prime objective.

   The Commission is of the opinion that such adjustment of the tariffs would also be of benefit to the Canadian manufacturers, since they would then have the benefit of the mass market, and that instead of decreasing employment in manufacturing it would have the opposite effect.
9. Farm lines should not be built in any area unless there is adequate assurance that there will be sufficient return on the capital investment.
10. A rate schedule should be adopted which gives the farmer every inducement to use the maximum amount of energy and should conform as closely as possible with the uniform standard rates for towns and villages.
11. Farmers in local areas should be organized into local advisory and promotional bodies in order to facilitate the signing up of as nearly 100% of the farmers in the community as possible, engage in load building and educational work on the uses of electricity, safety measures, and patrol activities.
12. The farmers should be required to read their own meters, bill themselves and in this and all other ways possible help to reduce the operating costs of the system.
13. In the less densely settled area, and where it is practical and essential, the farmers themselves should be organized into self-help bodies under which they would receive credit or cash for procuring materials and doing other work in order to reduce the cost of the lines and to enable the farmers to build up a fund for the purchase of wiring materials and appliances.
14. Farm lines should be built wherever possible on private rights-of-way so as to avoid future costs which might be involved in road widening and such rights-of-way should be made available to the Manitoba Power Commission by the farmers free of cost.
15. The Commission has investigated the feasibility of a plan for the more economical operation of the present system of generating, transmitting, and distributing electricity in Manitoba. Substantial savings can only be made by eliminating as far as possible the duplication of property and operating staffs of the three major electric utilities, the Winnipeg Electric Company, the City of Winnipeg Hydro Electric System and the Manitoba Power Commission.

    There is no doubt that large savings can ultimately be made particularly in the capital investment in, and fixed charges on properties, but these cannot be accurately determined until the final plan of reorganization is fixed upon.

    The Commission was not empowered to conduct negotiations in an effort to bring the said utilities together in order to work out a plan of reorganization and is of the opinion that in any event the present time is not opportune for such negotiations.

    If it is desired that a complete investigation be made of this matter, we recommend that it be carried out by a body whose membership is not identified with the management of any of the utilities concerned.

---

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## WOOD AS A SUBSTITUTE FOR METAL

JOSEPH L. STEARNS
*National Lumber Manufacturers Association*

Conversion to wood of products previously manufactured of metal will release to war service more than five million tons of metal during 1943, technicians of the National Lumber Manufacturers Association, Washington, D.C., estimate. This figure is compiled from reports of WPB, Army, Navy, Maritime Commission, Forest Service, Census Bureau, and industrial concerns.

Statisticians of the association find that, on the average, it is possible to save one ton of steel by the use of one thousand board feet of lumber. On some items, such as cast iron, it is possible to save more; on others, such as sheet metal, the saving is smaller.

The volume of saving is comparable to the 1942 figure, but there is a definite difference in the use of the material. Last year wood went to bat for metal in construction. Now the cantonment building programme, the shipyards, and the factories are all but complete. The industrial effort has shifted from construction to production. Wood is being used this year to replace metal in a long list of civilian products that have been largely curtailed or discontinued, as well as being diverted into essential war uses other than construction.

Expenditures for construction in 1942 reached an all-time high of $6,170,000,000. Had it not been that timber replaced structural steel so extensively, a building programme of this magnitude would have been impossible. The savings of structural steel in roof trusses alone through the use of timber connector construction has been estimated by the Timber Engineering Company at 400,000 tons.

Manufacture of some 2,200 metal items has been stopped entirely. Many of these are still being produced—in wood. Wood is performing some jobs it never has done before, but in many instances the use of wood is not historically new, although its use is new in modern industrial practice.

For example, when the manufacture of metal furniture was stopped, that portion of the furniture industry reverted to wood. That was followed shortly by the estoppal of metal springs for upholstered furniture, and the industry met the crisis with a new development—wood springs. These are now fairly well standardized and, according to all accounts, are just as comfortable and substantial as the metal springs they supplanted. The shift back to wood furniture was not too difficult, because the bulk of metal had been finished to simulate wood grain anyhow.

The range of consumer goods in metal that have been estopped or seriously curtailed and have reverted to wood in whole or in part, is surprising: mechanical refrigerators, caskets and vaults, door and window screens, mirror and picture frames, certain farm implements, beauty shop equipment, children's vehicles, athletic equipment, lawn mowers, slot vending machines, radios, carpet sweepers, weather strip, gutters and downspouts, bottle caps, pocket books, atomizers, bathtubs, jelly molds.

Thus, wood is pulling an extra oar on the home front, although the pressure for direct war service has not relaxed. While the shipyards and cantonments are built, demands for wood continue to tax the utmost efforts of the forest industries. Probably the greatest single consumer of lumber this year is the box and crate industry. Nearly one-third of the total 1943 production of lumber, or 10,500,000,000 board feet, will be used for boxes and crates for shipment of military supplies, according to the best authority.

## GLASS FOR PRECISION GAGES

By COL. H. B. HAMBLETON
*Chief of Gage Section, U.S. Ordnance Department*
From *Mechanical Engineering* (NEW YORK) APRIL, 1943

In an effort to contribute to the programme for the conservation of steel, the Ordnance Department has initiated a development project of glass gages. The responsibility for the development project has been assigned to Frankford Arsenal. This arsenal, with the aid of the most progressive glass manufacturers in the country, has formulated tentative specifications and provisional standard drawings of glass gages. These standards, in so far as is possible, will be dimensionally the same as those of the American gage design standard, shown in publication CS8-43 of the National Bureau of Standards. This standardization of steel-gage design was formulated and completed prior to this war, and has insured complete co-ordination and interchangeability of all steel gages manufactured.

Up to this time, Frankford Arsenal has procured from the Corning Glass Works, Corning, N.Y.; Fischer and Porter Company, Hartborough, Penn.; The A. H. Heisey Company, Newark, Ohio; T. C. Wheaton Company, Millville, N.J.; Specialty Glass Company, Newfield, N.J.; and the Blue Ridge Glass Corporation, Kingsport, Tenn., a limited number of glass gages for experimental and development purposes. One of these gages, similar to the sample displayed, had been used in the Frankford Arsenal cartridge-case shop for the inspection of 57-mm cartridge cases. This gage performed 260,000 gaging operations before it was worn out. For the first 160,000 operations, the wear was only 0.00005 in. A steel gage for this duty normally has a life of 60 to 70 thousand operations. The Ordnance Department now has several glass gages under test on brass gears for mechanical time fuzes, steel parts for other fuzes, and cartridge-case inspection previously referred to. The results to date indicate that glass gages are giving a very satisfactory performance and, in some cases, show very definite advantages over steel gages, some of which are as follows:

1. Many greasings and degreasings are eliminated, since no question of rust is involved.

*Official OWI Photo by Hollem*

**Glass gages of various types are replacing steel gages at Frankford arsenal. (*Left, top to bottom:* double-end plug gage, "Go" plug gage, ring gage. *Right, top to bottom:* "Not Go" plug gage, double-end solid-handle plug gage, double-end taperlock, standard-handle plug gage.)**

2. Glass gages are much easier in handling inasmuch as they are lighter than steel.

3. Glass gages afford visibility in inspection which is not always possible with steel.

4. Glass will more or less teach the inspectors to have respect for handling gages.

5. Most important at this time is the saving of tool steel for other uses.

6. Perspiration of the hands of the inspectors has no corrosive effect on the glass gage as it does on steel.

7. When the component is very near the size of the gage, there is less tendency for the component to seize or gall in or on the gage.

8. Scratches on glass do not raise burrs or change the effective size of the gage.

9. The thermal conductivity of glass is less than steel, and therefore heat transferred from the hands of the inspectors to the gage will not affect the gaging dimensions.

10. Glass appears to have abrasive-resisting qualities equal to or better than steel in many gaging applications.

11. The comparative weights of glass and steel are around 160 and 485 lb. per cu. ft., respectively. The lighter weight of glass is obviously an advantage in the use of gages.

In the design of standard blanks, great care has been taken to parallel the American gage design standard, in order that handles will be interchangeable and the possible resistance to the use of glass gages will be minimized. The main deviation from steel is a radius which is required on glass gages to keep them from chipping.

Contrary to common thought it is not believed that much change will be required, if any, in the standard machines for grinding glass plug gages. There has been a great deal of discussion regarding possible changes required in the standard grinders for steel, when grinding glass blanks. This can now be discounted. The Wheaton Company has used a Norton 6-in. x 18-in. type C, having a wheel speed of approximately 1,190 rpm., using a 20-in. x 1-in. x 12-in. wheel with approximately 6,000 surface feet per minute, which we understand is a common speed for most cylindrical grinders. By using silicon-carbide wheels of 60-80 grit, they were able to rough to within 0.003-0.004 in. of finish size in a short time. They recommend a rather fast table traverse speed in this operation with a slow work speed.

*Official OWI Photo*

**This gage checked 160,000 cases without wear. (Presumed life of a steel gage is 50,000 cases.)**

After changing to a 180-grit silicon-carbide wheel using very slow table traverse speed and a slow work speed, they were able to obtain a beautiful finish on the surface. The blank used was approximately 1 in. in diameter.

It is interesting to note that during the last four or five passes of the wheel, without changing the wheel setting, they turned off the coolant and secured a polished surface. In regard to the coolant required for grinding glass, they have found from experience that plain water is all that is required. However, it is necessary to provide some agent to prevent rust on the machine; for this, they have used International Chemical Company's No. 219 oil, diluted 25 to 1.

In using the taper lock handle, it will not be necessary to grind the taper on the glass shank as this can be molded close enough to give the required fit.

It is entirely possible to grind centres in the ends of plugs, using a tungsten-carbide drill and lapping with a centre lapping stick, such as a Norton 60 Q ½ x 2. Blanks will be supplied by glassmakers with the centre ground in. The question has been asked many times, whether the molded male centres could be supplied on the blank; this is impractical to do in glass molding procedure.

## SHIP-BORNE AIRCRAFT

From *The Engineer*, (London, Eng.), April 9, 1943

The warning recently given to the public by Lord Brabazon that one must never in any circumstances that exist to-day expect seaborne aircraft to compete with those based on shore led to an interesting *Times* correspondence. Among those who took part were Lord Sempill and Admiral the Earl of Cork and Orrey. One naturally attends to any point of view which Lord Brabazon expresses on such subject, as he was one of the first to fly, holding, indeed, we believe, the first pilot's certificate issued in this country, besides having filled the office of President of the Royal Aeronautical Society. Nevertheless, his view on this occasion met with some opposition, for, in the present intense phase of the war, such importance attaches to aircraft which patrol the seas that strongly held opinions are inevitable. One anonymous pilot goes so far as to deny entirely any lower fighting ability in shipborne aircraft, holding that it is practicable to land on the deck of a modern carrier any single-engined aircraft at present in the Air Force, provided only that it first undergoes some slight modification. Lord Brabazon's view, however, receives support from Lord Sempill, also with many years of actual flying, with the proviso that with prospective technical improvements, both in the aircraft carriers themselves and in the aircraft using them, the position is changing; but he thinks aircraft carriers necessary to fill the much-discussed "gap" in the Atlantic convoy route which is not at present covered by the shore-based aircraft which operate from the two ends.

This discussion raises two important points—the comparative technical excellence of shipborne aircraft, and the effectiveness of the operational range of those based on land. As regards the former point, one can hardly do otherwise than admit that so long as shipborne aircraft have to be made with folding wings, they must be at a disadvantage in structural weight economy, and therefore in their flying range and perhaps speed. Owing to the efficiency of the modern catapult, there need certainly be no difficulty about their taking off from the deck nor need there be any in the landing on carriers, having regard to the various aids now available. We know, for instance, of the splendid *Hurricane* fighters which can be catapulted even from the decks of merchant ships. In these cases folding wings are not needed. These aircraft form part of the Merchant Ship Fighter Unit which has been in operation so successfully for the last eighteen months. But if one is meticulous, one must admit the accuracy at the present time of Lord Brabazon's statement, though the margin of difference between the two types, especially if folding wings can be avoided, is small, and will almost assuredly grow less as the years pass. In the protection of Atlantic convoys an invariably high fighting performance can hardly be called for; the most useful aircraft must be those with good endurance and sufficient bomb-carrying capacity. With a sufficient supply of such aircraft, however provided, the "gap" in the Atlantic is capable of being closed. Submarines hate the sight of aircraft, and the effect of their presence is always markedly good. Whether this object could now or hereafter be equally achieved from airfields at either end raises large issues. The Admiral, in supporting Lord Sempill's views, claims the existence of vast expanses of ocean "far beyond the range of the aircraft of to-day." If this means that aircraft cannot cross in one flight the whole width of the Pacific Ocean, one must admit its truth, leaving aside, of course, such record-breaking efforts as that of the 7,159-mile flight in the year before the war of the *Wellesley* aeroplanes designed by Mr. Wallis. But if one thinks rather of the Atlantic, with its current submarine menace, one cannot but recall the many hundreds of aeroplanes which have flown right across during the present war. Here there cannot truly be said to be any "gap" that could not be closed, given sufficient aircraft, even of types already available. No doubt there is a wide demand for aircraft with this kind of capacity; since if they can do that much, they can do much else, and there is much to be done. But our own "High Command" is aware of the facts and the allocation of aircraft must be left to its decision.

The filling of the Atlantic "gap" can hardly be regarded as a difficulty which is primarily technical, whilst, on the other point, carrier-borne aircraft can be designed to be but little below the fighting capacity of land-based aircraft; moreover, such design difficulty as there may be is surely in the main attributable to the need conform to the design of existing carriers and hardly arises at all in respect of the aircraft itself.

## VARIABLE-PITCH PROPELLERS

From *Trade and Engineering*, (London, Eng.), April, 1943

Within the next couple of months the first large ocean-going ship to be equipped with a variable-pitch propeller is to be launched. There are numerous vessels afloat, up to about 1,500 tons deadweight, in which such propellers are used, but so far they have been confined to coasters, harbour launches, fishing vessels, and tugs. Last year, however, the Johnson Line, of Stockholm, decided to order a large, fast cargo motor-liner to be fitted with the Kamewa type of variable-pitch propeller.

The new vessel, which is being built in the Lindholmen yard at Gothenburg, is of about 7,400 tons gross. Two Götaverken engines of 3,500 b.h.p. are to be installed, and the service speed will be over 16 knots. The engines run at constant speed for all manoeuvres. Movement of the blades for reversal or for variation of pitch is effected by an oil-operated servo motor regulated from the bridge. The mechanism is fixed within the hub of the propeller, and this feature is claimed to represent one of the main advantages.

It remains to be seen whether the undoubted advantage of the variable-pitch propeller for many classes of relatively small ships will be repeated in a large ocean-going vessel maintaining constant speed for days on end. The pitch of the propeller can be set to give maximum propulsive efficiency under all conditions of loading and weather, and cylinder liner wear in the engines should be reduced, since only one starting operation is needed, no matter how many manoeuvres have to be carried out. The most commonly accepted theory concerning liner wear is that it is largely dependent upon the number of starts which the engine has to make and not so much upon continuous service at constant loading. As the engines need no reversing mechanism, their design, construction, and upkeep are simplified, and, generally speaking, the work of the engineers should be eased by the use of the system.

SAVING CRITICAL MATERIALS IN GUN MANUFACTURE
(The finished anti-aircraft-gun part held by a worker in the Pontiac Plant of General Motors weighs 6 lb. Formerly it was machined from a 56-lb. solid steel forging, which resulted in the 50 lb. scrap shown in the left foreground. Pontiac engineers replaced the forging with a 14-lb. piece of steel tubing, welded to a forged base. Now only 8 lb. of scrap, shown in the small pile at the right, need be machined away to produce the finished part.)

## WELDING IN SHIPBUILDING

From *The Engineer*, (London, Eng.), April 9, 1943

Probably to most people the very wide use of welding in shipbuilding under the present programme of an emergency ship construction is the most arresting feature of what is now being done in American shipyards. Upon this subject the 1941 report to Congress made by the U.S. Maritime Commission may properly be cited here: "The most important development in speeding up ship construction has been the replacement of the riveter by the welder. The use of welding affects many sides of shipbuilding activity. In the first place, welders can be trained far more rapidly and can perform their task without assistants. This is of particular importance in the present era of tremendous expansion of shipbuilding activity, in which the dilution of shipbuilding skill is of vital importance. In the second place, the time consumed by each vessel on a launching way is greatly curtailed under modern conditions by the use of welding, which permits the assembling and welding of large sections of the ship in the various shops before being fitted to the frame of the vessel. In the third place, from the point of view of economy in operation, the all-welded ship permits of a saving in steel due to the absence of overlapping plates, thus increasing the cargo-carrying capacity of the vessel." Back in 1940 Rear-Admiral Howard L. Vickery, U.S.N., vice-chairman of the U.S. Maritime Commission, made this announcement regarding the adoption of welding by many of the shipyards then engaged in building vessels for the commission under that organization's peacetime, long-range programme: "This method of joining the plates and shapes that enter into the hull structure is rapidly replacing riveting. Increased joint efficiencies, with the same scantling or dimensions of plates or bars, ensure a stronger vessel."

The substitution of welding for the older practice of riveting not only affects the ship structure, but it also has its influence on the shipyards themselves. Regarding this phase of the matter, we have the authoritative statement of H. Gerrish Smith, for years a member of the Construction Corps of the United States Navy. Mr. Smith has said: "The new technique of welding in shipbuilding has influenced the character of new shipyard lay-outs (those especially created for the building of 'Liberty' ships). The most effective and expeditious welding is what is known as 'down welding,' eliminating wherever practicable overhead welding work. Down welding permits sub-assembly and welding of large sections on the ground (not on the ways). This necessitates large assembly areas, which have been provided in new shipyard lay-out. This, in turn, necessitates cranes of large lifting capacity to hoist the assembled pieces into place on the ships (while on the ways). This permits the performance of a much greater percentage of the work on the ground, and reduces the number of men required on board ship in congested spaces. All this helps speed construction."

"The advantages of sub-assembly have long been well known. But previously they have not been available to us in general because of the very limited capacities of the cranes in the older shipyards. With the great number of these cranes of large lifting capacity which will be available after the war, it is certain that sub-assembly in the shipbuilding industry will continue as an established practice. Building ships in quantity is a shipbuilders' dream, which has never become true in the peacetime of the past. For, except in times of emergency, like the present, large numbers of ships of the same design are not required by a single operator."

Undoubtedly, much of the work now being done in American shipyards represents a sharp break away from the older traditions of the industry, but this was called for by the emergency. Standardization of design has been of fundamental importance in shortening time of construction and in contributing towards economy of effort in many directions. Work on the entire undertaking can now go forward systematically, not alone in the building of the ships, *per se*, but in the manufacture of their propelling engines and their auxiliaries, as well as in turning out all other necessary equipment. As has been said: "Thousands of workers can now build a dozen ships at once, instead of a few hundred men being concentrated on a single hull. Intelligent planning of work and the handling of men and materials in an efficient and time-saving manner are enabling America to multiply her ship production output steadily."

It should be evident that production in American shipyards is still in a stage of expansion, and for that reason most figures and some of the facts will change from month to month during 1943, and for the better. Whether or not this should promote further astonishment, it should at least give comfort to all the peoples of the United Nations. How the records made have been achieved has thus recently been explained by Admiral Land: "Several factors have made possible the production records of American shipyards. Most important is the close co-operation between labour and management, and their willingness not only to adopt new methods and ideas, but also to pledge themselves to eliminate work slowdowns or stoppages. The morale in most of our shipyards has been excellent and has an important part in obtaining great production. Other contributory items to the great records are: extensive prefabrication or the building of large sections of a ship before they are carried to the shipways, adaptation of assembly line methods, supported by a flow of materials procured through central purchasing; increased use of welding instead of riveting, which results in conserving man-power, faster construction, a saving in steel, and a stronger ship structure; standardization of design and no changes.

"Americans can be proud of the more than half million men and women employed in building craft for the Merchant Marine. In addition, there are approximately a million working in factories throughout the country, producing parts, materials, and supplies for ships."

The Maritime Commission has shipyards in twenty-four States on the Atlantic, Pacific, and Gulf coasts, as well as on the Great Lakes; and more than 1,200 factories in thirty-two States are producing material for ships building in thirty-three shipyards.

## AN ENGINEERS' PEACE

Robert Summers Stockton, m.e.i.c.
*Retired superintendent operation and maintenance, Western Section Irrigation System, Canadian Pacific Railway Company, Department of Natural Resources*

Engineers are urged to take an interest in civic duties outside their professional responsibilities.

The world needs the analytical and scientific approach to the problems of war and peace, so that useful facts may be accumulated and reasonable and impartial solutions arrived at. There follows the urgent need, in democratic countries, for the spreading far and wide of sound economic principles, in order to head off the alluring but impracticable promises of demagogues or idealists. In the world war now in progress, when unconditional surrender has been forced on the Axis Powers, and subjugated countries liberated, there will remain many important details and adjustments to be attended to.

The most practical way to carry on would be simply to continue the present co-operation of the Allied Nations with the responsibility for the enforcement of proper decisions resting with the armed forces of these nations.

As pointed out by ex-president Herbert Hoover, no attempts should be made for final settlements, until all the facts are collected and studied. An engineer does not start work until surveys have been made and plans prepared. Political problems can not be properly solved without first compiling all the known and observable facts and then deducing a solution of the problem.

It is probable that the Allied Nations will eventually perfect some definite organization on the form of a council of nations, backed up by sufficient force to insure prompt attention to necessary regulations and decisions. Peace can be guaranteed by overwhelming power, but not by balance of power nor appeasement.

The Allied Nations therefore should maintain their armies, navies and air power on a sufficiently generous scale to insure peace and enforce the conditions that are agreed upon as right and necessary. Only the future can determine whether it will ever be safe to disarm, except for an international police force. General disarmament is a goal to be worked for, but we cannot expect it to materialize for many years. In the meantime each country should maintain its natural defences and bases for its army, navy and airforce, organized for defence and not for aggression.

The Allied Nations should begin by arraigning for trial those persons who have been guilty of unnecessary cruelty. They should be punished promptly and without much mercy so that as far as possible justice shall have been rendered for the thousands murdered and starved by the Axis Powers. Further, all the property and valuables taken by the Axis Powers should be as far as possible restored to the original owners or to the country of origin.

The Axis Powers of course should be completely disarmed and then given an opportunity to organize an honest responsible government, with the expectation that they would eventually qualify for full co-operation with the family of nations.

We think that the peace should provide for the freedom of the seas and the freedom of the air over the seas. Each sovereign country should then determine just which airports and cross country air lines could be used by other nations and under what conditions. These rights plus the adoption of reasonably low tariffs by the nations of the world should encourage international trade and travel with accompanying prosperity and natural understanding.

To ensure a peaceful world all peoples must strive for governments whose honour may not be impugned, who keep their engagements and whose actions are honest and straightforward and hence deserving support.

Peace would be promoted by a policy that recognizes the right to peoples heretofore included in colonial empires or possessions to organize their own governments wherever they have evolved to a point where stable government seems feasible. In the meantime, civil rights and liberties should be protected and education and progress encouraged. The aid of the more advanced nations is needed to help develop more backward peoples. There are naturally many small units that cannot properly maintain an independent organization and should be attached to some larger power. There are in fact all gradations from savage tribes to people ready for nationhood.

History shows that it is to the advantage of small nations or units of population to bury their differences and prejudices and unite with others to form large political units, where this can be done without undue loss of local autonomy. Such action would increase their military and economic strength. The outstanding example is presented by the U.S.S.R. with its multiplicity of nationalities and languages, the units of which are now all united in the fight for their country.

All the nations of the Western Hemisphere will be called upon to help feed and rehabilitate the unhappy peoples of Europe and Asia. This should be carried out in a reasonable and business-like manner, remembering that we are not responsible for existing conditions, although anxious to help within our means and where it will be appreciated.

Immigration to Canada should be carefully controlled with emphasis of quality rather than quantity.

The English speaking countries have demonstrated the soundness of their system of free enterprise, which, coupled with our ample natural resources, have produced such a high standard of living. It is essential to preserve this system which provides for the ownership of property and a reward for industry, ability, honesty and thrift in proportion to the exercise of these qualities by the individual or business.

Under this system, government should not be expected to do those things that can be done by private enterprise. But it should be strong enough and impartial enough to regulate organized business, labour and finances so that there will be, as nearly as practicable, a fair division of the wealth produced. Farmers, labour business and accumulated capital should all receive their just and proper share.

Organized business should be prevented from securing monopolies, or making exorbitant profits at the expense of labour or failing to provide for the health and safety of employees.

Organized labour should be prevented from pushing wages to a point where farmers are greatly underpaid and the earnings of capital so reduced that enterprise falters and declines, for this is a direct cause of unemployment and business depression. Farther, organized labour should relinquish those rules which lower efficiency and those which prevent non-union men from working. This means that make-work rules, picketing, the closed shop and the check off system should be abolished. Unions should be made financially responsible under the same rules as apply to corporations. When, owing to world conditions, farmers are forced to sell for less than parity prices, wages, profits and interest rates should be reduced to keep the system in balance. In the past, wages were forced higher and higher by closed unions, the manufacturer passed the increased cost on to the public. The farmers with less money could buy less and less, higher labour costs discouraged building and construction and the vicious circle continued with unemployment widespread. The increased costs of public and private work benefitted only a very small part of the population; the war effort has removed this lack of employment but a huge public debt is being created and excessive taxation is necessary.

When the war is ended, the problems of rehabilitation will be difficult enough under any circumstances but will be doubly so if we fail to adopt a sound and fair economic and financial system. To remedy the defects in our system of government we do not need socialism or any change in fundamentals but simply such reforms as will correct the faults discovered.

## ALCOHOL-GASOLINE BLEND TESTS REPORTED

Alcohol-gasoline blends containing not more than 20 per cent anhydrous ethyl alcohol are satisfactory fuels for modern motor vehicle engines, on the basis of both fuel mileage and accelerating ability.

This was one of the conclusions reached by R. G. Paustian, Research Assistant Professor of Civil Engineering, Iowa State College, upon completion of a comprehensive series of tests designed to measure the mileage and performance characteristics of alcohol-gasoline blends. The results of these tests are reported in Bulletin No. 158 of the Iowa Engineering Experiment Station, "Road Tests of Automobiles Using Alcohol-Gasoline Fuels."

Extensive road tests were conducted with two completely-equipped test cars, which were driven a combined total of more than 23,000 miles. Blended fuels were used in one car and regular gasoline in the other, while operating both cars simultaneously over a 232-mile concrete test route in central Iowa. Simultaneous operation of the test cars eliminated, as far as possible, the effects of wind, temperature and other variable factors. Laboratory tests with small single-cylinder engines supplemented the road tests.

The bulletin reports in detail the performance of alcohol-gasoline blends with respect to fuel mileage, accelerating ability, anti-knock properties and oil consumption, as determined by the road tests. The results of the single-cylinder engine laboratory tests, which were designed to measure crankcase-oil dilution and sludging, corrosion of metals, and carbon formation, are reported.

Single copies of this 56-page bulletin may be obtained without charge from the Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa.

## PINE PLASTIC

Resin and Vegetable Fibres in Newly Announced Material

From *Scientific American*, February, 1943

A new plastic composition, which can replace steel or other metals in many uses, has been developed from vegetable fibres and a resin from Southern pine trees, according to G. R. Stark, vice-president of The Patent and Licensing Corporation. Mr. Stark said that the resin is made only by Hercules Powder Company from the wood of the Southern pine in its naval stores plants in Georgia and Mississippi, and is now available without priorities.

Announcement of the new plastic followed within three months the announcement by Hercules chemists of another plastic, soft ethyl cellulose, found suitable to replace rubber in many articles.

Lightweight but sturdy, these new compositions can be used instead of steel or other metal for many purposes such as structural members, pipe, wall panels, air conditioning ducts, corrugated sheets, and so on.

To make this plastic, the resin-treated fibre is turned out in sheets on standard paper-making machinery. These sheets are hydraulically pressed together to make compositions which are hard, dense, stiff, but not brittle.

## RAMIE ON THE WAY

From *Scientific American*, February, 1943

Textile development, urged on by war requirements, is bringing forward ramie, formerly obtained almost exclusively from China, but now being grown in Florida. This fibre, subjected to scientific study and experiment, is now produced in extremely pliable form, soft, white, and silky. As formerly processed it was durable but not sufficiently flexible for many purposes. Although ramie fiber can be used alone, probable applications of it in the future will be as a blend with other fibres. For example, it is stated that, mixed with wool, ramie gives better wearing qualities and prevents shrinkage when the fabric is laundered or soaked with water.

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

### COMPULSORY LABOUR LEGISLATION AND THE ENGINEER

In the representations which have been made recently at Toronto and Ottawa relative to collective bargaining there are definite indications that the learned and scientific professions are considered by organized labour as a part of its field of operation. As an indication of this policy the following quotation from the *Toronto Telegram* of March 29th, 1943, is submitted. "The labour officials served notice that they could not agree with the clause to exclude from collective bargaining rights such important groups of workers as civic employees, employees of commissions and those of the learned professions."

It is not necessary to take sides on the issue of collective bargaining in order to declare one's belief that a profession should not be controlled by any persons who themselves are not members of the profession. No one would consider handing over to the engineers the control of employment and working conditions for doctors, dentists, chemists, architects and so on. It would be at least equally inconsistent to hand over to trade unions the control of these conditions for any or all of the professions in Canada.

In the negotiations for collective bargaining legislation in Ontario, trades union officials expressed themselves definitely as objecting to the exclusion of the professions from the proposals, and at one advanced stage in the preparation of the legislation, sufficient pressure was applied that the clause excluding the professions was withdrawn from the bill. Only the sudden application of similar pressure from the professional groups caused the exclusion clause to be re-inserted.

Profiting by the Ontario experience, a group of representatives of the professions of engineering, architecture and

***From left to right:* M. Barry Watson, Dr. Léon Lortie, W. P. Dobson, F. J. Hambly, A. D. Ross, L. Austin Wright, G. MacL. Pitts**

chemistry met in Montreal at Institute Headquarters to discuss the advisability or necessity of making representations to the National War Labour Board at Ottawa, to which body recommendations for national collective bargaining had already been made by organized labour.

The discussion led to a brief being prepared and an appointment with the Board for May 26th. The delegation presenting this brief represented the Canadian Institute of Chemistry, the Royal Architectural Institute of Canada, the Canadian Institute of Mining and Metallurgy, the Dominion Council of Professional Engineers, the Association of Professional Engineers of Ontario, the Corporation of Professional Engineers of Quebec and The Engineering Institute of Canada. The Board, made up of Mr. Justice McTague, chairman, and Messrs. J. L. Cohen and Léon Lalande, gave the delegation an excellent hearing. The brief follows:

"National War Labour Board, Ottawa, Ontario.

"Gentlemen:

"Officers of the undersigned Dominion-wide professional organizations, whose combined membership totals over 15,000, have followed with interest the sittings of the National War Labour Board and the submissions which have been presented by representatives of employers and organized labour bearing on labour relations throughout Canada.

"It has been noted that the field of the professional man, although a large and important section of all employment in Canada, has not yet been brought to your attention. Therefore, the committee representing this group is pleased to have this opportunity to place before you the professional point of view.

"Since most engineers, chemists and architects are employees and at the same time are recognized as members of learned professions, they feel that they may be inadvertently involved in disadvantageous employer-employee relationships and in compulsory collective bargaining legislation. In fact, labour representatives in their recent presentations to the Ontario Legislature and before your Board have, by implication, indicated that the learned and scientific professions would be included in such legislation.

"*The national organizations represented by this committee are unanimously and unalterably opposed to the forcible inclusion of professional men in any compulsory collective bargaining legislation.*

"An important fact which we would emphasize is that these professions are already controlled by provincial legislation which has been enacted for that purpose.

"Similar conditions exist in the United States and, in the case of the Shell Development Company and the International Federation of Architects, Engineers, Chemists and Technicians, the National Labour Relations Board of the United States ruled that architects, engineers and chemists cannot be forced into a heterogeneous bargaining unit sought by a labour union in its negotiations with an employer unless a majority of the professional employees, through a vote confined to the professional group, express their desire to be included. (Case No. R-3245.)

"The committee respectfully requests that these representations be favourably considered by the members of your Board or other government bodies when recommending or preparing labour legislation. The committee will be pleased to submit any additional information that may be desired, or to assist in any other way that the Board may wish."

Respectfully submitted,

Canadian Institute of Chemistry:
Léon Lortie, *President*
F. J. Hambly, *Chairman, Legislation Committee*

Canadian Institute of Mining and Metallurgy:
R. A. Bryce, *President*

The Engineering Institute of Canada:
K. M. Cameron, *President*

Royal Architectural Institute of Canada:
Gordon MacL. Pitts, *President*

Dominion Council of Professional Engineers:
W. P. Dobson, *President*
M. Barry Watson, *Secretary*.

Corporation of Professional Engineers of Canada:
A. D. Ross, *Secretary*.

## JOINT MEETING

Arrangements have just been completed for a joint meeting this fall with The American Society of Mechanical Engineers to be held at Toronto on September 30th and October 1st. The programme details have not been determined, but it has been agreed that all papers and discussions will relate to phases of war production and will be divided between members of both societies.

It is expected that in the next number of the *Journal* the programme can be given in detail. In the meantime it is recommended that members make some note of the dates so that personal plans can be built around them.

## ENGINEERS ARE NOT ADMINISTRATORS

So says a weekly publication in Toronto! It is difficult to imagine these days how any person who has access to the pages of a modern publication would know so little about modern administration.

The following letter was written by the general secretary in the hope that the editor of the erring publication might care to correct the misstatement, but after two months of waiting no correction has appeared. Hence the letter is published herewith for the attention of our members.

The Editor, March 31st, 1943.
"Saturday Night," Toronto, Ontario.
Dear Sir:

Engineers, as well as other readers of your paper, must have been startled by the statement contained in your issue of February 6th, that "Not often is a topflight engineer a good administrator." This appeared in a biographical article about Mr. Henry Borden. The remark itself was made as a complimentary aside in referring to the Honourable C. D. Howe.

The author of this article, Corolyn Cox, must be pretty well out of touch with administrators, because anyone with even a reading acquaintanceship with the heads of industry to-day would realize that there are more administrators in the engineering profession than in any other single professional or business group. My object in drawing your attention to it is that I believe, in justice to the engineer, you should examine the Cox statement, and if you find it to be incorrect, do something about it.

For instance, does Corolyn Cox realize that the administrative heads of the Canadian army are practically all engineers? Let's start with Lieut.-Gen. A. G. L. McNaughton, chief of the First Canadian Army; then we have Lieut.-Gen. K. Stuart, Chief of General Staff; Lieut.-Gen. H. F. G. Letson, Adjutant General, and Major General J. P. MacKenzie, Quartermaster General.

Imagine the surprise of the following companies and businesses to find out that engineers are not good administrators—The Royal Bank of Canada, of which Sir Herbert Holt was for so many years the chief administrator; the Banque Canadienne Nationale, where Beaudry Leman is now president; the Northern Electric Company, with its president, Paul Sise; Consolidated Mining & Smelting Co., where S. G. Blaylock is president; Research Enterprises, (Col. W. E. Phillips, president); Otis-Fensom Elevator Co., (W. D. Black, president); Bathurst Power & Paper Co., (R. L. Weldon, president); Consolidated Paper Co., (L. J. Belnap, president); Shawinigan Water & Power Co., (for years administered by the late Julian C. Smith); Montreal Light, Heat & Power Cons., (R. C. A. Henry, vice-president); the National Research Council, (C. J. Mackenzie, acting president): The Hydro Electric Power Commission of Ontario, (T. H. Hogg, chairman); Anglo Canadian Pulp and Paper Mills, (E. M. Little, general manager, and ex-director of National Selective Service).

In the United States, we think immediately of such engineers as Donald Nelson, W. L. Batt, Herbert Hoover, and so on. The lists would be inexhaustible if we had time to really go into it, but those few names should refute the insinuations of your contributor.

Outside of the political field, engineers will continue to be the chief administrators in most countries of the world. Industrial development is dependent upon them, and it is natural that, in the future, more and more enterprises will be managed by them, as opportunities are developed.

Yours sincerely,

L. AUSTIN WRIGHT,
General Secretary.

## COMMITTEE ON ENGINEERING FEATURES OF CIVIL DEFENCE

There has been issued to all members of this committee and to the chairmen of branches which have not yet set up branch committees, information supplied by Chairman W. P. Brereton of the Winnipeg Branch Committee relative to the organization for Manitoba of a Committee for Civil Defence, and the relationship of the Winnipeg Branch Committee and of the 10th (R) District Engineers, R.C.E. to this organization, and relative to instructions and training given to this Reserve Army Engineer Unit in connection with public utilities in the event of their being damaged by enemy action.

There has been issued to the same addressees copies of eight lectures prepared by Lieut. Col. T. G. Tyrer, chairman of the Saskatchewan Branch Committee, at the request of the Saskatchewan Provincial Defence Committee, relative to aerial bombing and its effects, and supplied to this committee by Col. Tyrer as information.

The Canadian Engineering Standards Association has issued CESA/ARP No. 505, Specification for Blackout Requirements for Highway Movements, and Secretary McCaffrey has very kindly supplied this committee with a copy. All members of this committee have been notified of the existence of this specification.

Mr. Pitts' Sub-Committee dealing with the protection of buildings and the personnel and equipment in them has noted that the Office of Civilian Defence (U.S.) recommends, relative to domestic gas at the time of an air raid, that the gas *be not shut off*, and that the A.R.P. (Canada) recommendation is that the gas *be shut off* from the building. At the request of this sub-committee the matter is now under correspondence between the main committee and Dr. Manion with a view to clarifying the situation.

President Cameron has been advised verbally by the Hon. C. D. Howe that the matters referred to in the joint submission of the E.I.C., R.A.I.C. and C.C.A. to the Prime Minister last November have again been called definitely to the attention of the War Committee of the Cabinet.

## WARTIME TRAFFIC ADJUSTMENT

Anyone who has tried recently to travel by rail or bus over a weekend will realize the wisdom of the arrangement proposed in the following letter. It should be an easy matter for employers to arrange vacation schedules in such a way that employees may avoid the devastating congestion that now prevails from Friday night to Monday night.

The letter is presented herewith on instruction of Council:

WARTIME INDUSTRIES CONTROL BOARD

Ottawa, Canada,
The Engineering Institute of Canada, May 4, 1943.
2050 Mansfield Street, Montreal, Que.
Dear Sirs:

On May 27, 1942, a circular letter was issued to employers of labour, including Insurance Companies, Banks, Departmental Stores, etc., in which an earnest request was made that in order to prevent congestion of common carrier facilities (bus, rail and water) and to ensure a maximum available supply of equipment for essential travel, that directions be issued that annual leaves or vacations should be scheduled to start on Tuesdays, Wednesdays or Thursdays and to terminate so that returning travel would occur on Tuesdays, Wednesdays or Thursdays of each week.

It was our further suggestion that leaves or vacations be scheduled throughout the twelve months of the year, taking into consideration, of course, special cases where vacations during the winter would be a hardship. This suggestion should prevent concentration of vacation leaves during the months of July and August.

It is our desire to go further this year and request you to arrange your holiday leaves in accordance with the above request and we trust you will co-operate by so doing.

It would be much appreciated if you would communicate promptly with your Branches or Member Organizations, if any, in support of this programme.

Undoubtedly Canadian business firms are anxious and willing to assist the carriers so that motive power and equipment can be effectively utilized to carry needed war supplies to the various battlefronts, and to enable the troops and the army personnel to be carried on both duty and leave. We trust, therefore, that we will have your active co-operation in carrying out this request.

Yours truly,

| | |
|---|---|
| G. S. Gray, | T. C. Lockwood, |
| Transit Controller, | Transport Controller, |
| Toronto. | Montreal. |

## WASHINGTON LETTER

Last month's letter dealt in a general way with a recent visit to Australia and intimated that our notes on Australian war industries would be put in shape and permission sought to publish them in the *Journal*. It now appears that these notes will run to a greater length than the space alloted to the Washington Letters and, furthermore, permission for their publication has not yet come to hand. Therefore, in a recent conversation which I had with the secretary, it was decided to hold these notes in abeyance in the hope that it may be possible for them to appear *in extenso* in the very near future.

One of the interesting items on my programme during the last month was a trip to Montreal to attend a meeting of American, British and Canadian authorities. The purpose of the meeting was to discuss ways and means of collecting and disseminating the latest improvements in war production techniques and the latest measures of conservation and substitution. The conference was held under the direction of Mr. C. B. Stenning, Chairman of the Conservation Committee of the Department of Munitions and Supply. On the British side, the main production branches of the Department of Munitions and Supply and the Material Controllers were represented. The British and Canadian Admiralty, the Inspection Board of the United Kingdom and Canada, the Australian Government and the War Industries Control Board were also represented. On the American side, there were three representatives from the U.S. Army, two from the U.S. Navy, one from the Maritime Commission and two from the War Production Board. Mr. Hilton Wilby, the Canadian representative on the Conservation Division of the War Production Board, made arrangements at the Washington end and the meetings were held under the joint chairmanship of Mr. Stenning and Col. Butterworth, who is attached to the United States Headquarters Service, as Chief of the Conservation Branch of the Resources and Production Division. The Executive Director of the United States section of the Joint U.S.-Canadian War Production Committee also attended the meetings.

One of the first items on the agenda was a visit to the Conservation Exhibition, which was prepared under the direction of Mr. Stenning's Committee. This exhibition sets out actual examples from Canadian war plants of improvements in manufacturing technique, substitutions of less critical materials and alterations in design. Each exhibit has a history card explaining the alteration in technique or material and the resultant saving in both material and man-hours. The dollar savings on the items included in the exhibition amounted to over $150,000,000 a year. This exhibition was tangible evidence of the pooling of all the ideas and advances made by Canadian manufacturers.

There are similar types of exhibits now on display in several of the Government Agencies in Washington but they do not cover the whole range of war production nor are they subject to the coordination of a National Committee, as is the Canadian case. Inclusion in the exhibit of the case history giving savings of material, man-hours and dollars is also unique to the Canadian exhibition. The Canadian Committee has gone even farther and has prepared cards on which the significant information of each particular saving or operation is recorded. One of the main items which came under discussion during the actual meetings was the form of these cards, the most appropriate method for their distribution, the manner in which they should be issued and the question of keeping them up to date. Some thought was also given to the preparation of similar cards by the various American authorities.

It was also suggested by several of the U.S. members that consideration be given to the possibility of bringing the Canadian Conservation Exhibit to Washington. It was not possible to see whether this suggestion would be feasible or not but it does tend to highlight the general fact of Canadian leadership in this as well as in so many other wartime endeavours.

After the general discussion, the meeting broke up into small sub-committees for more detailed discussions. The two-day conference also included a lunch tendered by the Manufacturers Association and arrangements were made for representatives to visit a number of the war plants in and around Montreal.

Production in the United States is at present going through an interesting phase of adjustment in which the tendency appears to be a reversion of production capacity from war to civilian purposes. A superficial view might be disquietening but the actual facts behind this phenomenon are encouraging rather than discouraging. In the first place, it looks as though, in certain phases of our war requirements at least, we are not going to need quite as much as was originally estimated. Another factor is that war plants have gone into production faster than was expected and that they are exceeding the original production estimates. The third factor is probably to be found in the recent report of the Office of War Information survey of over 60,000 small plants. A drive has been in progress for some time to bring small plants into the war production picture and the O.W.I. survey indicates a rise of about 20 per cent in the production of small plants—a small plant being defined as one of not more than 135 wage earners. A further contributing factor seems to be a belief that previous war production plans would have eventually eaten into the civilian supply programme to a dangerous extent and it is important that an adjustment of any such tendency should be undertaken as early as possible. The new Facilities Review Committee of the War Production Board will assist in administering the recently announced cut-back of munition plant projects and the obvious intention to strengthen the hand of the Office of Civilian Supply is another important factor in this adjustment. It may well be also that labour and man power problems will be involved to a considerable extent.

Another trend in the direction of events is contained in the recent statement of Gen. Somervell, Chief of the Army Services of Supply, to the effect that the battle of production is passed and that we are now engaged in the battle of distribution. The basis for this fact, of course, is the shipping position and the startling figures which have recently been quoted regarding the amount of shipping involved in a major military operation, such as the landing of the North African expedition in which it is estimated that between seven to ten tons of equipment are required for each member of an expeditionary force and that three to eight tons a month must follow each man, depending on the locale and conditions of combat. In this regard the success of the shipbuilding programme in 1942 and the fact that the American programme confidently aims at more than double the 1942 record are very encouraging, as is also the fact that some significant advances in the technique of anti-submarine warfare appear to be implicit in the remarks which Mr. Churchill made on the subject in his recent speech to Congress.

There are many other items of interest round Washington these days but it is too early to be able to say anything about them. There is a very important Food Conference at present under way at Hot Springs; tax, labour and trade legislation measures of considerable importance are occupying the government; the gas drought on the eastern coast holds interesting implications; most important of all, of course, is the Churchill-Roosevelt conference now under way. The "procession" from the White House to the Capitol on the occasion of Mr. Churchill's address was a matter of considerable interest but all it would be wise to say at this time would be to note the favourable remarks made regarding the charming appearance of the Duchess of Windsor!

E. R. Jacobsen, m.e.i.c.

## NATIONAL CONSTRUCTION COUNCIL MEETS

Following is a report prepared by the Institute's representative on the National Construction Council, D. C. Tennant, m.e.i.c., Engineer, Ontario Division, Dominion Bridge Co. Ltd., Toronto.

### The Challenge

The continued successes of the Allied Nations in the war, recently, have resulted in a challenge to those at home in Canada to think more definitely and act more promptly regarding the problems that will have to be faced here when peace is declared. This challenge was very evident in the attitude of the various members of the National Construction Council at its recent annual meeting in Toronto on May 27th.

### The Council and its Scope

The National Construction Council consists of representatives from constituent bodies such as The Canadian Construction Association, The Royal Architectural Institute of Canada, The Trades and Labour Congress of Canada, The Canadian Manufacturers Association, The Canadian Paint Oil and Varnish Association, The Engineering Institute of Canada, and several other national bodies. The presidents of these various organizations are ex-officio members of the National Construction Council and, moreover, each organization has another separate representative who may continue in office from year to year. The Council also includes Col. James H. Craig, r.a.i.c., who is on Active Service in Great Britain and makes it a point to keep in touch with the British Building Industries Council. Thus the scope of the Council is very broad. It is appointed by engineers, architects and industry and there is no body that should be better fitted to give constructive leadership in the solving of post-war problems affecting the building trades. Mr. A. S. Mathers, r.a.i.c., was re-elected president by the meeting, Mr. J. W. Gooch, c.c.a., Toronto, as first vice-president, and Mr. Ernest Ingles, Trades and Labour Congress of Canada, London, second vice-president with Mr. L. L. Anthes, c.m.a., Toronto, as honorary treasurer.

### Dr. James' Committee

Mr. K. M. Cameron, chief engineer of the Department of Public Works of Canada, and president of The Engineering Institute of Canada, was present at the meeting and addressed the luncheon. Mr. Cameron is one of the members of the Advisory Committee on Post-War Reconstruction under the chairmanship of Dr. Cyril James, principal of McGill University, Montreal. Mr. Cameron pointed out in his address that the word reconstruction as applied to Dr. James' Committee might be a little misleading because, while it is true that, in Europe, devastation due to the war was so general that a great deal of reconstruction would be necessary, yet, in Canada, in so far as industry was concerned, there might after the war be more factories than were really necessary and the problem would be to convert the war factories to peace time uses or to re-convert them to the peace time industries they housed before the war began. This problem, he said, was being considered by the Department of Munitions and Supply at Ottawa. He mentioned also the problem of rehabilitation of returned men and of war workers which is being considered by the Department of Pensions and National Health. He said that under the James' Committee there were six sub-committees as follows:

1. Agriculture and land settlement.
2. Development of natural resources including tourist traffic.
3. Employment opportunities.
4. Construction projects.
5. Housing and community planning.
6. Problems of special interest to women.

Mr. Cameron is chairman of the sub-committee on construction projects. This committee has already reported to the James' Committee and its report has been sent on to the Government. The contents of the report are not yet available to the public. Mr. Cameron made it clear that the James' Committee looks to industry to suggest actual plans for post-war adaptations applicable to each locality and industry.

### Plans of Council

Mr. Mathers in his address to the Council pointed out that booms and depressions had always been marked by rise and fall in employment and we had come to look on construction activity as being subject to such causes. He suggested that possibly the rises and falls in the construction industry may be the causes rather than the effect of these booms and depressions because the results of healthy construction activity are very far reaching. He advanced three general suggestions as essentials of good planning.

1. The adequate supply of properly trained technical men and tradesmen for the execution of building projects.
2. The promotion of construction from without the industry as well as from within including housing projects, transportation and power projects and the development in the Alaskan Highway region.
3. Proper financing dependent in the long run on the maintaining of sufficient employment.

The plans of the National Construction Council are crystallizing in three directions:

1. The re-appointing of regional committees in various centres throughout Canada with a view to having these committees canvass as accurately as possible the construction projects, either private or governmental, that are likely to go forward in the post-war period in their own locality. No comprehensive list of such projects for Canada has yet been completed although the Royal Architectural Institute of Canada has made a beginning.

2. The making of suitable representation to the Dominion Government suggesting the revival of the Home Improvement Act and Housing Plans for the larger centres

and also for rural areas. Consideration was given particularly to the housing plan that has been carried out successfully in Boston. The Council deemed it advisable that Wartime Housing Limited, a Government company that has already built many necessary and more or less temporary homes for war workers, should not operate after peace is declared, but should be replaced as soon as possible by private construction but with very strict governmental control for speculative building.

3. As a means of arousing an increasing interest in post-war construction and problems, the National Construction Council has in mind the carrying out of an educational tour throughout the various centres in Canada perhaps sometime this fall. Just when this can take place will depend to quite a large extent on the activities of the regional committees in the various districts.

### Apprenticeship

The Ontario Apprenticeship Act was very strongly commended by Mr. Ingles who pointed out that skilled artisans are absolutely necessary in the construction trades and that apprenticeship training was the best, if not the only, solution for securing these. The Ontario Act has been in force quite a number of years but the activities were handicapped in the first place by the depression of 1929 and more recently because the supply of young men has been so fully taken up by the present war. It was pointed out that it was very desirable that apprenticeship training should be encouraged in a similar way in other provinces and Mr. Nicholls pointed out that the Canadian Construction Association has actively sponsored the spread of the apprenticeship system.

### Discussion

Several points of interest came up in the discussions at the annual meeting as for instance:

(a) The preparation of private plans for post-war projects is handicapped by the lack of available funds and also the lack of properly trained men as so many of these are employed in the Army, Navy or Air Force or by the Government.

(b) The orderly marketing and disposal after the war of material in wartime houses is important because otherwise these houses will result in disrupting the regular building market. Several suggestions were made; one that they might be sold as summer cottages, another that they might be taken down and shipped as a gift to devastated areas in Europe, still another that they could be dismantled and the materials in them returned to the regular dealers in building materials.

(c) It was felt that much of the talk regarding radical changes in building operations and designs after the war should be discouraged and it was mentioned that many innovations such as pre-fabricated houses had not yet proved themselves to be an economical proposition.

(d) Emphasis was also given to the thought that, after the last war, many companies had acted in an exceedingly generous way towards their employees, yet after this war, while generous hearts might be even more in evidence than previously, the excess profits tax on industrial companies might have the effect in many instances of making it impossible for companies to act as generously as they would like to.

Mr. Lane, the director of Boston Housing, has been quoted as saying in connection with post-war problems: "The race is between education and catastrophe, and catastrophe has at present a big lead." With such a challenge in mind the National Construction Council is prepared to give leadership to the construction industry in post-war problems and to do this effectively it will need the full co-operation of all its constituent bodies.

## REPAIR WORK IN HEAT OF BATTLE

**A Further Appreciation of the Newly Formed Royal Electrical and Mechanical Engineers Corps**

The British press continues to laud the new formation of engineers in the Imperial Army. The experiment of taking all engineering work away from the Ordnance Corps and assigning it to a corps established for the purpose has proved a success. Much of the credit for the North African campaign is given to the new alignment of engineering personnel. The custom of the Canadian Army following the practices of the Imperial Army doubtless will lead to a similar set-up in our own forces both in Canada and overseas.

The following references to R.E.M.E. are based on accounts published in England and communications sent to the Institute. This revolutionary development seems to justify some study by members of the profession in Canada, both military and civil, and therefore the *Journal* plans to produce similar articles from time to time, as an aid to such study.

The application of the phrase "mechanization" to land warfare dates from the last war, in which mechanically propelled vehicles began to supplant the horse both for transport and fighting, and it is still mainly used in this sense. In British usage, "armoured" troops are those which fight in and with their vehicles, as against "motorized" units which, though borne in carriers, coaches and lorries, fight on the ground.

But land warfare to-day is "mechanized" in a far wider sense. Not only is transport mechanical, not only do tanks and armoured cars play the part that cavalry once played, but the weapons of infantry and artillery are highly finished products of mechanical engineering, and to assist and supplement them a whole range of electrical and optical instruments have come into being. In Wellington's day, probably not one soldier in five thousand had a "spy-glass" or a compass, and not one in fifty or a hundred had a watch. To-day the design and servicing of such things forms a not inconsiderable part of army engineering. And all these refinements must stand the knock-about of campaigning and the mud and dust of battle. As the result, engineering must now not only design and produce he weapons and instruments, but "service" them as well. But what is implied by "servicing"? First, of course, reasonable care and knowledge on the part of the actual users. But, with the complexities of modern weapon design, the limit of regimental resources, both in skill and in tools, is soon reached, and the specialized engineer must take over responsibility at the front itself if weapons and instruments are to be kept "battle-worthy."

Even twenty or thirty years ago, this was not nearly so much the case as it is to-day. Then, the ruling principle was that a weapon or instrument that became unserviceable was evacuated, like a wounded soldier, and replaced, the repairs being carried out either in workshops in rear areas or by arsenals and civil factories at home. Now, the workshop has pushed forward, and its emissaries more forward still, so that servicing has come to mean more than maintenance, and immediate repair, rehabilitation, reconditioning—call it what one will—has very largely superseded evacuation. Replacement, too, has, in many cases, become a forward activity—in other words, modern engineering has progressed so far in standardization that many components can be carried as spares, so that it is no longer necessary to evacuate a whole equipment in order to make good a damaged part. A tank engine for instance can be taken out and a new one bolted in in a few hours, without going further back than the edge of the immediate battle.

Further, quite apart from battle requirements, the modern army depends on engineering skill for the working of its whole system, movement in particular being conditioned by it. Gone are the days when a horsed army could pick up its replacements, as well as its food, on the countryside. And to-day it is precisely the troops that are most fully mechanized and most sensitive to mechanical failure, namely the armoured divisions, that are, as often as not, the most advanced.

For all these reasons, a new organization of army engineering became necessary, and the major part played by machines in the Libyan campaign did no more, in fact, than focus attention on, and perhaps speed up, a process of natural evolution.

Till the spring of 1942, the bulk of the repair work of the material of the army, from watches and compasses to tanks and guns, had been carried out by the Royal Army Ordnance Corps, and had arisen out of its functions of providing, storing and issuing almost all the army's stores, as distinct from its "supplies," which were handled by the R.A.S.C. (The general distinction between "stores" and "supplies" is that the former are not consumed from day to day; e.g., food and petrol are supplies, while split pins and radio sets, guns and tent boards are stores.) The R.A.O.C. was thus a dual organization of storekeeping on the one side and engineering on the other. Further, the Royal Engineers were responsible for the mechanical engineering incidental to their work as builders of bridges, coast batteries, barracks, docks, etc., and the R.A.S.C. serviced and repaired its own transport vehicles. But the centre of gravity was in the engineering branch of the R.A.O.C., and this by force of circumstances became a "combatant" branch in the full sense of the word. The conditions of modern war, with its constant menace of air raids and of deep penetrations by armoured forces made it necessary even for back-area stores and workshops to look after their own local defence, but apart from this, the engineering side had become mobile and engaged in the battle itself, and the store side—as represented by spare parts—extended to its fringe. But the two functions became more and more distinct, though stores and workshops in the back areas are usually sited close to one another for obvious reasons of convenience.

The next step followed on October 1st, 1942, when the Corps of Royal Electrical and Mechanical Engineers (R.E.M.E.) was created by Royal Warrant.

The duties of the Corps are defined under the Warrant as:

1. Inspection and maintenance of tanks, wheeled vehicles —all artillery (including field, anti-aircraft and coast defence) small arms and medium arms—radiolocation, fire control and all other instruments—tunnelling equipment, pumping sets and the installation of coast artillery machinery.

2. Repair of all the above equipment consequent upon ordinary wear and tear or battle casualties.

3. Investigations into defects and recommendations for improvement.

4. Advice on prototype design from a maintenance angle.

The new Corps, or rather its nucleus, was formed by the bodily transfer of a large percentage of the R.A.O.C. together with such elements of the R.E. and R.A.S.C. as were concerned with the duties thus specified.

A consequent readjustment of duties as between the R.A.S.C. and the R.A.O.C. brought some of the former into the "Ordnance," now reorganized as a providing, storekeeping and issuing organ.

10% of the strength of a normal division is made up of R.E.M.E. personnel under a Commander R.E.M.E. (C.R.E.M.E.) who is a Lieut.-Colonel. At Corps headquarters, the service is represented by a Colonel at Army Headquarters by a Brigadier and at the War Office by a Major-General.

The amazing speed of the advance by the British Eighth Army in North Africa depended to a great extent on the work of the newly formed Corps of Royal Electrical and Mechanical Engineers (R.E.M.E.).

These specially picked technicians had as their most vital tasks the repairing of British tanks on the battlefield, and ensuring that paths were kept clear through Axis minefields for the tanks and supply columns.

The key problem of armoured units operating so far from their base is maintenance, and it is the duty of mobile repair units to see that the fighting vehicles are kept in running order and to retrieve them when they get bogged in marshy ground, as sometimes happens after heavy rains in North Africa.

Often the men of these mobile repair units must leave their workshops to join in the fighting. Yet they have set up production records of which mechanics in the British factories from which they have been drawn would be proud. The time required to remove a tank engine and replace it with a new one has been reduced by two-thirds. Units estimated to be capable of repairing three tanks a day have repaired eleven tanks a day.

Behind these front line units are others, also mobile, capable of carrying out major replacements and repairs at high speeds, semi-mobile repair depots at intervals along the lines of communication, and modern work shops equipped for full-scale reconstruction of damaged tanks and armoured vehicles.

### WONDERS OF RECOVERY

In the heat of battle or in situations where it was temporarily impossible to get spare parts, the men of the R.E.M.E. have performed miracles of improvisation on the spot with the greatest success.

On one occasion some wheeled tractors operating in a rain-soaked swamp district became completely bogged. A Brigadier and another officer (who has since died of wounds) jointly worked out the solution. This was to remove the tracks of captured German tanks and fit them to the British wheeled tractors so that they became half-tracked vehicles able to pull their loads under almost any conditions.

The R.E.M.E. performed wonders in recovering tanks during battle when they did most of their work within gun range. On one occasion a shell cut a tow rope in half—but the tank was retrieved an hour later.

British Recovery crews working at night fought pitched battles with Axis snipers to get possession of damaged tanks. R.E.M.E. craftsmen went to work first with tommy guns and hand grenades before they dropped them to take up their tools. Mobile workshops working at incredible speed repaired damaged Axis vehicles and had them in the service of the British forces within a few hours.

Equally important is the work of the Minefields Task Force of the Royal Electrical and Mechanical Engineers. Minefields were sown everywhere by the fleeing Afrika Korps in an effort to impede the Eighth Army's pursuit. Sappers of the Royal Engineers had the job of clearing lanes through these so that British armour and lorried infantry could go on. The R.E.M.E. Minefields Task Force, kept the lanes clear.

The Task Force was formed just before General Montgomery began his assault at El Alamein, where the heavily mined Axis positions were broken. It was foreseen that no matter how quickly or well the Sappers cleared pathways, some British tanks might stray into the minefields or strike an undetected mine during the night.

A tank with tracks blown off lying across the minefield path might hold up an advance for hours, so skilled craftsmen of R.E.M.E. were formed into special Task Forces, given their positions in minefields and one order "Keep the lanes clear at any cost."

### AXIS TRY GHOULISH TRICKS

The advance had barely started when calls for R.E.M.E. assistance began to come in. Surrounded by mines and amid a hail of Axis machine-gun and artillery fire they took their recovery equipment to the scene of the casualty. Inevitably men and vehicles were lost, but the lanes were kept clear and the tanks thus recovered were in many instances repaired by R.E.M.E. experts operating immediately behind the British guns and sent back into action in a few hours.

All the distorted ingenuity of which the Axis is capable failed to delay the men of the Eighth Army for long. Trip wires were tied to the bodies of British soldiers killed in action so that when their comrades went to bury them they were blown to bits. This ghoulish trick defeated its own ends. In the words of one who saw it, the consequence was to rouse a great wave of fury which the Axis will feel in due course.

General Montgomery has said that the Eighth Army is ready to operate on supply lines 1,500 miles long, the distance from Cairo to the Tunisian border. The R.E.M.E. as well as other corps supplying and maintaining the British fighting men, are playing their part in attaining this end.

## CORRESPONDENCE

### Engineering Education

Kingston, Ont., May 19, 1943.

The Editor, The Engineering Journal,
Montreal, Canada.

Dear Sir:

The recent article, The Training and Education of Engineers, by Dr. S. D. Lash, draws attention once more to the difficult question of engineering education. With his broad conclusions there will probably be rather general agreement, but about the details there will be a multitude of opinions. Moreover there will be very real practical difficulties in the elimination of a high degree of specialization, even in the early years of engineering courses. I think I can see the seeds of specialization even in the general course outlined. It is the aim of most university authorities and is a definite suggestion made by Dr. Lash to choose instructors with as much advanced training and as wide practical experience as possible. It is almost invariably true that every instructor, especially in the early years of his teaching career, gives undue weight in his courses to those features of the subject which he has found of most interest in his own academic training or in his own experience. It is not in any sense exhibitionism. It is merely the attempt of enthusiastic instructors to pass on to their students those things considered to be of greater value without realizing that students must first master the elements before they can proceed to advanced work. This is specialization in its worst form. There is no cure for this difficulty except teaching experience, or the laying out of a detailed syllabus and the establishment of boards of outside examiners. That may have certain advantages but it also has many disadvantages.

By inference, Dr. Lash has intimated some lack of culture among engineers. That is a criticism that has been too often leveled at our profession and too seldom challenged. It is realized by those concerned with engineering education and should be impressed on all educators, that men entering engineering schools have already credit for courses equivalent to a year's standing in an arts course in most Canadian universities, or what amounts to the same thing, they are three years from graduation in the general arts course in those universities which admit only with upper school standing. Most matriculants have had two, if not three, years of French; fewer have had German. If they have taken three years of French they will have had sufficient for reading purposes and adequate for the requirements in graduate schools. After entrance, certain of the subjects in most engineering curricula are equivalent to certain courses in the standard arts prescription. Disregarding mathematics for which Dr. Lash quite rightly makes a strong case, physics and chemistry, most engineering students are required to take some courses in English and economics. Whatever the prescription of work the development of culture is not inherent only in certain fields of study. Many an engineer can remember a teacher of mathematics in whose hands the solution of a problem in geometry or trigonometry furnished as great an inspiration as could be drawn from an ode of Horace.

But these are not the features of the article that led me to discuss it. I was surprised and a little chagrined to find that Dr. Lash's outline for an engineering course, specifically for structural engineers, omits geology entirely. Geology has been part of the prescription in engineering in most schools for so long that its omission strikes one as a radical if not retrograde step. Properly taught, no subject has greater aesthetic value. Properly applied, it can be of immense service in engineering problems of many kinds. So important is the geological setting of most great structures that, for many years past, few of the large undertakings in the metropolitan area of New York City have been carried through without expert geological advice. Perhaps the experience in connection with one of the bridges to Long Island, which was begun on the trial and error method, has had its influence in determining the present policy. In contrast to this, large public buildings are still being constructed in Ottawa quite ignoring the fact that the foundations of many of them bridge active fault zones.

I feel sure that the comment will suggest itself, that present courses in engineering geology are neither cultural nor of practical value. There may be some truth in that. The unfortunate instructors in charge of them are forced to condense, into a single course, elementary geology which should give an enthusiastic teacher scope to appeal to students' imaginations, and applications of geological principles for which there is little time and no really adequate preparation. It is a case for more geology, not less. Nor am I urging that all engineers should become geologists. They should have sufficient knowledge of the science to know what contribution it can make, when properly applied, to engineering problems. They should know when the services of a capable geologist should be enlisted.

Dr. Lash has rendered engineering education a service in presenting a concrete plan. I have no doubt that his purpose in so doing was to arouse discussion from which improvements in present courses may come.

Yours very truly,

E. L. Bruce,
*Professor of Geology, Queen's University.*

---

The Engineering Institute of Canada, May 28th, 1943.
2050 Mansfield Street,
Montreal, Que.

Dear Sirs:

Dr. Bruce's comments are much appreciated. May I assure him that the omission of geology from structural engineering course was entirely an oversight. A general appreciation of structural geology combined with a knowledge of the properties of rocks and soils should be part of the equipment of every structural engineer.

Yours very truly,

S. D. Lash.

## REPRINTS ON POST-WAR RECONSTRUCTION

The papers and discussion presented at the last annual meeting of the Institute under the auspices of the Committee on Post-War Problems, and printed in the April issue of the *Journal*, have been in great demand from outside sources as well as from members. In order to meet this demand, reprints have been made and may be obtained from Headquarters at 25cts a copy, with special prices for quantities.

The papers, assembled under one cover in a sixteen-page reprint, along with the discussion, are as follows:

"Post-War Pattern," by H. G. Cochrane, M.E.I.C.

"The Construction Industry in Post-War Economy," by O. J. Firestone, Ph.D.

"Soil and Water Conservation," by Professor A. F. Coventry, B.A.

"Forestry Problems in Reconstruction," by John C. W. Irwin, B.Sc.F.

## MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, May 15th, 1943, at ten o'clock a.m.

*Present:* President K. M. Cameron in the chair; Vice-President G. G. Murdoch; Councillors J. E. Armstrong, E. V. Gage, E. D. Gray-Donald, R. E. Heartz, W. G. Hunt, J. A. Lalonde, N. B. MacRostie, G. M. Pitts, H. J. Ward, and J. W. Ward; Secretary Emeritus R. J. Durley, General Secretary L. Austin Wright, and Assistant General Secretary Louis Trudel. Mr. C. C. Kirby, secretary of the Association of Professional Engineers of New Brunswick, was also present for part of the meeting.

### Affiliations with Sister Societies

The general secretary pointed out that although the report of the Committee on Professional Interests had been approved by Council at the regional meeting held in Saint John on April 17th, the committee felt that in view of the far reaching nature of its recommendations, they should be given wider publicity and approved by members of Council across Canada. He read again the first section of the report dealing particularly with the Institute's relations with sister societies as recorded in the May *Journal*.

Further conversations had been held with officers of the American societies who were very anxious to discuss the possibilities of closer co-operation with the Institute.

Mr. Pitts thought that as the Institute had not yet completed arrangements with the provincial professional associations in Canada, it might be a little too soon to open negotiations with the American societies. However, he approved of the recommendations in principle, and following some discussion it was unanimously resolved that this meeting of Council endorses the resolution of the Saint John Council meeting.

### The Dominion Council of Professional Engineers

The general secretary outlined briefly the proposals of the Dominion Council of Professional Engineers which had been referred by Council to the Committee on Professional Interests. The recommendations in the report of the Institute committee were based largely on these suggestions for co-operation. The Dominion Council had included with their submission an invitation to each of the seven organizations named, to send a representative to attend their annual meeting being held in Vancouver on May 26th.

The general secretary read the section of the committee's report dealing with the proposal of the Dominion Council. At the meeting in Saint John it had been pointed out that although the Institute could not send an official delegate to the meeting, Vice-President Murdoch, who was attending as an official representative of the New Brunswick Association, would be there and could represent the Institute unofficially.

Following discussion, it was unanimously resolved that this meeting of Council endorses the opinion expressed at the Saint John meeting.

### Association Representation on Institute Council

It was unanimously resolved that this meeting endorses the resolution of the Saint John meeting of Council regarding representation on the Institute Council from the professional associations with whom the Institute has co-operative agreement.

The general secretary reported that the Committee on Professional Interests was in accord with Council's suggestion that representatives of the Association on the Institute Council should be voting members.

### Proposed New By-law

The general secretary read the draft of a new by-law as proposed by the Committee on Professional Interests, with a view to implementing the various suggestions made in their report. Considerable discussion took place as to the desirability of having representatives from other national engineering societies on the Institute Council. Mr. Heartz raised the point as to whether or not such representatives could be considered officers of the Institute. In Mr. Lalonde's opinion, the only organizations which should be represented on the Institute Council were the provincial professional associations. Mr. Pitts thought that there should be another by-law dealing only with association representation on Council.

The general secretary pointed out that this was merely a draft, and that the Committee on Professional Interests would be glad to receive suggestions. Accordingly, it was unanimously resolved that the secretary be directed to submit the proposed draft by-law to members of Council for consideration and comment.

### Legal Action by Architects Against an Engineer

Following on the instructions given at the Council meeting in Saint John, the general secretary reported that he had been in touch with Mr. Perry but that no further action had been taken as Mr. Perry indicated that he would call at the Institute as soon as possible to discuss the whole matter. Due to pressure of business this discussion had not yet taken place.

Mr. Pitts emphasized the desirability of the engineers and the architects maintaining close and friendly co-operation and expressed the hope that the development of this particular case would not in any way interfere with the good relationships which had been established.

It was unanimously agreed that the extent of the Institute's participation in this case should be referred to the Committee on Professional Interests for study and report.

### Income of New Brunswick Branches

A recommendation from the Saint John Branch Executive to the effect that the portion of fees from Students and Juniors now paid to the Council of the Institute should in future be paid direct by the Association to the branches, had been referred to the Finance Committee by Council. In view of the small joint fee collected by the New Brunswick Association the Finance Committee recognizes that the Association could not make grants to the branches on the same basis as is done in the other provinces without drawing from capital or special income. If the proposal offered by the Association leaves the branches short of the requisite amount required for their operation the committee is prepared to recommend that a grant be made by Council over and above other rebates which may be due. Council approved of this recommendation, and the secretary was instructed to so advise the branches and to suggest that they inform Headquarters of the amount which their budgets show will be required.

### Engineering Journal to all Students

Acting on the proposal of the Montreal Branch that all students should be made to subscribe to *The Engineering Journal* at a nominal charge, the Finance Committee recommends to Council that the Students' fees be made $3.00 per year, less $1.00 discount for prompt payment, this fee to include the subscription to the *Journal*, which all Students would be required to take.

Council unanimously approved of this recommendation which it was noted would involve an amendment to the by-laws. The secretary was directed to take the necessary action.

### National Construction Council

The general secretary read a letter from the National Construction Council, advising that their annual meeting would be held in Toronto on May 27th, and asking if the Institute had any suggestions to make as to items to be included in the agenda. It also pointed out that representatives of the various constituent bodies would be appointed at this meeting. It was unanimously resolved that Mr. D. C. Tennant be re-appointed as the Institute's representative on the National Construction Council.

In response to an inquiry from Mr. Pitts as to whether or not anything had been done regarding a request received from the National Construction Council, asking the Institute to make a survey of works coming within the purview of engineers, that were being held in abeyance until after the war, President Cameron stated that he had discussed this with Dr. James and, in view of the various sub-committees dealing with this matter, it had been felt that no effective contribution could be made at this time by the Institute in this connection.

### Junior Section—Toronto Branch

The general secretary presented for the approval of Council the constitution of the newly formed section of the Toronto Branch, pointing out that there was provision for a group of persons who would belong to the Junior Section but who would not necessarily be members of the Institute. It was proposed to call such persons "Associates of the Branch" following, he understood, suggestion of the Institute Membership Committee that branch Affiliates might properly be styled "branch Associates" in order to distinguish them from Affiliates of the Institute.

Following some discussion, on the motion of Mr. Heartz, seconded by Mr. Murdoch, it was unanimously resolved that the constitution of the Junior Section of the Toronto Branch be approved, with the recommendation that the term "Affiliate of the branch" be used to designate those persons who do not belong to the Institute.

### Affiliation with University Engineering Societies

The general secretary read a letter from Councillor Arthur Jackson, of Kingston, expressing his regret at his inability to attend the Council meeting, and submitting the following suggestion for the consideration of Council:

"For some time it has seemed to me that closer relation could exist between the E.I.C., and the undergraduates of Canadian universities. It is true we have the E.I.C. prizes awarded annually in each engineering school, Junior Sections, and student papers, but as a whole applied science undergraduates do not know as much about the E.I.C. as is desirable.

"Each engineering school has, as far as I know, an engineering society and all applied science undergraduates of that school are members of it. If each of these societies could be affiliated with the E.I.C. all undergraduates might become Student members of the E.I.C. With this condition obtained and eventually all engineers in Canada E.I.C. conscious, it would not be difficult to carry out arrangements with sister societies, and should help greatly in the solution of future problems."

Council felt that this was an excellent suggestion and, following some discussion, it was decided to refer Councillor Jackson's letter to Mr. Bennett's Committee on the Training and Welfare of the Young Engineer for consideration and report.

### Collective Bargaining Legislation

The general secretary reported that on Friday, May 14th, a meeting had been held at Institute Headquarters, attended by representatives of various technical scoieties whose names are given below, to discuss compulsory collective bargaining in relationship to the professional group. In view of the request to the National War Labour Board from organized labour for national compulsory collective bargaining legislation, and in view of the fact that an attempt had been made in Ontario to include the learned professions in such legislation, the meeting was of the opinion that the National War Labour Board should be informed of the desires of the professional group represented by the delegates at the meeting. Accordingly, the brief which appears on p. 354 was prepared for submission to the societies.

It was unanimously resolved that the Council of the Institute approves of this draft letter and is agreeable to the Institute being included as one of the signatories. Those attending the meeting were:

W. P. Dobson, Toronto, Ont.
President, Dominion Council of Professional Engineers
M. Barry Watson, Toronto, Ont.
Secretary, Dominion Council of Professional Engineers; Registrar, Association of Professional Engineers of Ontario.
A. D. Ross, Montreal, Que.
Secretary, Corporation of Professional Engineers of Quebec.
Dr. L. Lortie, Montreal, Que.
President, Canadian Institute of Chemistry.
F. J. Hambly, Buckingham, Que.
Canadian Institute of Chemistry—Committee on Legislation.
Gordon MacL. Pitts, Montreal, Que.
President, Royal Architectural Institute of Canada.
Dr. J. B. Challies, Montreal, Que.
Chairman, Committee on Professional Interests, The Engineering Institute of Canada.
L. Austin Wright, Montreal, Que.
General Secretary: The Engineering Institute of Canada.

### St. Lawrence Waterway

The general secretary presented a submission from Mr. J. G. G. Kerry, M.E.I.C., regarding the possibility of maintaining open waterways throughout the year from Lake Ontario to the sea, or to Montreal or Albany. In Mr. Kerry's opinion the possibilities appeared to justify some further investigation into the designs for the St. Lawrence River Waterway. He felt that this could most properly be recommended by the Institute as a national body after Council had satisfied itself that the proposals are founded on technical data that cannot be challenged. A similar submission had been presented to the American Society of Civil Engineers who had referred Mr. Kerry to Dr. B. A. Bakhmeteff, chairman of the executive committee of the A.S.C.E. Hydraulics Division. Following some discussion, it was decided to leave this matter with the president to be brought up again at the next meeting of Council.

### Succession Duties

A circular letter was presented from the Canadian Chamber of Commerce asking the Institute for an expression of opinion regarding succession duty taxes. Following some discussion as to whether or not the Council of the Institute should express an opinion on such matters, it was decided that the questionnaire should be answered as follows:

1. Does your Board or Chamber favour a continuance of the present Canadian imposition of succession duties whereby the nine provinces and the Dominion all impose and collect, independently such taxes?
No.

2. Does your Board or Chamber favour the transfer to the Dominion of the succession duty tax field with the provinces ceasing to impose succession duties in return for suitable compensation?
Yes.

### Dr. C. R. Young

Council's attention has been drawn to the announcement that the Stevens Institute of Technology has conferred upon Past-President C. R. Young the honorary degree of Doctor of Engineering. Council desires to express to Dr. Young its great pleasure in hearing of this award, and its gratification that institutions outside of Canada are so well aware of Dr. Young's character, attainments and leadership.

At the meeting of Council held on May 15th, 1943, the following elections and transfers were effected:

## ELECTIONS AND TRANSFERS

*Members*

**Bjerring,** Kari Herbert, B.Sc. (Univ. of Man.), designing engr., Defence Industries, Ltd., Montreal, Que.

**Braden,** Norman Short, vice-chairman of the Board, and Director, Canadian Westinghouse Co. Ltd., Hamilton, Ont.

***Hunter,** David, sales engr., Canadian Westinghouse Co. Ltd., Winnipeg, Man.

**Jupp,** Ernest H., B.A.Sc. (Univ. of Toronto), asst. district airway engr., Dept. of Transport, Civil Aviation Divsn., Hollyburn, B.C.

**Langelier,** J. Napoléon, B.A.Sc., C.E. (Ecole Polytechnique), chief engr., Montreal Metropolitan Commission, Montreal, Que.

**Scarlett,** Arthur Alfred, B.A.Sc. (Univ. of Toronto), chief engr., Hamilton Works, International Harverster Co., Hamilton, Ont.

**Segsworth,** R. Sidney, B.A.Sc. (Univ. of Toronto), development engr., General Engineering Co. (Canada), Ltd., Toronto, Ont.

**Titus,** Olcott Wood, B.A.Sc. (Univ. of Toronto), chief engr., Canada Wire & Cable Co. Ltd., Toronto, Ont.

**Waines,** Russell Talbot, B.A.Sc. (Univ. of Toronto), mechl. engr., Dominion Bridge Co. Ltd., Shaw St. plant, Toronto, Ont.

**Widdifield,** Ivan Stewart, B.Sc. (Queen's Univ.), elect. supt., General Engineering Co. (Canada), Ltd., Scarboro, Ont.

*Juniors*

**Crane,** George Joseph, B.A.Sc. (Univ. of B.C.), elect. supt., Electric Reduction Co., Buckingham, P.Q.

**Holden,** Alexander Herbert, B.A.Sc. (Univ. of Toronto), ballistic engr., Canadian Industries Ltd., Brownsburg, Que.

***Saintonge,** Jérôme, mechl. inspr., Aluminum Co. of Canada, Arvida, Que.

**Van Winckle,** Jack Mullen, B.A.Sc. (Univ. of Toronto), mech. engr., i/c Engineering Dept., Steel Company of Canada, Ltd., Swansea Works, Ont.

*Transferred from the class of Junior to that of Member*

**Barnhouse,** Frank William, B.Sc. (Univ. of Alta.), asst. mgr., Wire & Cable Dept., Canadian General Electric Co., Toronto, Ont.

**Black,** Frank Leslie, B.Sc. (N.S. Tech. Coll.), elec. supt., Belgo Divsn. Consolidated Paper Corp., Shawinigan Falls, Que.

**Dunne,** Charles Vincent, B. Eng. (McGill Univ.), res. engr., Works & Bldgs. Branch, Naval Service, Sydney, N.S.

**Francis,** John Barten, B.Sc. (McGill Univ.), project engr., Defence Industries Ltd., Montreal, Que.

**Inglis,** William Leishman, Squadron Leader, B.A.Sc. (Univ. of B.C.) constrn. officer, R.C.A.F. Headquarters, Ottawa, Ont.

**Sillitoe,** Sydney, B.Sc., M.Sc. (Univ. of Alta.), technical engr., Special Products Division, Northern Electric Co. Ltd., Montreal, Que.

***Willis,** Edwin Aubrey, electrician, Electricity & Gas Inspn. Lab., Dept. of Trade & Commerce, Ottawa, Ont.

*Transferred from the class of Student to that of Member*

**Cleveland,** Courtney Ernest, B.A.Sc. (Univ. of B.C.), M.Sc., Ph.D. (McGill Univ.), geologist and engr. at Takla Mercury Mine (Bralorne Mines), via Fort St. James, B.C.

**Ross,** Oakland Kenneth, B.Eng. (McGill Univ.), factory mgr., Continental Can Co. of Canada, Montreal, Que.

*Transferred from the class of Student to that of Junior*

**Davis, Samuel,** B.Sc. (Civil) (Univ. of N.B.), M.Sc. (Structl) (Mass. Inst. Tech.), stress analyst, Noorduyn Aviation Ltd. Montreal, Que.

**Hoar,** Charles Richard, B.Sc. (Univ. of Alta.), senior A.I.D. Inspector, British Commonwealth Air Training Scheme, Edmonton, Alta.

**Osborn,** John Follett, B.Sc. (Univ. of Man.), asst. engr., Industrial Control Dept., Canadain General Electric Co., Peterborough, Ont.

*Have passed the Institute's examinations.

*Students Admitted*

**Adams,** Gerald Clifton (Univ. of N.B.), Box 877, Campbellton, N.B.

**Blakely,** Nelson Wesley (McGill Univ.), Fleetwood Apts., Winnipeg, Man.

**Bowes,** William Henry (N.S. Tech. Coll.), 53 Windsor St., Halifax, N.S.

**Chambers,** Joseph Byng (Univ. of Man.), Killarney, Man.

**Clark,** Frederick Hubert (N.S. Tech. Coll.), 33 Brenton St., Halifax, N.S.

**Donahue,** John Joseph (Univ. of N.B.), 126 Prince William St., Saint John, N.B.

**Foley,** Maurice Aloysius (N.S. Tech. Coll.), 63 Queen St., Halifax, N.S.

**Foster,** John Stanton (N.S. Tech. Coll.), 23 York St., Halifax, N.S.

**Haliburton,** George MacDonald (N.S. Tech. Coll.), 310 Jubilee Rd., Halifax, N.S.

**Hussey,** Cletus Harold (Univ. of N.B.), 619, Scully St., Fredericton' N.B.

**Langille,** Lorimer Leon (N.S. Tech. Coll.), Lunenburg, N.S.

**Leonards,** Gerald Allen (McGill Univ.), 4137 Esplanade Ave., Apt. 6, Montreal, Que.

**Lévesque,** Paul Carmel (Univ. of N.B.), 156 Regent, Fredericton, N.B.

**Long,** Ludovic Andrew (Univ. of N.B.), Albertine, N.B.

**MacMillan,** John Daniel (Univ. of N.B.), Box 418, Campbellton, N.B.

**McSorley,** Thomas Holland (Univ. of N.B.), 111 King St., Fredericton, N.B.

**Mroz,** Boris (McGill Univ.), 381 Edward Charles St., Apt. 8, Montreal, Que.

**Rodman,** Marvyn Floyd (Univ. of Toronto), 336 Forman Ave., Toronto, Ont.

**Trudeau,** Guy (St. Mary's Coll.), 5 Beech St., Halifax, N.S.

**Vaughan,** Joseph Philip, (St. Mary's Coll.), 294 North St., Halifax, N.S.

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

*Members*

**Aitken,** John Alexander, B.Sc. (Univ. of Man.), divn. engr., Imperial Oil Ltd. Maritime Division, Marketting Dept., Halifax, N.S.

**Barron,** Lewis Joseph, B.Eng. (N.S. Tech. Coll.), mtce. and safety engr., Foundation Maritime Ltd., Shipbuilding Division, Pictou, N.S.

**Britnell,** Carl B., B.A.Sc. (Univ. of Toronto), asst. to district engr., Works & Bldgs., Naval Service, Dept. of National Defence, Halifax, N.S.

**Feetham,** Edward Joseph, B.Eng. (N.S. Tech. Coll.), eng. i/c field work, Wartime Housing Ltd., Halifax, N.S.

**Freeborn,** Frank, Lieut.-Commander (S.B.), R.C.N.V.R., asst. supt. of Overseers Maritimes, H.M.C. Dockyard, Halifax, N.S.

**Smith,** Francis Leo, asst. to staff engr., Maritime Telegraph & Telephone Co. Ltd., Halifax, N.S.

**Thomas,** Edward Christian, B.Eng. (N.S. Tech. Coll.), res. engr., Standard Paving Maritimes Ltd., Halifax, N.S.

*Transferred from the class of Student to that of Member*

**Sutherland,** Donald Boyd, B.Sc. and Engineering Diploma (Dalhousie Univ.), Prob. Sub.-Lieut., R.C.N.V.R., H.M.C. Dockyard, Sydney, N.S.

*Transferred from the class of Student to that of Junior*

**Chapman,** Harris, J., B. Eng. (McGill Univ.), 31 Park Street, Moncton, N.B.

## THE PRESIDENT VISITS QUEBEC BRANCHES

President K. M. Cameron is visiting, this month, the branches of the Institute in the province of Quebec, outside of Montreal.

The first port of call is Quebec, where a regional meeting of the Council of the Institute will be held on the morning of the 19th. All past officers of the Institute in the province and the executive of the Quebec Branch have been invited to join with members of Council at this meeting. At the time of writing, Past Vice-Presidents Fred Newell and E. P. Muntz have indicated that they would be present and that they would accompany the president on part of his trip. The presidential party will also include the general secretary and the assistant general secretary.

The itinerary follows:

| | | | |
|---|---|---|---|
| Lve. Montreal | June 18 | 11.45 p.m. | C.P R. |
| Arr. Quebec | June 19 | 6.40 a.m. | |
| | 9.30 a.m. | Council meeting at Chateau Frontenac | |
| | 1.00 p.m. | Branch luncheon at Chateau Frontenac | |
| Lve. Quebec | June 20 | 8.00 a.m. | C.S.L. Boat |
| Arr. Bagotville | June 20 | 9.45 p.m. | |

Dinner meeting with Saguenay Branch at Saguenay Inn, June 21 at 6.30 p.m.

| | | | |
|---|---|---|---|
| Lve. Bagotville | June 22 | 7.00 a.m. | C.S.L. Boat |
| Arr. Quebec | June 22 | 7.00 p.m. | C.S.L. Boat |
| Lve. Quebec | June 23 | 1.35 p.m. | C.P.R. |
| Arr. Trois-Rivières | June 23 | 3.15 p.m. | C.P.R. |

Dinner meeting with St. Maurice Valley Branch at night.

| | | | |
|---|---|---|---|
| Lve. Trois-Rivières | June 24 | 9.25 a.m. | C.P.R. |
| Arr. Montreal | June 24 | 12.25 p.m. | C.P.R. |

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

### ENGINEERS' SHARE IN KING'S HONOURS

It will be a matter of interest to all members of the Institute to see the complete list of their fellow members who share in the recent King's Honour List. There are in all 23 persons included in the lists printed in the newspapers which we have every reason to believe are complete.

The honours are divided with eight going to persons in military posts and fifteen to those in civilian occupations.

The Institute joins with the other citizens of Canada in congratulating the following members for the honours which they have so well deserved.

#### COMPANION, ORDER OF THE BATH (C.B.)

**Major-General Charles Sumner Lund Hertzberg,** M.C., V.D., Toronto; chief engineer, headquarters, First Canadian Army Overseas; consulting engineer, Toronto.

**Air Vice-Marshal George Owen Johnson,** M.C., Rockcliffe, Ont.; Air Officer Commanding Eastern Air Command, Halifax, N.S.

#### COMPANION, ORDER OF ST. MICHAEL AND ST. GEORGE (C.M.G.)

**Robert Alexander Cecil Henry,** Montreal; president, Defence Communications Ltd.; vice-president, Montreal Light, Heat and Power Consolidated.

**Chalmers Jack Mackenzie,** M.C., Saskatoon; acting president, National Research Council; dean of engineering, University of Saskatchewan.

#### COMMANDER, ORDER OF THE BRITISH EMPIRE (C.B.E.)

**Brigadier John Ernest Genet,** M.C., Kingston; Chief Signals Officer, Corps Headquarters, Canadian Army Overseas.

**Frederick Innes Ker,** Hamilton; managing-director and editor of the Hamilton *Spectator*.

**Frederic Henry Sexton,** D.Sc., LL.D., Halifax, president, Nova Scotia Technical College.

#### OFFICER, ORDER OF THE BRITISH EMPIRE (O.B.E.)

**Lieutenant-Colonel George Edwin Beament,** Ottawa.

**Lieutenant-Colonel Gideon Milroy Carrie,** Montreal, Que., at present overseas; president, Canadian Refractories Ltd., Montreal.

**John Ballantyne Carswell,** Washington, D.C.; director-general, Washington office, Department of Munitions and Supply; and vice-president, War Supplies Ltd., Washington.

**Hector John MacLeod,** PH.D., Vancouver, head of department of mechanical and electrical engineering, University of British Columbia.

**Wing-Commander Walter Alyn Orr,** Halifax; Eastern Air Command.

**Denis Stairs,** Montreal; director-general, Defence Projects Construction Branch, Department of Munitions and Supply, Ottawa; chief engineer, Montreal Engineering Company Ltd.

#### MEMBER, ORDER OF THE BRITISH EMPIRE(M.B.E.)

**Albert R. Decary,** Quebec; superintending engineer for the province of Quebec, Department of Public Works of Canada.

**Reginald Hugh Field,** Ottawa; supervisor, physical testing laboratory, division of physics and engineering, National Research Council.

**C. A. MacVey,** bridge engineer, Department of Public Works, Fredericton, N.B.

**Harold Ernest Maple,** Ottawa; superintending engineer, Department of National Defence.

**Flying-Officer Guy McRae Minard,** Ottawa; No. 1 Wireless School, R.C.A.F., Montreal.

**William Arthur Newman,** Montreal; president and managing-director, Federal Aircraft Limited; chief mechanical engineer, Canadian Pacific Railway Company.

**John E. Openshaw,** Ottawa.

**Major John De Witte Relyea,** Toronto, overseas with Royal Canadian Ordnance Corps; formerly mechanical engineer with the Dominion Government at Ottawa.

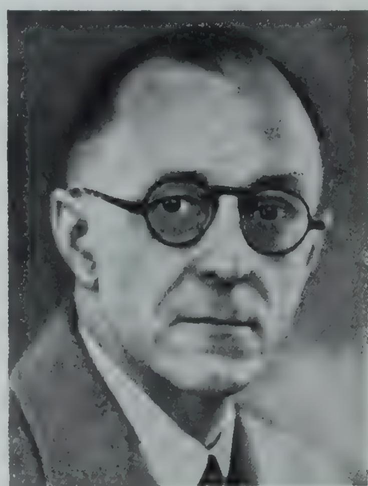
**Lesslie Rielle Thomson,** Montreal, special liaison officer, Department of Munitions and Supply, Ottawa, formerly consulting engineer, Montreal.

#### COMPANION, IMPERIAL SERVICE ORDER (I.S.O.)

**John Goodwill Macphail,** Ottawa; director of marine services, Department of Transport of Canada.

* * *

**Past President H. W. McKiel,** M.E.I.C., dean of science at Mount Allison University, was given an honorary degree of Doctor of Laws at Mount Allison Convocation last month. Dean McKiel has been on the staff of the university since 1913 when he joined as a professor of mechanical engineering. In 1920 he was appointed Brookfield professor of engineering, a title he still possesses. He was made dean of the faculty in 1934.



Dr. H. W. McKiel, M.E.I.C.

Dr. McKiel has just been appointed director of Rotary International for the whole of Canada. He was previously district governor for the maritime provinces. He is a charter member of the Sackville Rotary Club and has served as secretary, vice-president and president of it.

**D. G. Anglin,** M.E.I.C., was appointed vice-president of Anglin-Norcross Corporation Limited, Montreal, following a recent meeting of the directors.

**H. G. Angell,** M.E.I.C., who in recent years had been with the British Admiralty in England and Bermuda, has now accepted a position with the Royal Canadian Naval Services as assistant district engineer in Newfoundland. Lately, he was employed with Defence Industries Limited in Montreal.

**T. M. S. Kingston,** M.E.I.C., city engineer and water works superintendent at Chatham, Ont., is the newly elected chairman of the Canadian Section of the American Water Works Association.

**S. T. Fisher,** M.E.I.C., has recently left the Northern Electric Company Limited, Montreal, to take up new activities as assistant to the president of Rogers Radio Tube Limited, Toronto, and special products manager of Rogers Majestic Limited, Toronto. The two companies are associates of Rediffusion Limited, London, England.

Mr. Fisher had been with the Northern Electric Company ever since he graduated from the University of Toronto in 1930, first in the transmission department and later in the research products department. From 1934 to 1939, he was assistant development engineer in the special products division and from 1939 to 1941 he was sales engineer and in 1941 he was appointed development engineer of the special products division.

**A. O. Wolff,** M.E.I.C., district engineer, Canadian Pacific Railway, Saint John, N.B., is the newly elected chairman of the Saint John Branch. Mr. Wolff was also chairman of the London Branch of the Institute in 1937 while he was division engineer at London.


S. T. Fisher, M.E.I.C.


Maj.-Gen. Howard Kennedy, M.E.I.C.


A. O. Wolff, M.E.I.C.

**C. R. Whittemore,** M.E.I.C., research metallurgist, Deloro Smelting and Refining Company Limited, Deloro, has been appointed to the Advisory Committee on Non-ferrous Welding, Brazing and Hard-surfacing. This committee is functioning under the Metals Controller, Department of Munitions and Supply, Ottawa.

**J. S. Campbell,** M.E.I.C., is now superintendent of aircraft metal fittings division of the Massey-Harris Company Limited at Brantford, Ont. He has been with the company since 1935 and he was previously located at the Toronto plant as supervisor of the pricing and routing department.

**C. C. Jeffrey,** M.E.I.C., has been appointed executive assistant to F. C. Mechin in the Protection of Petroleum Resources Branch of the Department of Munitions and Supply at Ottawa. He has obtained leave of absence from the Department of Public Works of Canada where he was senior assistant engineer in the district engineer's office at Toronto.

**A. I. Cunningham,** M.E.I.C., has been appointed president of Chaguaramas Terminals Limited a subsidiary of the Aluminum Company and has recently taken his new post at Trinidad, B.W.I. For the past few years, Mr. Cunningham had been construction manager of the Aluminum Company of Canada Limited, Montreal, and in this capacity he was busily engaged in the expansion programme of the company since the beginning of the war.

**Major-General J. P. Mackenzie,** D.S.O., M.E.I.C., was named recently inspector general of the Canadian Army for western Canada. General Mackenzie had been quartermaster general at National Defence Headquarters, Ottawa, since early in 1942. Previously he was in command of an infantry brigade overseas.

**Major-General Howard Kennedy,** M.C., M.E.I.C., was promoted from the rank of brigadier and is now quartermaster general succeeding Major-General J. P. Mackenzie, M.E.I.C. General Kennedy is a native of Dunrobin, Ont., and an engineering graduate of McGill University in the class of 1914. He joined the Canadian Expeditionary Force in November, 1915 and was commissioned a lieutenant. He served overseas for four years in the Seventh Field Company, Royal Canadian Engineers. He was invalided home as a captain in 1919 with serious wounds and won the Military Cross for conspicuous gallantry.

He was raised from the rank of colonel to brigadier last year, and was later appointed chairman of the Officers' Selection and Appraisal Board of the Adjutant-General's branch.

Before the war, General Kennedy was manager of the Quebec Forest Industries Association and lived in Quebec City.

**Brigadier W. N. Bostock,** M.E.I.C., returned from overseas recently and was appointed to the general staff at Ottawa. Before the war, Brigadier Bostock was at the Staff College at Quetta, India, having been previously stationed for some time at the Royal Military College, Kingston.

**Brigadier M. M. Dillon,** M.C., M.E.I.C., of London, Ont., was recently promoted to this rank and appointed deputy quartermaster general (B) at National Defence Headquarters, Ottawa. Brigadier Dillon has been director of trades training since last June. He previously commanded No. A-6 Engineering Training Centre at Dundurn, Sask. and before, the No. A-18 Canadian Infantry (Machine Gun) Training Centre at Dundurn.

In civil life, Brigadier Dillon is a well-known consulting structural engineer, having designed many important buildings in London, Ont., and outside.

**Lieut.-Commander Noel N. Wright,** R.C.N.V.R., M.E.I.C., has recently been promoted to this rank and has been made deputy director of the signals division (wireless section) at Naval Headquarters, Ottawa. Before joining up last year, Commander Wright was with the Ferranti Electric Limited, at Montreal, as sales and service engineer for the eastern district.

**P. E. Doncaster,** M.E.I.C., is now district engineer of the Department of Public Works of Canada at Winnipeg. He occupied previously the same position at Fort William, Ont. Lately he had been on leave of absence from the Department and had been employed with Polymer Corporation Limited, Sarnia, Ont.

**Past-President Arthur Surveyer,** M.E.I.C., consulting engineer, Montreal, received an honorary degree of Doctor of Science from the Université de Montréal, at the convocation held on the occasion of the official inaguration of the new buildings on the Mount Royal, early this month.

**Augustin Frigon,** M.E.I.C., assistant general manager of the Canadian Broadcasting Corporation was given an honorary doctor's degree from the Université de Montréal at the convocation held to mark the inauguration of the new buildings on the Mount Royal. Dr. Frigon is the president of the Corporation of the Ecole Polytechnique which is the Faculty of Applied Science of the Université de Montréal.

**Ernest Cormier,** M.E.I.C., consulting engineer and architect of Montreal, who designed and supervised the construction of the new buildings for the Université de Montréal received an honorary doctor's degree at the convocation held to mark the official opening of the buildings, on the Mount Royal. Dr. Cormier graduated in civil engineering from the Ecole Polytechnique at Montreal, in 1906, and a few years later he obtained his degree in architecture from the Ecole des Beaux-Arts de Paris. From 1915 to 1918, he was in Paris as an engineer in charge of concrete designs for the French government. Since 1918, Dr. Cormier has carried a private practice in Montreal as an architect and engineer, and has designed several important projects, among the latest being the Supreme Court building at Ottawa. Dr. Cormier is a past president of the Province of Quebec Association of Architects.

*(Blank & Stoller)*

**Lieut.-Col. C. H. Drury, S.E.I.C.**

**G. E. Griffiths, M.E.I.C.**

**Lieutenant R. E. Jess, D.S.C., S.E.I.C.**

**Geo. E. Griffiths,** M.E.I.C., the recently elected chairman of the Niagara Peninsula Branch of the Institute for 1943-44 was born at DeCew Falls near Thorold, Ont. Mr. Griffiths was educated at Thorold High School and the University of Toronto, graduating in electrical engineering in 1915. Following graduation he served in the Second Army Troops, Royal Canadian Engineers on the French and Belgian section during the First World War. Returning from overseas in 1919 he joined the staff of the Hydro-Electric Power Commission of Ontario at their Niagara Falls district office as assistant meter engineer, which position he now holds.

**Gordon D. Hulme,** M.E.I.C., assistant manager of the department of development of the Shawinigan Water & Power Company, Montreal, was recently elected first vice-president of the Montreal Junior Board of Trade.

**E. M. Nason,** M.E.I.C., is at present employed with the engineering department of the Canadian Pacific Railway at Fredericton, N.B. He has recently returned from British Columbia where he was employed in a civilian capacity with the Royal Canadian Air Force.

**George Morrison,** M.E.I.C., has joined recently the staff of the English Electric Company at St. Catharines, Ont. He had been with the Commonwealth Electric Corporation at Welland, Ont., since 1934.

**A. R. Moffatt,** M.E.I.C., is now resident engineer for the Naval Service at Renous, N.B. Before the war he was chief surveyor of Lamaque Gold Mines Limited at Bourlamaque, Que.

**M. S. Saunders,** M.E.I.C., has recently returned from Colombia, S.A., where for the past five years he had been employed as topographic engineer with Tropical Oil Co. He is now on the staff of Imperial Oil Limited at Moose Jaw, Sask. He is a graduate of the University of Toronto in the class of 1933.

**F. G. Rounthwaite,** M.E.I.C., is now with the Northwest Purchasing Limited, at Edmonton, Alta. Lately he had been with the Department of Munitions and Supply of Canada, in Washington, D.C.

**Captain G. W. O'Neill,** M.E.I.C., is now Camp Ordnance Officer at Debert, N.S. He was previously stationed at Petawawa, Ont. Before the war he was employed with Riverside Iron Works, Calgary, Alta.

**J. G. Dale,** M.E.I.C., is the newly appointed registrar of the Association of Professional Engineers of Alberta, succeeding W. E. Cornish, M.E.I.C. A graduate of the University of Alberta in 1934, Mr. Dale joined the Northwestern Utilities Company at Edmonton, Alta., as an inspector and has been with the company ever since, lately as installation engineer.

**J. L. Connolly,** M.E.I.C., has recently returned to Canada after having spent three years at Mackenzie, British Guiana, as assistant plant superintendent with Demarara Bauxite Limited. From 1937 to 1940 he was employed in the special products department of the Northern Electric Company, in Montreal. Previously, he was employed with Imperial Oil Refineries at Dartmouth, N.S. He is a graduate of the Nova Scotia Technical College in the class of 1935.

**Lieut.-Col. K. H. McKibbin,** Jr.E.I.C., has recently returned from overseas and is at present stationed at Halifax as district ordnance mechanical engineer with M.D. No. 6.

**Jules Mercier,** Jr.E.I.C., of Canadian General Electric Company, was transferred recently from Peterborough to Toronto to take up duties in the distribution equipment division of the supply department. Mr. Mercier is a graduate of the Ecole Polytechnique, Montreal, in the class of 1940 and has been with the company since graduation.

**Georges Archambault,** Jr.E.I.C., of the Aluminum Company of Canada Limited, was transferred a few months ago from Arvida to Shawinigan Falls.

**A. I. Clark,** Jr.E.I.C., has enlisted in the army recently as 2nd lieutenant and is at present training at Barriefield, Ont. He was previously employed with Aluminum Company of Canada at Arvida.

**Lieutenant R. E Jess,** S.E.I.C., has been awarded the Distinguished Service Cross "for air operations against enemy shipping."

Born in Quebec, in 1918, the son of Mr. and Mrs. R. L. Jess, he was a third year engineering student at McGill University when he enlisted in the R.C.N.V.R. in July, 1940. He proceeded to England in September, 1940, and served at various Royal Navy shore bases until January, 1941, when he was transferred to the Fleet Air Arm. He received his training at Portsmouth, Eng., and at Trinidad, B.W.I., where he graduated as naval observer in December, 1941. He returned to Britain in January, 1942, proceeded to and was stationed at Gibraltar; later he joined the aircraft carrier *H.M.S. Eagle*. He was shore based on Malta from June, 1942, until February, 1943. While on Malta he was continually engaged in air operations against Axis convoys in the Mediterranean, flying on a Fairey *Swordfish* (two-man torpedo plane) as navigator. He was reported missing on January 1st, 1943 having gone out to attack an enemy convoy. He came down in the vicinity of Bone but succeeded in returning to Malta. He was gazetted lieutenant in December 31st, 1942. At present Lieutenant Jess is serving with the Bomber Command R.A.F. on heavy bombers.

**Pilot-Officer J. B. Sweeney,** S.E.I.C., led the graduating class, last April, at the School of Aeronautical Engineering in Montreal. Pilot-Officer Sweeney was secretary-treasurer of the St. Maurice Valley Branch before enlisting last year.

**Lieut.-Colonel C. H. Drury,** S.E.I.C., has recently been promoted to this rank and appointed assistant quartermaster general of the First Canadian Army overseas.

Colonel Drury who is only 25, joined the Second Montreal Regiment from the Royal Military College in 1938, went "active" with the First Medium Battery in September, 1939, and has been overseas since 1940. Prior to his new appointment he was deputy assistant quartermaster general of the Fifth (Armoured) Division.

He graduated from Kingston Military College in 1938 and from McGill in the class of 1939.

**John M. Dyke,** S.E.I.C., graduated this year in mechanical engineering at the University of Toronto and is now enrolled for active service with the R.C.N.V.R. as a Probationary Sub-Lieutenant.

**J. D. Anderson,** S.E.I.C., received his degree in mechanical engineering at McGill's convocation last month and is now on active service with the R.C.N.V.R. as Probationary Sub-Lieutenant. During his engineering course, Mr. Anderson was active in the Junior Section of the Montreal Branch of the Institute.

**G. J. Brown,** S.E.I.C., has been commissioned as a warrant-officer in the R.C.N.V.R. and is at present in training. Before enlisting he was employed with Herbert Morris Crane & Hoist Company Limited, Niagara Falls, Ont.

**J. R. Eastwood,** S.E.I.C., has recently returned from overseas and has taken a position with Canadian Industries Limited, at Kingston, as planning and scheduling engineer in the nylon division. Before enlisting in the R.C.O.C. a few months ago, Mr. Eastwood was employed with Consolidated Paper Corporation.

**C. B. Livingston,** S.E.I.C., is now a Sub-Lieutenant in the R.C.N.V.R. He is a graduate of the University of Toronto in the class of 1942.

**R. L. Dimock,** S.E.I.C, is now assistant engineer at Naval Service Headquarters, at Ottawa. He has recently been granted a leave of absence from McColl-Frontenac Company, Montreal.

**Ernest Dauphinais,** S.E.I.C., is at present employed as a job engineer with the Foundation Company of Canada at Montreal. He graduated at the Ecole Polytechnique in 1941.

**E. T. Skelton,** S.E.I.C., has returned recently from British Guiana where he was employed with Demarara Bauxite Company and is at present located at Montreal.

## VISITORS TO HEADQUARTERS

**Georges Demers,** Jr.E.I.C., consulting engineer, Quebec, on May 6.

**Sub-Lieut. (E.) J. C. Watson,** R.C.N.V.R., Jr.E.I.C., Halifax, N.S., on May 6.

**P. G. Wolstenholme,** Affiliate E.I.C., Aluminum Company of Canada Limited, La Tuque, Que., on May 6.

**G. L. McGee,** M.E.I.C., supervising engineer of aerodromes, Department of Transport, Ottawa, on May 7.

**W. P. Dobson,** M.E.I.C., chief of research and inspection department, Hydro-Electric Power Commission of Ontario, Toronto, on May 14.

**M. Barry Watson,** M.E.I.C., registrar, Association of Professional Engineers of Ontario, Toronto, on May 14.

**E. D. Gray-Donald,** M.E.I.C., general superintendent, Quebec Power Company, Quebec, on May 15.

**G. G. Murdoch,** M.E.I.C., consulting engineer, Saint John, N.B. on May 15 and June 1.

**H. J. Ward,** M.E.I.C., superintendent of property, Shawinigan Water & Power Company Limited, Shawinigan Falls, Que., on May 15.

**N. B. MacRostie,** M.E.I.C., consulting civil engineer and surveyor, Ottawa, Ont., on May 15.

**H. A. Wilson,** M.E.I.C., chief draughtsman, Krumm Young & Company Limited, Toronto, on June 1.

**J. W. Ward,** M.E.I.C., electrical superintendent, Beauharnois plant of the Aluminum Company of Canada Limited, Beauharnois, on May 15.

**E. R. Jacobsen,** M.E.I.C., engineering and technical assistant to director, Commonwealth of Australia War Supplies Procurement, Washington, U.S.A., on May 18.

**Paul Vincent,** M.E.I.C., chief, technical section, Department of Colonization, Quebec, Que., on May 18.

**Professor G. M. Williams,** M.E.I.C., professor of civil engineering, University of Saskatchewan, Saskatoon, Sask., on May 20.

**W. C. Byers,** Jr.E.I.C., C. D. Howe Company Limited, Port Arthur, Ont. and secretary-treasurer of the Lakehead Branch of the Institute, on May 25.

**Lieutenant A. D. Cameron,** R.C.A., S.E.I.C., Fredericton, N.B., on May 28.

**J. L. Connolly,** M.E.I.C., Demerara Bauxite Company, Mackenzie, British Guiana, on May 31.

**C. C. Kirby,** M.E.I.C., secretary-treasurer, Association of Professional Engineers of New Brunswick, Saint John, N.B., on May 15.

**J. A. Van den Broek,** M.E.I.C., professor of engineering mechanics, University of Michigan, Ann Arbor, Mich., on June 4.

**Yvon Nadeau,** Jr.E.I.C., instrumentman and assistant engineer, Fraser Brace Company Limited, La Tuque, Que., on June 9.

# Obituaries

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

**Charles James Crowley,** M.E.I.C., died at Toronto on May 6, 1943. He was born at Bromley, Kent, Eng., on January 11th, 1860. He received his primary education in England, France and Germany, and later studied mathematics under private tutor and attended drafting and technical classes at King's College, London.

He came to Canada in 1879 and entered the drawing office of the Grand Trunk Railway at Montreal. He rose successively from the positions of rodman, topographer, leveller and transitman on railway surveys. He was transferred to Toronto, and in 1886 he was placed in charge of double track construction between Montreal and Toronto. From 1892 to 1897 he was resident engineer in Toronto for the Grand Trunk Railway. From July, 1897 to June, 1898 he was resident engineer of the Middle division of the Grand Trunk Railway covering at that time 1600 miles of road. He resigned his position with the railway in 1898 and engaged in private practice. After 2 years spent in hydro-electric development he returned to railway work in 1900 with the Central Vermont Railroad and was successively employed with the Grand Trunk Western at Detroit, and the D.L. & W. at Newark.

In 1904 he engaged in the construction of subways and tunnels in the United States and from there on was connected with some very outstanding projects. From 1905 to 1908 he was works manager for the Hudson and Manhattan Railroad and in this capacity was in full charge of the construction of two tunnels under the Hudson river and all connected work. From 1910 to 1913 he was superintending engineer on construction of Hale's Bar Dam Tennessee. From 1913 to 1915 he was works manager on construction of subways in New York.

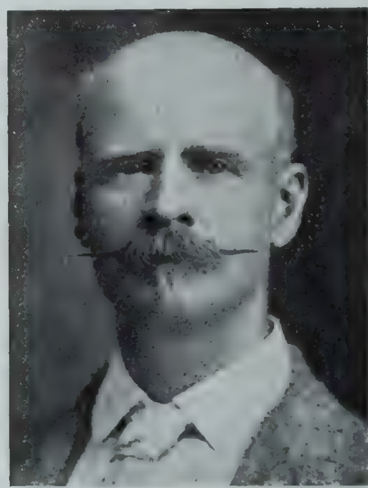
In 1915 the consulting firm of Fitzhugh-Crowley was established in New York with Mr. Crowley as vice-president and chief engineer. In this capacity he carried out a successful practice in New York as railway and construction consultant until 1924 when he returned to Canada and was engaged by the City of Toronto on subway work. Mr. Crowley had retired from active practice several years ago and was living in Toronto.

Mr. Crowley was one of the early members of the Institute having joined as an Associate Member in 1887. He had been transferred to a Member in 1889 and had been made a Life Member in 1932.

**Robert Livingstone,** M.E.I.C., pioneer mining engineer in Alberta, died in the hospital at Lethbridge, on April 10, 1943. He was born at Youngstown, Ohio, U.S.A., on December 9, 1872. He entered the profession of engineering and was employed in mining work in Tennessee before coming to Canada. He went to Lethbridge in 1896 as underground foreman for the Alberta Railway and Irrigation Company, where he was employed until 1906, when he became mine manager and engineer for the Standard Coal Company, at Edmonton. In 1908, he went with the Alberta government as district inspector of mines in Lethbridge and Calgary. Later he became chief inspector of mines for the province leaving that position in 1910 to return to Lethbridge as manager of the Galt Mine of the Canadian Pacific Railway. When, in 1935, amalgamation took place of the North American Collieries at Coalhurst, Cadillac Collieries at Shaughnessy and C.P.R. Galt mines into the Lethbridge Collieries, he became general manager, which post he held until his retirement in 1938.

Mr. Livingstone joined the Institute as a Member in 1923. He was chairman of the Lethbridge Branch in 1925-26 and was a councillor of the Institute in 1928. He was also a member of the Association of Professional Engineers of Alberta which he represented in the Senate of the University of Alberta during eight years.

Robert Livingstone, M.E.I.C.



Lewis Redman Ord, M.E.I.C.

Cyril Barron Symes, M.E.I.C.

**Lewis Redman Ord,** M.E.I.C., died at his home in Toronto on December 27, 1942. He was born on October 17, 1886, at Toronto. He was educated at Goderich Grammar School and engaged in surveying work in 1872.

In 1874-75 he was on special survey under Lindsay Russell, assistant surveyor-general, Manitoba; in 1876-80, on geological survey of Canada; 1881 on special survey; in 1882, as Dominion land surveyor, on township outline of the plains; in 1882-3-4, as Dominion land surveyor in N.W.T., plains, Battle river and Edmonton district; in 1885, instrumental in formation of D.L.S. (Dominion Land Surveyors) Corps, during Riel Rebellion, was at Batoche; 1886-7-8, surveys on Canadian Pacific Railway; in 1889-90, work in Florida; 1891-92 B.A.F.C. del Sud, on location and construction in Argentina, S. America; 1893-99, location and construction, Florida East Coast Railway; 1900-1-2, Great Northern Railway, location and construction in Quebec; 1903-4-5-6, Grand Trunk Pacific, reconnaissance and location north of Kenora, Edmonton and Pine River Pass to summit of Bulkley, B.C.; 1907, sub-division land surveys, Lakes Winnipeg and Manitoba; short reconnaissance, Hudson Bay Railway, north of the Pas Mission; subdivision township surveys, Manitoba; stadia survey of Lake le Rouge, north of Prince Albert, Dominion Lands; stadia survey of islands of Georgian Bay, Ontario Lands and Forests; 1910 winter subdivision of Townships, Edmonton and Athabaska Landing; service of Messrs. Price

Bros., lumber and pulpwood, Quebec; 1913-14, construction of railway ferry dock, Quebec.

1915-27, survey practice in Barrie.

From 1928 to 1932, he was with the Ontario Hydro-Electric Power Commission.

Mr. Ord joined the Institute as a Member in 1897. He was a charter member of the Toronto Branch.

**Cyril Barron Symes,** M.E.I.C., city engineer of Fort William, Ont., died suddenly on April 26, 1943. He was born at Winnipeg, Man., on May 10, 1888 and went with his parents to Fort William ten years later. He was educated at the Fort William Collegiate and later took correspondence courses in engineering.

Following his graduation he started work under J. L. Davidson, who was then town engineer. With Mr. Davidson as engineer, Mr. Symes started on the survey for the Kaministiquia Power Company, and was employed until the construction was completed in 1906. At this time he entered the town's services as an instrument man on construction of the Loch Lomond water supply, under H. S. Hancock, city engineer. Mr. Symes was made assistant and acting engineer in 1917, and city engineer in 1918.

He was responsible for the paving of the city and cement sidewalks. He relayed the sewage system in the north end of the city, gradually changing it. The sewage disposal system was erected under his supervision three years ago.

Paying tribute to the city engineer, Mayor Garfield Anderson said that Mr. Symes was conscientious about his duties, endeavoring at all times to protect the interests of the city. "He is one of the oldtime city employees and will be greatly missed not only by his fellow workers but the citizens as a whole."

Mr. Symes joined the Institute as an Associate Member in 1922 and he became a Member in 1940.

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## BORDER CITIES BRANCH

W. R. Stickney, M.E.I.C. - *Secretary-Treasurer*
J. F. Blowey, M.E.I.C. - *Branch News Editor*

The monthly dinner meeting of the Border Cities Branch was held at the Prince Edward Hotel on Friday, March 19, at 6.45 p.m. Thirty-two members and guests were present for the dinner and ten additional attended the meeting afterward.

The chairman called on Mr. MacQuarrie to introduce the speaker of the evening, Mr. R. B. Young, assistant chief testing engineer for the Hydro-Electric Power Commission of Ontario, whose subject was **Recent Developments in Concrete Technology.** Mr. Young is the author of many papers dealing with cements and is an internationally recognized authority on the subject of concrete mixtures.

In the early days of the cement industry there were many kinds of cements, but an organized effort eliminated individual specifications, and in 1921 the Committee on Cement of the A.S.T.M. drew up a specification which provided for only one grade of cement to be known as Portland cement. But about this time there began the gradual development of special cements, each designed for a specific purpose. About the first o these were aluminous cements whose principal property was the ability to gain strength very rapidly; following this came masonry cements having two properties in common, a high degree of plasticity and capacity to retain water.

After the discovery that serious internal cracks may be caused in large concrete structures by the development of a large amount of heat during setting, a low-heat cement was developed, and later on a modified low heat cement which, because it would not take so long to harden and cure, was more suitable for many types of construction such as in cold weather. The latter has been used to a limited extent in Canada.

At the same time there came on the market another type of Portland cement to meet the demand for one resistant to alkali attack. Kalicrete, one of these, was developed in Canada and others were developed in the U.S. and called sulphate-resisting cements.

The latest development is treated cement; this is one to which a foreign material has been added to give it some desired property not otherwise possessed. Such substances as beef tallow, crusher oil and vinsol resin, when added in minute amounts to cements, decrease its strength but increase the plasticity of the concrete and increase its resistance to freezing and thawing, and when used in pavement slabs increase its resistance to scaling caused by repeated applications of chloride salts.

Originally it was thought that in aggregate for cement, the sand grains should be of graded size with coarser grains predominating. It was learned, however, that concrete made from coarse sands was harder to work, segregated more readily and was difficult to finish. Later, as engineers realized the importance of a truly workable concrete and the part the finer materials in the aggregate played in obtaining it, there came a demand for more fines in the sand and better concrete is the result.

Another new development in the manufacture of cement is the application of absorptive form linings for removing water from concrete immediately after setting. Several methods have been used but the practical use of most of them is limited; the H.E.P.C. of Ontario have used absorptive wall boards covered with cheese cloth which will remove water from the surface of concrete to about a depth of one-half inch, giving it what amounts to a case hardening. Such surfaces are more resistant to severe exposure, erosion or frost action.

In conclusion, Mr. Young stated that good concrete is much more prevalent now than a few years ago. Education has been partly responsible for this improvement but so has the ready-mix industry which has carried the precise methods of the large well-engineered concrete job into towns and cities and taught engineers and architects what concrete should be. The best of concrete can be ruined in handling and placing and workmanship is still a major factor in obtaining a satisfactory product, so that craftsmanship must not be forgotten to ensure quality in our structures and machines.

Many interesting slides of different structures and roads in various lengths of service were shown during the lecture.

## EDMONTON BRANCH

F. R. Burfield, M.E.I.C. - *Secretary-Treasurer*
L. A. Thorssen, M.E.I.C. - *Branch News Editor*

The April meeting of the Edmonton Branch of the Institute was held in the drawing room of the Macdonald Hotel on April 29, 1943, at 6.30 p.m. It was preceded by a dinner for 67 members and visitors. The business of the meeting included the selection of a new slate of officers for the 1943-44 season. The personnel of the new executive is listed on p. 333.

The retiring chairman, Mr. D. Hutchison, gave a brief review of the past session activities before turning over the chair to his successor, Mr. C. W. Carry of the Standard Iron Works. The speaker of the evening was Mr. L. A. Thorssen, who gave an interesting and instructive talk illustrated by slides of the hydro-electric development recently constructed at Shipshaw in Quebec.

# PRESIDENTIAL VISIT TO HALIFAX BRANCH

***Head table, right to left:* I. P. Macnab, Hon. L. D. Currie, General Secretary L. Austin Wright, Chairman A. E. Flynn, the president, Pro-Mayor Alderman G. E. Kinley and Dr. F. H. Sexton.**

**Chairman A. E. Flynn with the president and Dr. Sexton in the background.**

**Council meeting of Association, Dr. A. E. Cameron presiding. S. W. Gray in foreground and President K. M. Cameron on the chairman's left.**

**At Association Council meeting—*from left to right:* C. Scrymgeour, L. E. Mitchell, Michael Dwyer, F. W. W. Doane, I. P. Macnab, S. W. Gray and President A. E. Cameron.**

**Michael Dwyer and K. L. Dawson.**

**First chairman of Branch, F. A. Bowman with P. A. Lovett on his right and D. C. V. Duff on his left.**

## HAMILTON BRANCH

W. E. Brown, M.E.I.C. - *Secretary-Treasurer*
L. C. Sentance, M.E.I.C. - *Branch News Editor*

Wednesday, May 19, marked the occasion of the official visit of President K. M. Cameron to the Hamilton Branch; Dr. L. A. Wright, general secretary, accompanied Mr. Cameron. After a tour of Hamilton industrial plants, the presidential party repaired to McMaster University, where dinner was served to some sixty members and guests.

**T. S. Glover, chairman of the Hamilton Branch**

T. S. Glover, branch chairman, presided, and opened the meeting proper by introducing H. F. Bennett, chairman of the special Institute committee on the young engineer. Mr. Bennett spoke briefly on the work of his committee.

H. A. Cooch introduced President Cameron to the assemblage as eminently qualified to speak on **The Engineer and Post-War Construction.**

Mr. Cameron prefaced his remarks with information regarding the recent extension of Institute interests and activities as evidenced by the formation of committees to study problems of a sociological nature. The work of the Government Advisory Committee on Post-war Reconstruction was briefly described, and due tribute paid to Dr. James.

The duty of the Sub-committee on Construction Projects was described as the investigation of construction projects which might be instigated after the war, for the alleviation of unemployment problems. On the basis of the present situation, rehabilitation of 600,000 members of the armed forces, and approximately 500,000 civilian workers who had not been employed in industry prior to the present emergency, must be accomplished. The fallacy of embarking on a construction programme principally as a panacea of unemployment was pointed out as the fact that some constructional projects, when completed, often make no further contribution to the community.

The speaker stressed the importance of a vigorous and realistic attack upon the problems of rehabilitation—such efforts, however, to be tempered always by the unfortunate experiences of the period subsequent to 1918.

The successful accomplishment of the desired end depends on the determined execution of a plan, and the engineer, as the advocate of most careful and timely planning, must ever strive to impress upon the proper authorities the wisdom of,

***From right to left:*** **A. H. Wingfield, H. F. Bennett, Alex. Love, L. Austin Wright, T. S. Glover, K. M. Cameron, H. A. Cooch**

and the necessity for the early and complete preparation of their course of action.

Dr. L. A. Wright, general secretary, gave a brief report of Institute affairs, covering membership, finances, and committee activities. Special attention was being given, Dr. Wright stated, to the position of the engineer in the armed forces.

W. L. McFaul suitably expressed, to Mr. Cameron and to Dr. Wright, the thanks of the 75 members and friends who were present.

Through the courtesy of Mr. D. M. Chisholm, sales manager of the Norton Company of Canada, two interesting and informative films on the manufacture and use of abrasives, were shown.

## LAKEHEAD BRANCH

W. C. Byers, Jr.M.E.I.C. - *Secretary-Treasurer*
R. B. Chandler, M.E.I.C. - *Branch News Editor*

A dinner meeting of the Lakehead Branch was held in the New York Lunch at Fort William on April 29, commencing at 6.30 p.m.

The chairman, Miss E. M. G. MacGill, presided at the meeting.

W. H. Small paid tribute to the late C. B. Symes, city engineer of Fort William, whose sudden death occurred on April 26. A moment of silence was observed in honour of Mr. Symes.

The speaker of the evening was Mr. A. D. Norton, chief tool designer and methods supervisor at the Canadian Car and Foundry Co. Ltd. in Fort William. The title of his address was **A General Survey of Aircraft Tooling Problems.**

He described the breaking down of the aircraft into its various components and working out of the sub-assemblies and the preparation of a programme of tooling to produce the correct number of parts in the required time. The development of several basic tools and jigs was discussed and illustrated. He pointed out the importance of the time element for each operation, and showed how thousands of man-hours can be saved in the construction of an aircraft.

## MONCTON BRANCH

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

Technicolour films depicting engineering construction, under northern conditions, were shown at a meeting of the Engineering Society of Mount Allison University, held on April 13. The films were taken to Sackville by H. J. Crudge and V. C. Blackett, chairman and secretary respectively of the Moncton Branch. James Fraser, president of the Engineering Society, presided at the meeting.

On April 14th, a dinner meeting was held in honour of Mr. K. M. Cameron, president of the Engineering Institute

Chairman H. J. Crudge of Moncton welcomes President K. M. Cameron, seated on his right with Councillor G. L. Dickson. At opposite end of the table is Past-President H. W. McKiel

of Canada. H. J. Crudge, chairman of the branch, presided. Thirty-four members and guests were present. During the course of the dinner, vocal selections were rendered by LAC Griffith John and Corporal George Pryde, both of the R.A.F.

Councillor N. B. MacRostie, the first speaker, conveyed the greetings of the Ottawa Branch to the meeting.

President Cameron in a short, humourous address, told of the progress of the Institute since its organization over 60 years ago, and of the problems it had faced. He gave a résumé of the present "all out" war effort of Canadian engineers and the assistance and encouragement given them by the Institute. Chief among wartime committees mentioned were, the Wartime Bureau of Technical Personnel and the Post-War Planning Committee. Special reference was made to the work of the committee that had pressed for Government action in raising salaries of engineers in the Civil Service to a level comparable with that maintained in industry. The president predicted that there would be repercussions in other Government services and in the Government railways.

Mr. Cameron was followed by Dean McKiel, who spoke in appreciation of the president.

The general secretary, Dr. L. Austin Wright, was congratulated by the chairman, on the degree recently conferred upon him, an honour well merited. Dr. Wright spoke briefly on the status of engineers in the armed services and the progress that had been made in obtaining for them the same recognition as was given members of the other professions.

The meeting closed with the singing of the national anthem.

Moving pictures dealing with engineering projects in Labrador were shown at a branch meeting held in the City Hall, on April 20. A vote of thanks to Major A. S. Donald for obtaining the loan of the films, was moved by C. S. G. Rogers and seconded by G. E. Smith.

*From left to right:* W. R. Godfrey, T. D. Pickard, C. W. Milton, G. C. Torrens, C. Reuben, H. J. Chapman; in the foreground, G. E. Smith

## MONTREAL BRANCH

L. A. Duchastel, M.E.I.C. - *Secretary-Treasurer*

Summary of the meetings held lately by the Montreal Branch:

March 4th, 1943—**Launching of 10,000 Ton Cargo Vessels,** by P. G. A. Brault. The paper dealt with the launching computations and local yard conditions which affect the launching cradle design. It described the cradle construction adopted, and the author discussed the results of observations taken at actual launchings during 1942. The paper was illustrated with slides.

March 11th, 1943—**The Technician at War,** by Dr. H. G. Littler. The paper dealt with the effects of the war on technicians generally, and in particular, with the relations between technicians and the rest of society, as modified by economic changes accelerated by the war.

March 18th, 1943—**Modern Engineering in Timber,** by Carson F. Morrison. The paper dealt with many phases of the design of structures built of timber and included the use of timber connectors, as well as glued laminated construction. The paper was illustrated with examples of some of the latest structures, and samples of typical joints were exhibited.

March 25th, 1943—**Wartime Chemicals and Explosives Programme**—Harold Crabtree. Mr. Crabtree is president of Allied War Supplies Corporation and his paper dealt with the organization of the chemicals, explosives and ammunition production programme. A tropical motion picture was shown.

April 1st, 1943—**Pre-stressed Concrete**—A. J. Durelli. The speaker, an Argentinian engineer, spoke on the general methods of pre-stressed concrete design and construction, and mentioned the research work he was doing at Ecole Polytechnique, where he was delivering a course of lectures.

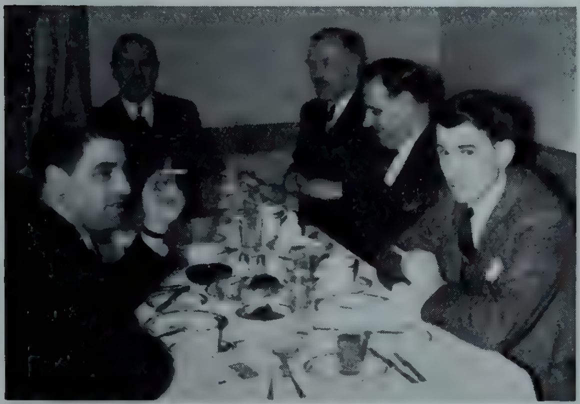
The presidential party stopped at St. Francis Xavier University, Antigonish, on their way to Sydney. *From left to right:* General Secretary L. Austin Wright, O. S. Cox, G. T. Clarke, President K. M. Cameron, Rev. Dr. P. J. Nicholson and Father Clarke

The boys at St. F-X. listen with keen interest to President Cameron

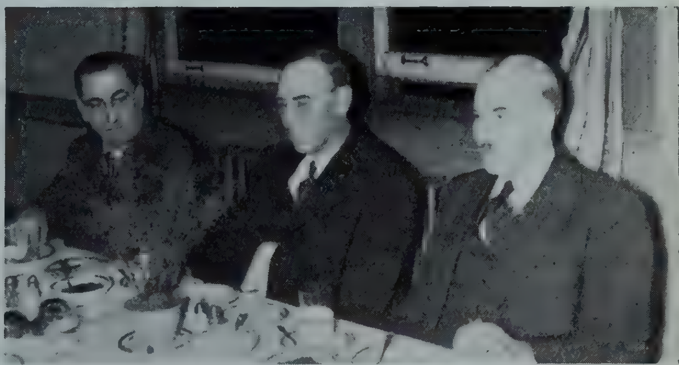
# THE PRESIDENT VISITS THE CAPE BRETON BRANCH

Head table, *left to right*: Lieut.-Colonel Dobbie, the president, F. W. Gray, the general secretary and Capt. Schwerdt, R.N.

*Left to right*: Col. J. A. McDonald, W. E. Clarke, C. M. Anson, T. L. McCall, J. H. Fraser and S. C. Mifflen, secretary-treasurer.



*Left to right*: C.V. Dunne, C. M. Smyth, M. F. Cossitt, W. A. McDonald, G. T. Clarke.



*Left to right*: Otis Cox, A. McDonald and D. S. Morrison.

## PETERBOROUGH BRANCH

A. R. Jones, M.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, Jr.E.I.C. - *Branch News Editor*

Two papers were presented at the Students and Junior Night, Thursday, May 6th.

A. C. Northover spoke on **New Methods and Substitute Materials in Wartime Construction.** Regulations on the conservation of metal products have forced the increased use of less vital materials such as timber, concrete, brick. For structures, the factors most prominent in the choice of methods and materials are floor loadings and spans. Timber construction is the cheapest—in the order of 20 per cent under reinforced concrete. Refinements in timber construction have tended to make it even more serviceable than in the past. Of particular interest is the development of timber connectors such as the Teco connector which eliminates a substantial number of bolts and results in a more efficient joint. These are small metal rings of various shapes that are set into the wood about the bolts and distribute the stress. Economies may run from 10 to 50 per cent over truss construction with bolts and plates.

Glued wood construction as applied to trusses, beams and columns was described in full. Large sections are built up from comparatively thin pieces of timber which are glued together, pressure being applied by either nails or clamps to permit proper setting of the glue.

In concrete constructions, sections are being made heavier to reduce the content of reinforcing steel. In another field, soil cement blocks promise to be a useful material, slightly cheaper than concrete. They have much better insulating properties and do not require gravel or stone, a consideration in localities where these materials are scarce. Much has been said about the use of plastics in construction but at the present time the two severest handicaps are cost and methods of fastening.

Mr. Northover told how large buildings were being erected of non-critical material with negligible use of metal for fittings, nails, connectors and such other details only.

G. M. McHenry's paper **Some Aspects of Boulder Dam Project** was of a more general character. The speaker confined himself to the treatment of unusual or unique features of the development rather than attempting a comprehensive report.

The Colorado river on which the dam is located has two distinguishing features. The variation of stream flow from spring to autumn is enormous and the quantity of silt in the water may run as high as 15 per cent by weight. For this reason the river without extensive control was useless for power or irrigation. Now, the storage basin for the boulder dam will hold two years flow so it not only furnishes a uniform supply of water for power but also serves as a sedimentation basin freeing the water of silt so that it may be used for irrigation projects. A third utility is served by the system as it provides a source of municipal water supply.

The prodigies of engineering and construction performed by a western syndicate has been amply described in various publications. Mr. McHenry, however, presented a few figures to enable the audience to visualize the scale of operations. Interesting sidelights were the erection of a cement mill and a rolling mill on the site. Some excellent kodachrome slides revealed that the whole project blends harmoniously with the locale.

Something over a million and a quarter is immediately involved and the use of all this power introduces some features of interest in the distribution system. Operation and distribution of power from individual machines is allotted to four separate bodies, although power may be transferred from any machine to any system if required. Due to complications involved by several operating concerns and other factors, the distribution system has highly refined automatic features. Distances involved caused the

## PRESIDENTIAL VISIT TO FREDERICTON

In Memorial Hall. Dr. Turner opens the meeting and B. H. Downman, president of Engineering Society welcomes the president.

H. W. McFarlane thanks the visitors. Also visible are R. F. Coffin, D. H. Green, J. J. Donohue, J. A. Turnbull, I. M. Beattie and E. Mean.

Student engineers in University Air Training Corps.

*Extreme right front* Sgt. T. H. McSorley, 1944 President of Eng. Soc.

*Very back alone* G. H. Loane, Winner Institute Prize, 1942.

"And we'll all have tea." Dr. and Mrs. Turner entertain at their home.

*Left to right*: J. P. Mooney, D. R. Smith, Prof. Harry Moore, Mrs. Mackenzie, Mrs. Turner, K. M. Cameron, M. W. Black.

choice of 287 Kv., a record high voltage for use in transmission.

Despite the large sum involved and in addition to the public benefits with no money return, the project will be self liquidating over a period of 50 years. If no further precautions are taken the silt will destroy the usefulness of the storage basin in about 100 years. The speaker concluded that the U.S. could scarcely have afforded to pass up the construction of such a beneficial system as that at Boulder Dam.

### SAINT JOHN BRANCH

G. W. Griffin, M.E.I.C. - *Secretary-Treasurer*

The Saint John Branch was visited by Mr. K. M. Cameron, president of the Institute; Dr. L. Austin Wright, general secretary, and other members of Council, on April 15th, 16th and 17th.

The present healthy relations between the Institute branches and the professional associations was Mr. Cameron's theme in addressing the Saint John Branch at a supper meeting held in his honour on the evening of 16th April.

Every step should be taken to further this relationship, he observed, declaring that both bodies have the same objective, advancement of professional engineering in Canada. "The Association is a necessity" stated Mr. Cameron "and is entitled to the enthusiastic support of the Institute."

The president was in disagreement with the belief in some circles that a "super organization" was required to speak for the profession. This was to be in addition to the existing bodies. There would be very little gained but rather the Institute stood to lose much of the prestige which it had gained over its 60-year period of existence as the representative engineering body in Canada, he thought.

The meeting was presided over by A. O. Wolff, vice-chairman of the Branch and other speakers were Mayor C. R. Wasson, Professor E. O. Turner, president, Association of Professional Engineers of New Brunswick; Professor H. W. McKiel, Mount Allison University, past president of the Institute; Dr. Wright; Messrs. N. B. MacRostie, Ottawa, G. G. Murdoch and John H. Flood, Saint John.

Other special guests were Capt. C. J. Stuart, R.C.N.R., Naval Officer in charge, Saint John; F/O C. M. Campbell, Station Adjutant, R.C.A.F., Saint John; and S. R. Anderson, Toronto. There were also many members from Fredericton and several from Moncton.

Arriving from Moncton on the morning of the 15th, Mr. Cameron and party accompanied by the executive of the Saint John Branch drove to Fredericton where a luncheon was arranged by Professor E. O. Turner for the party. Some 75 persons attended the affair, including many Fredericton members and students from the University of New Brunswick. So enthusiastic was the student body regarding Mr. Cameron's visit that many were unable to gain access to the luncheon.

In the afternoon, Mr. Cameron addressed the Engineering Society of U.N.B. He outlined the problems facing the youth of today going out into the world. He had confidence that they would be equal to the tasks confronting them and expressed the opinion that "the present generation will be the salvation of this country."

Dr. Wright spoke regarding conditions of uncertainty under which science students graduating from Canadian universities had worked this year and told of steps the Institute had taken to clarify the situation. Speaking of decisions reached by the Wartime Bureau of Technical Personnel regarding the placing of science graduates this year, Dr. Wright said that those who did not enter the armed forces would be assigned to industry.

Affiliations of the Institute with similar bodies in the United Kingdom and United States were spoken of by Dr. Wright who impressed on the graduating class the duty that was theirs in upholding the fine reputation which Canadian engineering enjoyed in other countries.

After an inspection of the University buildings the presi-

# THE PRESIDENT VISITS THE SAINT JOHN BRANCH

The president speaks. Oscar Wolff on his left and Capt. C. J. Stuart, R.C.N.R. on his right.

Alex. Gray, N. B. MacRostie and Past-President H. W. McKiel dine together.

Head table: *left to right:* the president, Chairman A. O. Wolff, Mayor C. R. Wasson, F/O C. M. Campbell, and Dr. E. O. Turner, president of the Association of Professional Engineers of New Brunswick.

W. J. Lawson, W. D. MacDonald, J. G. Bishop, H. Stephenson, H. C. Lawton and F. P. Vaughan.

F. A. Patriquen, G. L. Phillips, G. W. Griffin, F/Lt. F. H. C. Sefton, C. C. Kirby and John Warner.

V. S. Chesnut, J. M. Lamb, E. B. Martin, J. N. Flood, S. Hogg and T. S. Moffat.

dential party enjoyed afternoon tea at the home of Professor and Mrs. Turner.

Saturday, 17th April, was devoted entirely to a Council meeting presided over by President Cameron. Councillors from Montreal, Ottawa, and Toronto attended, together with representatives of all the maritime branches. Members of the executive of the Saint John Branch were present as guests.

The Saint John Branch held its annual supper and business meeting on May 11th at the Admiral Beatty Hotel. There were 29 members present.

After the supper two very interesting films were shown, one being a General Electric sound picture entitled "Railroadin' "; the other one of the "Canada Carries On" series, entitled "The Battle of Brains." The business meeting was then called to order. As a result of the election, officers elected for the year 1943-44 are listed on page 333.

## SASKATCHEWAN BRANCH

Stewart Young, M.E.I.C. - *Secretary-Treasurer*

The Saskatchewan Branch met jointly with the Association of Professional Engineers in the Saskatchewan Hotel, Regina, on the evening of May 20 to welcome W. P. Dobson, president, Dominion Council of Professional Engineers, G. G. Murdoch, vice-president (Maritimes) E.I.C. and W. R. McCaffrey, secretary, Canadian Engineering Standards Association. In attendance also were members of the Saskatchewan Section, A.I.E.E. The meeting was preceded by a dinner at which the attendance was 40.

After stating the purpose of the meeting, Chairman-President A. M. Macgillivray introduced G. G. Murdoch who conveyed greeting from the Maritime Branches and Associations. He also expressed appreciation of attendance at a joint executive-council meeting of the Saskatchewan Branch and the Association of Professional Engineers.

W. R. McCaffrey, secretary, Canadian Engineering Standards Association, was introduced by J. R. Young, secretary, Saskatchewan Section, A.I.E.E. Colonel McCaffrey outlined the activities of the Association and requested the support of Saskatchewan engineers when called upon to assist in committee work under the association.

The various codes are drawn by men representing consumer and producer interests in all the provinces of Canada. When war broke out a demand arose for British standard specifications. Copies of these are now carried by the association for use of those Canadian industries manufacturing goods for British consumption.

Shortage of materials has caused revision of many code rules to provide for the use of substitutes. The procedure is through an emergency committee which establishes the use subject to ratification by the regular standing committee having charge of the particular code.

The main speaker of the evening, W. P. Dobson, was introduced by D. A. R. McCannel, past president, Dominion Council of Professional Engineers.

Mr. Dobson, taking as his subject **Science in a Changing World,** stated that there had been two main causes of the development of scientific thought during the past two hundred years: neglect or the setting aside of (1) the authority of opinion and (2) emotional effect.

Prior to the period of the renaissance, scholasticism, based on argumentation had prevailed. Supplanted by research based on reason and experiment, science had developed to the point where it might be expected to influence government and offset or overcome the creation of public opinion by political demagogues. Statesmen, in general, do not understand the impact of science on society; otherwise greater thought would have been given to the solving of our present social difficulties. The application of scientific method to government is essential. Our problems must be studied from the point of view of search for truth rather than any preconceived notion of political or party prejudice. In this respect engineers could so exert pressure on the education of the coming generation as to compel leaders of public opinion to take into account the scientific approach to world problems.

In thanking the speakers, Professor R. A. Spencer, acting dean of engineering, University of Saskatchewan, pointed out that, in many instances, high placed executives are now engineers, a condition not in existence a few years ago; and, further, notwithstanding the rapid scientific advancement of recent years, many of our high placed executives are ignorant of fundamentals; the inference to be drawn being that the scientifically trained mind will gradually supercede.

### SAULT STE. MARIE BRANCH

O. A. Evans, M.E.I.C. - *Secretary-Treasurer*

The fourth general meeting for the year, 1943, was held in the Lounge Room of the Windsor Hotel on Friday, April 30, 1943 at 6.45 p.m., when sixteen members and guests sat down to dinner.

An item arising out of the minutes re "Engineers Pay in Government Service" was discussed. E. M. MacQuarrie, felt that engineers in the employ of the Government receive ridiculously low salaries for their services. He then moved the following motion which was seconded by L. R. Brown, and amended by A. M. Wilson. "In the interest of the Dominion of Canada, the Sault Ste. Marie Branch of The Engineering Institute of Canada is strongly of the opinion that engineers in the Government employ should be men of outstanding talent. As it is impossible to secure and retain the services of men of the highest calibre at the present inadequate scale of remuneration, we urge the Government to pay salaries to engineers which are more in line with those paid in the business world for similar work and responsibilities."

K. G. Ross, spoke on the motion for some time. He felt that as Canada is a pioneer country it would need men of excellent talents and top notch engineers should be amongst them, and the Government, which was a large employer of talents of all kinds could not keep capable men in their employ, if they continued to pay meagre salaries.

The chairman N. C. Cowie, introduced the speaker of the evening W. C. Buller, manager of the Dominion Oxygen Company. Mr. Buller had a number of films depicting the cutting of shapes by the oxy-acetylene torch and on flame priming and flame hardening which clearly illustrated the rapid strides that are being made in this branch of industry. Mr. Buller praised the co-operation of the industries in the Sault. At the conclusion of the films the speaker was asked numerous questions relative to oxy-acetylene work.

C. J. Ferguson, in moving a vote of thanks to the speaker said that he had attended few meetings which held the general interest of the people so well.

### TORONTO BRANCH

Junior Section

The April meeting of the Junior Section of the Toronto Branch was a dinner held at Diana Sweets, Bloor and Avenue Road on the 22nd. Mr. Van Winckle presided. Approximately 74 attended, including the Executive of the Toronto Branch. Professor Legget after saying a few words on behalf of Dean Young regarding the military rank of engineering graduates entering the armed services, introduced Mr. Laughlin who presented our section with a minute book on behalf of the branch executive.

The subject of the evening was **Reconstruction,** and the speakers, Mr. John Lang '35 Architecture U. of T. and Mr. E. A. Ricker, Planning Section, H.E.P.C. Mr. Lang spoke on the planning of towns of 5,000 to 7,000 persons where building obsolescence is extremely high, and little planning has been done. Larger parks should be provided, neighborhood units created, towns kept as compact as possible and planned on the basis of utility. Mr. Ricker reviewed Mr. Paul Ackerman's address before the A.I.E.E. entitled **Industrial Democracy and its Survival.** It was stated that in order to provide full employment the working life of man must be shortened to 20 years with a very extensive social security programme to encourage spending. A lively discussion, showing the wide diversity of opinion on the general subject, took place.

### VANCOUVER BRANCH

P. B. Stroyan, M.E.I.C. - *Secretary-Treasurer*
Archibald Peebles, M.E.I.C. - *Branch News Editor*

The subject of the address at the April meeting of the branch was **The Weyerhaeuser Hydraulic Barker and Log Chipping Unit.** The speaker was D. Keith MacBain, chief engineer, Pulp Division, Weyerhaeuser Timber Co., Everett and Longview, Wash.

The new hydraulic barking and chipping unit recently put into operation at the Everett pulp mill of the Weyerhaeuser Timber Co. is a revolutionary development in the method of producing chips for high grade wood pulp. Embodying a new principle for removing the bark from pulp logs it is quite different from the conventional tumbling barkers used by most mills. A great deal of research work was required before the idea could be translated into a smooth working and efficient unit. The principle employed is to use high pressure hydraulic jets to disintegrate the bark, leaving the log virtually clean. The idea was first discussed in 1931 and experimental work was begun in 1935. It was found that bark could be readily removed by high pressure jets suitably located. Other problems were introduced, especially the handling of the log to make efficient use of the water jets.

Two half-inch nozzles of chrome plated steel are set about five inches apart and placed below the log to direct streams upward against the bark. The jets are mounted on a moving carriage which travels along the log at a rate of 24 ft. per sec., then reverses in one-half second for a return pass.

An eight-inch strip of bark is removed at each pass, and during the half second reversal period the log is indexed or rotated a suitable amount for removal of the next eight-inch strip of bark. Jet pressure is 1,450 lb. per sq. in. and 875 gal. per min. are used. The pump which provides this water is driven by a 1,000 hp. motor at 3,600 r.p.m. Logs from 9 to 72 in. in diam., and from 11 to 26 ft. in length can be handled by the barker. Logs 20 in. diam. are barked at the rate of 3 per minute. The average capacity of the unit is 30,000 board ft. per hour, though it can handle 60,000 board ft. per hour. The difference is due to irregularities in feeding logs to the nozzles. The outer bark and also the tough inner bark or cambium layer are removed, without damage to the wood beneath. This is in contrast to the drum barker, which destroys from ½ to ¾ of an inch of wood before the bark is completely removed from the log. In large scale production this becomes an important item.

In Pacific Coast pulp mills where large logs are used, they are cut into blocks of various sizes before going to the chipping machines. The blocks are usually the same size as those fed to grinders for mechanical pulp in those mills which manufacture newsprint. In the present case the logs are not cut, except those too large in diameter for the chipper disc. These are sawn with a band saw in the usual manner, except that the carriage is operated by the sawyer, as automatic setting dogs are used. The chipping unit is conventional in type but very much larger than any heretofore used. The disc carrying the four knives is 171 in. in diam. and 10½ in. thick. It weighs 38 tons and is driven at 240 r.p.m. by a 1,000 hp. induction motor. The disc and motor rotor, shafting, etc., together weigh 47 tons. This tremendous size was used for its flywheel action, absorbing any irregularities in log size, toughness, or rate of feed. Timken bearings, 26 in. outside diam. are used. Logs are fed to the chipper at 60 ft. per min. by a conveyor, and chips are removed from beneath the disc on a 60-inch chain conveyor and a 60-in. belt.

Owing to priority troubles it was difficult to secure materials and machinery for this new plant. Steel could not be obtained for the chipper disc, so it was built up by laminating half-inch plates. These were salvage from the ill-fated Tacoma Narrows bridge. The plate edges were solidly welded on the outer rim, on the inner rim around the shaft housing, and around the knife slots. They were also plug welded through holes already in the plates used. A one-inch rim was then shrunk on the outside and the complete disc machined to balance. In operation, the knives are pointed by a portable grinder three times per day, and changed twice each day during the meal hour shut downs. The disc can be brought up to speed or stopped from full speed in 67 sec. Braking is accomplished by reverse current through the motor.

The most difficult problems in the design of this new plant were those of handling and control. Electric power and oil hydraulic power were used in place of the more common air and steam used in pulp mills. The various operations of the barker and chipper units with the various log handling devices required, are programmed and occur automatically through the use of relays on the switchboard. While the power factor is somethat upset by the two 1,000 hp. motors used, fluctuations are relatively small and are easily handled by the generators in the mill power plant.

The entire equipment is housed in a new structure which employs a much higher type of construction than most sawmill buildings. Treated piling and timber is used throughout, with concrete floors and reinforced concrete machinery footings. The cost of the new plant was high, partly by reason of its experimental nature, and partly owing to difficulty in securing labour and materials. A second installation could probably be built under normal conditions for about half the sum required in this instance.

Following are a few comparative figures showing the increase in efficiency over the old methods and plant, which is now inactive:

| | Old Plant | New Plant |
|---|---|---|
| Water used per day | 555,000 gals. | 550,000 gals. |
| Men to operate plant | 78 | 20 |
| Man-hours per ton of chips | 1.04 | 0.29 |
| Loss in wood | 19.16% | 4.77% |
| Power consumption | 1,810 k.w. | 1,700 k.w. |

The speaker illustrated his address with 400 ft. of film and many excellent photographs. Questions from the audience brought out many details and gave everyone an excellent picture of this remarkable addition to the pulp making industry. Mr. W. N. Kelly, branch chairman, presided, and a vote of thanks was proposed by W. H. Powell. About 40 members were present.

At a meeting on Monday, May 17, in the Medical-Dental Building, Harry C. Anderson, assistant chief engineer of the Department of Public Works of B.C., gave an address on **The Alaska Highway.** Mr. Anderson visited the southern end of the project last year when construction was in its early stages, and had excellent opportunities of seeing the organization and methods used, as well as some of the results.

The speed with which men and materials were assembled and put to work is a striking tribute to the organization of the U.S. Corps of Engineers and to the outstanding men of that company who came from all parts of the United States, bringing with them a wealth of experience in the handling of large bodies of men and quantities of equipment on reclamation projects, dams, highway construction and similar works.

The point of interest at the commencement of the work was Dawson Creek, B.C., the end of railway transportation. The first group of men to arrive came completely furnished with food, water, fuel, road building equipment and supplies for four months. Machinery was driven off the railway cars and proceeded on its way immediately on a 265-mile trek over a winter trail to Fort Nelson where they were to commence work. After leaving Dawson Creek they were out of touch with the outside world except by radio until enough road was built by themselves and a similar crew working from the Dawson Creek end would meet. In spite of the fact that they were superbly equipped, this was a remarkable feat for a regiment sent directly from California into sub-zero weather.

From the time of arrival of the first troops, men and equipment poured in steadily. A major obstacle was encountered in crossing the Peace River at Taylor's Flats. The ice might have broken up at any time but it held firm long enough to allow a ferry to be built to serve until a temporary bridge was constructed. This ferry, which carries 15 trucks, was built at Athabaska Landing by the Public Works Department of B.C. and the power plant for it was furnished by the U.S. Army. It was completed for service just 36 hours after the ice on the river went out. A temporary bridge was built by the troops and ready for traffic in 23 days. The permanent bridge at this site is now under construction and will be a suspension structure with a centre span of 1,830 ft., flanking spans of 450 ft. and approach spans of 100 ft. for a total length of 2,500 ft. It is unique in that one tower is 27 ft. higher in elevation than the other, and the bridge roadway is on a grade.

At the present time work is progressing rapidly on improving the highway to the high standard set by the Public Roads Administration of the United States. This calls for a 200 ft. right of way, 36 ft. roadbed and 30 ft. gravel surface. Side slopes on embankments are 1 in 6 and back slopes are 1 in 4. Soil samples are taken every 300 ft. and from this sampling a base course of 12 in. of selected material is spread on the subgrade. Over this, 12 in. of crushed material is used. On the lower section of the highway from Dawson Creek, the average haul necessary to secure aggregate is about 50 miles. This work is being done by civilian contractors who have suitable camps, repair shops, etc. Culverts are of creosoted wood stave pipe in most instances.

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**General Inorganic Chemistry:**
*M. Cannon Sneed and J. Lewis Maynard. N.Y., D. Van Nostrand, 1942. 5½ x 8½ in. $5.00.*

**Magnetic Circuits and Transformers:**
*A first course for power and communication engineers by members of the Department of Electrical Engineering, Massachusetts Institute of Technology. (Principles of Electrical Engineering Series. A publication of the Technology Press, M.I.T.) N.Y., John Wiley and Sons, 1943. 6 x 9½ in. $6.50.*

**Applied Electronics:**
*A first course in electronics, electron tubes and associated circuits by members of the staff of the Department of Electrical Engineering, Massachusetts Institute of Technology. (Principles of Electrical Engineering Series. A publication of the Technology Press, M.I.T.) N.Y., John Wiley and Sons, 1943. 6 x 9½ in. $6.50.*

**Plastics from Farm and Forest:**
*E. F. Lougee. Chicago, Plastics Institute, 1943. 4¾ x 7 in. $2.00.*

**Shop Mathematics and Shop Theory:**
*(The Chrysler Manual) John M. Amiss, G. Keith Shurtleff and Hughitt G. Moltzau. N.Y., Harper and Bros., 1943. 5½ x 8 in. $1.60.*

**Mathematics Dictionary:**
*Compiled and edited by Glenn James and Robert C. James. California, The Digest Press, 1943. 6 x 9¼ in. $3.00.*

**Applied Mathematics for Technical Students:**
*Murlan S. Corrington. N.Y., Harper and Bros., 1943. (Rochester Technical Series). 5¾ x 8½ in. $2.20.*

**High Frequency Thermionic Tubes:**
*A. F. Harvey. N.Y., John Wiley and Sons, 1943. 5¾ x 8¾ in. $3.00.*

**Stream Flow:**
*Measurements, records and their uses. Nathan C. Grover and Arthur W. Harrington. N.Y., John Wiley and Sons, 1943. 6 x 9¼ in. $4.00.*

**General Metallography:**
*Ralph L. Dowdell, Henry S. Jerabek, Arthur C. Forsyth and Carrie H. Green, N.Y., John Wiley and Sons, 1943. 6 x 9¼ in. $3.25.*

**1942 Book of A.S.T.M. Standards:**
*Including tentative standards. Part 1—Metals. Philadelphia, American Society for Testing Materials, 1943.*

**Industrial Fire Brigades:**
*A training manual. Boston, National Fire Protection Association, 1943. 8½ x 11 in. 176 pp. $1.50.*

**Canadian Engineering Standards Association:**
*C22.2—No. 75—1943: Construction and test of synthetic-insulated wires and cables. C22.2—No. 78—1943: Construction and test of varnished-cloth-insulated wires and cables.*

*C22.2—No. 79—1943: Construction and test of weatherproof (neutral) wires and cables (type WPN).*

*Z85—1943: Standard specification for abbreviations for scientific and engineering terms.*

**American Standards Association:**
*C35.1—1943: American standard for rotating electrical machinery on railway locomotives and rail cars and trolley, gasoline-electric and oil-electric coaches. Approved American Standard January, 1943, sponsored by the A.I.E.E.*

*C57.1, C57.2, C57.3—1942: American standard for transformers, regulators and reactors (including test code and guides for operation).*

*C68.1—1942: American standards for measurement of test voltage in dielectric tests. Approved American Standard, November, 1942, sponsored by the A.I.E.E.*

### PROCEEDINGS, TRANSACTIONS

**American Institute of Electrical Engineers:**
*Transactions, volume 61, 1942.*

**American Society of Mechanical Engineers:**
*Transactions, volume 64, 1942.*

**American Institute of Consulting Engineers:**
*Proceedings of the special meeting held November 6, 1942, re Post-war planning.*

### REPORTS

**National Harbours Board:**
*Annual report for the calendar year 1942.*

**Nova Scotia Power Commission:**
*Twenty-third annual report for the twelve months period ended November 30, 1942.*

**Canada—Dominion Water and Power Bureau:**
*Water resources paper No. 86—Pacific drainage: British Columbia and Yukon Territory climatic years 1936/37 and 1937/38.*

**Commission des Eaux Courantes de Québec:**
*Twenty-seventh annual report, 1938, and twenty-eighth annual report, 1939.*

**Winnipeg—Hydro-Electric System:**
*Thirty-first annual report, 1942.*

**The Institution of Structural Engineers—London:**
*Report on reinforced concrete for buildings and structures. Part 4-Design and construction of hollow floors. 1943.*

**Australia—Council for Scientific and Industrial Research:**
*Bulletin No. 155—Friction and Lubrication report No. 2: The lubricating effect of thin metallic films and the theory of the action of bearing metals.*

**University of California—Bulletin of the Dept. of Geological Sciences:**
*Vol. 27, No. 2—A marine invertebrate fauna from the Orinda, Cal., formation.*

**Ohio State University—Engineering Experiment Station:**
*Bulletin No. 114—A study of glaze stresses. May, 1943.*

**The Electrochemical Society—Preprints:**
*83-10: Laws governing the growth of films on metals.—83-11: Polarization at oxidation-reduction electrodes.—83-12: A load regulating system for synchronous converters.—83-13: Zinc yellow in the inhibition of corrosion-fatigue of steel in sodium chloride solution.—83-14: Temperature measurement and control with solid photo-electric cells.*

**Selected Bibliography on Agricultural Engineering and Related Topics:**
*Compiled for the Eastern Agricultural Engineering Committee by W. Kalbfleisch.*

**Organic Methods of Scale and Corrosion Control:**
*David W. Hearing. 5th edition. 1943. 28pp. (This pamphlet is available without charge to those addressing requests to D. W. Haering and Co., Inc., 205 West Wacker Drive, Chicago.*

**Association of Professional Engineers of the Province of Ontario:**
*Principles of job evaluation in the determination of equitable salary structures.*

Presenting the principles of job evaluation in the determination of equitable salary structures, the Association of Professional Engineers of Ontario, 350 Bay Street, Toronto, has recently published a 12-page brochure embracing a report compiled after intensive study, by a special committee appointed by the Council of the Association. The booklet, dealing with the broad fundamentals rather than any specific application of job evaluation, was prepared as a contribution to a solution of the problems of employer-employee relations not only under present-day conditions, but also as they will appear in the post-war period.

Approaching the subject by asking the question, "Are wage rates based on sound fundamentals"?, the text of the brochure proceeds to develop the various steps in establishing a wage rate structure that arrives at a fair relative remuneration for a given range of jobs and thereby meets the basic requirements of sound employer-employee relations. Each step is explained in turn with the aid of appropriate forms or charts. Also included is an explanation of "Merit Rating," whereby cognizance is taken of the manner in which an individual fills the requirements of his particular job.

The brochure closes with a recapitulation of the advantages of Job Evaluation to both employers and employees and with a comprehensive bibliography that gives an indication of the extent to which Job Evaluation has been applied to industrial concerns and public utilities.

### AIR RAID PRECAUTION AND CIVIL DEFENCE

*The following literature has been added to the Institute Library since the last published list in the January Journal.*

**Federal Works Agency—Public Buildings Administration:**
*Code for protection of federal buildings and their contents from subversive hostile acts. August, 1942. 39pp.*

**Emergency Transportation Organization:**
*Round Table discussion by members of the Metropolitan Defence Transport Committee of the New York Metropolitan Area, December, 1942.*

**Washington—Office of Civilian Defence:**
*Operations letter re Technical advice and research.*

**Landis, James M.**
*Address re Civilian Defence Before the Advertising Club of Boston, November, 1942.*

**Federal Works Agency—Public Buildings Administration:**
*Air raid protection code for federal buildings and their contents. August, 1942, 172 pp.*

**Boston—Office of Civilian Defence:**

*Evaluation and establishment of air raid shelters in existing buildings. January, 1943, 22 pp.*

**Canada—Office of the Director of Civil Air Raid Precautions:**

*Blackout for your home. Household series booklet No. 2. 30 pp.*

**A.S.C.E. National Committee on Civilian Protection in Wartime:**

*Letter issued October, 1942, re work of the Hawaii section and their general orders on lighting.*

**Aerial Bombardment Protection:**

*Harold E. Wessman and William A. Rose. N.Y., John Wiley and Sons, 1942. 6 x 9½ in. $4.00.*

**Canadian Engineering Standards Association—ARP Specification:**

*No. 505—Specification for blackout requirements for highway movement. March, 1943.*

**Saskatchewan—Civil Defence Committee:**

*Series of eight lectures on Aerial bombing and its effects, given December, 1942, to February 15, 1943.*

**Building Managers' Association of Chicago:**

*A handbook for civilian defence in office buildings. February 1942. 55 pp.*

*We have also received the following material from the Office of Civilian Defence, Washington:*

**Handbooks:**

*For Rescue Squads. May, 1942.*

*For Air Raid Wardens, April, 1942.*

*For Auxiliary Firemen. December, 1941.*

*For First Aid. December, 1941.*

*For Decontamination Squads. December, 1941.*

*For Messengers. December, 1941.*

*For Drivers' Corps Members.*

*For Auxiliary Police. August, 1942.*

*For Demolition and Clearance Crews. December, 1941.*

*For Road Repair Crews. December, 1941.*

*For Fire Watchers. January, 1942.*

**Medical Division—Bulletins:**

*No. 1. Emergency medical services for civilian defence.*

*No. 2. Equipment and operation of emergency medical units.*

*No. 3. Protection of hospitals.*

*No. 4. Central control and administration of emergency medical service.*

**War Department Specifications:**

*Blackout requirements for highway movement.*

*Street lighting during blackouts. Blackout of buildings.*

**Miscellaneous publications:**

*Municipal signaling systems, including specifications for emergency electrical power equipment.*

*Report of bomb tests on materials and structures.*

*Protective construction.*

*Protective concealment.*

*Suggested regulations for large apartment houses, in blackouts and air raids.*

*Suggested regulations for retail stores—department stores, large specialty stores—for blackouts and air raids.*

*Protection of industrial plants and public buildings.*

*Bomb reconnaissance.*

*Fire defence organization.*

*Fire protection in civilian defence.*

*Forest fire fighter service.*

*Colleges and universities and civilian defence.*

**ECCENTRIC LOADS ON CONCRETE**

*L. T. Evans, B.S.C.E., C.E., 1982 Pasadena Avenue, Long Beach, California, 1943, 8½ x 11 in. vi+35 pp. and 46 charts. $2.50. Reviewed by Viggo Anderson,* M.E.I.C.*

The progress in the design of continuous concrete structures during the last fifteen years has made combined bending and direct stress in concrete sections a very common problem, and a discussion of the subject treated in this small book a very timely one.

In the thirty-five pages of text, the author is first dealing with sections of homogeneous material with any combined loading. He then turns to special cases of symmetrical sections of reinforced concrete, loaded with a force in the plane of symmetry. Rectangular sections with combined bending and compression and with combined bending and tension, circular sections with combined bending and compression and square sections with an eccentric load on a diagonal axis are treated here. The forty-six charts following the text are for use in design of these sections.

The title of the last chapter of the text is "Solution by Parts Method." To investigate a section with an eccentric load at any point by this method, a location of the neutral axis is assumed and the resultant of the internal forces is found, and should coincide with the external force. If this does not happen, a new location of the neutral axis is assumed and the new location of the resultant is found. Repeated trials can bring the two forces as close together as it is desired. After that the actual stress at any point of the section can be found. In an example is shown how the trials and interpolation between them can lead to the result. A considerable amount of work is required to reach a satisfactory result, but the fact that no formulae or tables and only basic assumptions are used, makes the whole procedure very clear. In the example the author stops at a result about five per cent out. To obtain this, an ordinary slide rule could be used instead of a method giving five to six correct figures, as the added work will not make the result more correct.

Very little can be found in textbooks about sections of reinforced concrete columns with bending in two directions. The author has in this book presented an investigation of that problem in a very simple and practical way.

## BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters or may be sent direct to the publishers.**

**A.S.T.M. STANDARDS ON ELECTRICAL INSULATING MATERIALS**

*Prepared by A.S.T.M. Committee D-9 on Electrical Insulating Materials: Specifications, Methods of Testing. December, 1942. American Society for Testing Materials, 260 S. Broad St., Phila., Pa., 441 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.50.*

This pamphlet contains the specifications and tests established by the Society for insulating varnishes and paints, molded insulating materials, plates, tubes, mineral oils, ceramic products, paper, mica, rubber, textiles, etc. It also contains the report of the Committee on Electrical Insulating Materials and several reports on the significance of various tests, and a comparison of methods for determining the oxidation tendency of insulating oils.

**AIRCRAFT PRODUCTION, Planning and Control**

*By H. D. MacKinnon, Jr. Pitman Publishing Corp., New York and Chicago, 1943. 253 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.75.*

*Concrete Designer, Aluminum Company of Canada Ltd., Montreal.

This manual is intended to assist in training those intended for positions in the production departments of aircraft factories. The relation of the production department to other departments is described and the work of each outlined. The work of the various divisions of the production department is described, and the methods used to control and coordinate their work explained.

**AMERICAN SOCIETY FOR TESTING MATERIALS**

*1942 Book of A.S.T.M. Standards, including Tentative Standards (a Triennial Publication). 3 Vols. Part I, Metals, 1,643 pp., Part II, Nonmetallic Materials, Constructional, 1,482 pp.; Part III, Nonmetallic Materials, General, 1,637 pp. Published by American Society for Testing Materials, 260 So. Broad St., Phila., Pa., 1943. Illus., diagrs., charts, tables, 9½ x 6 in., cloth, $27.00 (3 Parts); $9.00 each Part. Also three unbound sets of Emergency Alternate Provisions.*

This edition, the first in three years, contains the standards, adopted and tentative, as of the present date. Emergency standards and alternate provisions issued to expedite procurement or conservation of materials are also included. The work appears in three volumes: Metals; Nonmetallic structural materials; Nonmetallic materials in general, which can be bought separately.

**APPLIED ELECTRONICS (Principles of Electrical Engineering Series)**

*By Members of the Staff of the Department of Electrical Engineering, Massachusetts Institute of Technology, (a publication of the Technology Press); John Wiley & Sons, New York; Chapman & Hall, London, 1943. 772 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $6.50.*

The volume presents a first basic course in electronics, electron tubes and associated circuits prepared for use at the Massachusetts Institute of Technology. The physical phenomena involved in this apparatus are discussed, the way in which these phenomena combine to cover the characteristics and limitations of electronic devices is explained, and the applications common to the several branches of electrical engineering are described. There is a bibliography. The text provides a good background for specialized study in the fields of power, communications, measurement of control.

**APPLIED MECHANICS (Rochester Technical Series)**

*By R. M. Bichler. Harper & Brothers, New York and London, 1943. 291 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.25.*

A textbook adapted for brief courses and intended for students having limited mathematics, in which practical applications are emphasized.

**CAMERON HYDRAULIC DATA**

*Edited by G. V. Shaw and A. W. Loomis, 11th ed. Ingersoll-Rand Co., Cameron Pump Division, 11 Broadway, New York, 1942. 233 pp., diagrs., charts, tables, 7½ x 4½ in., fabrikoid, $3.00*

This handbook presents in convenient form a collection of data, largely in tabular form, frequently wanted in dealing with practical problems involving the handling of steam, water and other liquids.

**CHEMICAL ENGINEERING LABORATORY EQUIPMENT, Design, Construction and Operation. (Chemical) Engineering Equipment Series**

*By O. T. Zimmerman and I. Lavine. Industrial Research Service, Dover, New Hampshire, 1943. 530 pp., illus., diagrs. charts, tables, 9½ x 6 in., cloth, $5.50.*

This volume contains descriptions of equipment that can be used in investigating the flow of fluids and of heat, evaporation, drying, gas absorption, filtration, crushing and grinding. The designs have been collected from chemical engineering departments of colleges and are complete, with cost estimates and bills of materials. The equipment has been built primarily for instructional purposes, but will also be useful to those engaged in industrial research.

**COKE FORMATION PROCESS AND PHYSICO-CHEMICAL PROPERTIES OF COALS**

*By W. Swietoslawski, with a preface by H. L. Olin. Polish Institute of Arts and Sciences in America, 37 East 36th St., New York, 1942. 145 pp., illus., diagrs., charts, tables, 9½ x 6 in., paper, $3.50.*

The author, an eminent Polish physical chemist, was formerly in charge of a programme of investigations by the Coal Division of the Warsaw Chemical Research Institute, and this publication makes available to English readers the results obtained. The monograph summarizes the methods used in physico-chemical investigations of coals and summarizes our factual knowledge, especially of the transformations that occur during coking.

**COPPER AND COPPER BASE ALLOYS, the Physical and Mechanical Properties of Copper and Its Commercial Alloys in Wrought Form**

*By R. A. Wilkins and E. S. Bunn. McGraw-Hill Book Co., New York and London, 1943. 355 pp., illus., charts, tablss, 11½ x 8½ in., cloth, $5.00.*

This collection of data on the properties of copper and its alloys will be of great value to users of the metal. The information, chiefly presented in tables and graphs, covers the physical and mechanical properties of all the alloys in commercial use, including the mechanical properties at low temperatures, resistance to fatigue and corrosion fatigue, and the bending properties. Much of the information is based on tests conducted under the direction of the authors. There is an excellent bibliography.

**A COURSE IN POWDER METALLURGY**

*By W. J. Baëza. Reinhold Publishing Corp., New York, 1943. 212 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

The aim is to provide a course in the subject for students of metallurgy. The history and modern development of the field are summarized briefly. The production of powders, powder specifications, the classification of particle size, cohesion, manufacturing problems and machines are discussed. A course of instruction is presented, with information on laboratory equipment and cost, and directions for a series of experiments. The course is based on actual experience.

**DICTIONARY OF SCIENCE AND TECHNOLOGY IN ENGLISH—FRENCH—GERMAN—SPANISH**

*By M. Newmark. Philosophical Library, 15 East 40th St., New York, 1943. 386 pp., tables, 9½ x 6 in., cloth, $6.00.*

This dictionary contains a list of some 10,000 English scientific and technical terms, with their equivalents in French, German and Spanish. French, German and Spanish indexes make it possible to use any of these languages with English. The selection is a good one and includes many recent terms which are absent from older books.

**DIESEL AND GAS ENGINE POWER PLANTS**

*By G. C. Boyer. McGraw-Hill Book Co., New York and London, 1943. 447 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

A practical discussion of internal-combustion power plants, intended for designers and operators. The book is not confined to a discussion of engines, but treats the plant as an entity, and attention is given to the economic conditions, power-plant design, buildings, fuel, piping, maintenance, electric equipment and similar subjects of prime importance.

**DIESEL AVIATION ENGINES**

*By P. H. Wilkinson. National Aeronautics Council, 37 West 47th St., New York, 1942. 92 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $1.00.*

The development of this engine and its principles are outlined briefly. The Guiberson and Junkers engines are described in some detail, flights with Diesel-powered aircraft are recorded, and the advantages of the engine for aviation indicated.

**THE ELEMENTS OF AEROFOIL AND AIRSCREW THEORY**

*By H. Glauert. University Press, Cambridge, England; Macmillan Company, New York, 1943. 228 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $3.50.*

The theory of the aerofoil and the airscrew is presented here in a form suitable for students with no previous knowledge of hydrodynamics, and with a minimum use of complex mathematical analysis. The author first reviews the necessary portions of hydrodynamic theory. Following this, the lift of an aerofoil in two-dimensional motion, the effect of viscosity and its bearing on aerofoil theory are presented, followed by the development of the theory of aerofoils of finite span. The final chapters develop the theory of the airscrew. This edition reproduces the English one published in 1926 and frequently reprinted.

**ELEMENTS OF TECHNICAL AERONAUTICS**

*National Aeronautics Council, 37 West 47th St., New York, 1942. 214 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $2.00.*

The theory of flight, aerodynamics, airplane design, the autogiro, the helicopter and associated questions are discussed briefly by various experts. The fundamentals are explained without mathematics.

**ENGLISH FOR ENGINEERS**

*By S. A. Harbarger, A. B. Whitmer and R. Price. 4th ed. McGraw-Hill Book Co., New York and London, 1943. 225 pp., 8½ x 5½ in., cloth, $1.75.*

This well-known guide to the study of English for engineers emphasizes the point of view of previous editions. The aim is to guide the student in his study of English and to point out the ways in which he can apply the basic principles of writing to his own activities. Part one of the book provides material for an inventory of the skills used in writing and speaking. Part two illustrates the use of these principles in the writing of letters, reports, professional papers, etc. The new edition has been skilfully revised and greatly improved.

**FLIGHT INSTRUMENTS**

*By H. W. Hurt and C. A. Wolf. National Aeronautics Council, 37 West 47th St., New York, 1942. 92 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $1.00.*

This book describes the instruments in use to-day and shows their purposes.

**FLYING BOATS**

*By H. C. Richardson, W. E. Beall and C. W. Manly. National Aeronautics Council, 37 West 47th St., New York, 1942. 122 pp., illus., 8½ x 5½ in., cloth, $1.00.*

This book is a popular account of the development, handling and testing of flying boats. Handling when in the air and when afloat, launching and beaching, and shipboard catapults are described and illustrated.

**GENERAL METALLOGRAPHY**

*By R. L. Dowdell, H. S. Jerabek, A. C. Forsyth and C. H. Green. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 292 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.25.*

This text presents a one-year course, intended for beginning students in metallography or physical metallurgy as an introduction to the specialized books and current publications in the field. The course is arranged so that laboratory work can proceed with it. The usual divisions of the subject are covered and illustrated with excellent micrographs. Many binary constitution diagrams are given, and an unusual amount of tabulated data upon commercial ferrous and non-ferrous alloys is included.

**HIGH-SPEED DIESEL ENGINES for Automotive, Aeronautical, Marine, Railroad and Industrial Use, with a chapter on Other Types of Oil Engines**

*By P. M. Heldt. 4 ed. P. M. Heldt, Nyack, New York, 1943. 430 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.00.*

During the seven years that have elapsed since the last revision, Diesel practice has undergone many changes. These changes have been incorporated in the present edition, which contains considerable new material. New chapters on lubrication and on supercharging have been added, with new material on fuels, injection pumps, governors, cooling injection, nozzles and on two-stroke engines.

**MARINE ENGINEERING**

*By J. M. Labberton. McGraw-Hill Book Co., New York and London, 1943. 439 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $4.00.*

This textbook is based upon courses given in the graduate division of the College of Engineering of New York University and to graduate engineers in ship and navy yards. It is intended especially for electrical and mechanical engineers who are entering this special field. Both steam and Diesel driven ships are considered.

**MECHANICAL VIBRATIONS, Theory and Applications, an introduction to practical dynamic engineering problems in the structural field**

*By R. K. Bernhard. Pitman Publishing Corporation, New York and Chicago, 1943. 139 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

This presentation is intended especially for those who have not studied dynamics extensively, and who wish a presentation without advanced mathematics. The needs of structural engineers are given special attention. Part one discusses the physical phenomena and their significance in engineering dynamics; part two, methods of measuring vibrations. There is a bibliography.

**MECHANICAL WORLD YEAR BOOK 1943**

*Emmott & Co., "Mechanical World," Manchester and London, England. 360 pp. +260 pp. Ads. and index, illus., diagrs., charts, tables, 6½ x 4 in., cloth, 2s. 6d.*

This year book, now appearing for the fifty-sixth year, provides a pocket-size manual of information on machine-shop practices, light alloys, plastics, bearings, steam boilers, turbines, internal-combustion engines, welding and other topics of interest to manufacturers and mechanical engineers, together with much tabular matter.

**METALLURGICAL PROBLEMS**

*By A. Butts. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 446 pp., illus., diagrs., charts, tables, 9½ x 6 in., fabrikoid, $4.00.*

This is the second edition of a work published in 1932 with the title, "A Textbook of Metallurgical Problems." The purpose is to provide practical training in the calculations required in metallurgy, in such operations as the smelting of ores, drying, roasting and calcining, in coke making and in electrolytic and hydrometallurgical processes. The new edition has been carefully revised; the data and the metallurgical processes have been brought up to date and new problems introduced. *(Continued on page 383)*

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

May 31st, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the July meeting.

L. AUSTIN WRIGHT, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

**FOR ADMISSION**

ALEXANDER—KENNETH EAMAN, of Exshaw, Alta. Born at Montreal, Jan. 26th, 1915; Educ.: 1934, 1st year Arts and Sciences, McGill Univ., March 1943, completed civil engrg. course, I.C.S.; with Canada Cement Co. Ltd., as follows: 1937-39, inspr. at plant No. 1, Montreal East, 1939-41, shift foreman, 1941-43, constrn. supervisor, and at present, asst. supt., plant No. 12, Exshaw, Alta.

References: J. B. Hanly, F. B. Kilbourn, W. G. H. Cam, K. L. MacMillan, J. A. Creaser.

BASTIEN—JEAN, of Ormstown, Que. Born at Montreal, Nov. 13th, 1906; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1933. R.P.E. of Que.; 1933-36, asst. divn. engr., and 1936 to date, divn. engr., Dept. of Roads, Prov. of Quebec.

References: E. Gohier, A. Gratton, J. O. Martineau, J. A. Lalonde, L. Trudel.

BESSETTE—OSCAR, of Drummondville, Que. Born at Richelieu, Que., March 6th, 1891; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1916. R.P.E. of Que.; 1916-17, asst. engr., Montreal Sand & Gravel Filtration Co.; 1918-20, engr., sewer systems, Munic. of Richelieu; 1920-26, res. engr. and divn. engr., Dept. of Roads, Prov.of Quebec; 1926-37, city engr., St. Jean, Que.; 1937-39, town engr., Val d'Or, Que.; 1940-43, engr., Dept. of Munitions & Supply; April 1943 to date, city engr., Drummondville, Que.

References: J. A. Beauchemin, A. Circé, J. Comeau, L. A. Dubreuil, C. E. Gélinas, T. J. Lafrenière, P. E. Poitras.

BONAVENTURE—JOSEPH EUGENE, of 3877 Van Horne Ave., Montreal, Que. Born at Lanoraie, Que., Sept. 12th, 1890; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1914; R.P.E. of Que.; with Dept. of Public Works of Canada as follows: 1914-28, junior engr., 1928-37, asst. engr., 1937-39, senior asst. engr., and 1939 to date, district engr., Montreal District.

References: B. Grandmont, J. A. Lalonde, H. Massue, J. A. Beauchemin, H. Gaudefroy.

CLEMENS—JAMES NICHOLAS, of 303 Furby St., Winnipeg, Man. Born at Dauphin, Man., July 6th, 1912; Educ.: Diploma, School of Electricity, Chicago Engrg. Works, 1930. I.C.S. Elec. Engrg.; 1928-34, Hudson Bay Rld.; 1935, installn. of water power plant at God's Lake Gold Mines; 1936-41, asst. supt. i/c elec. distribution, power house, switchboard and generators, Town of Dauphin; 1941 to date, aerodrome foreman electrician, i/c power and lighting, No. 2 Training Command, R.C.A.F., Winnipeg (Warrant Officer, Class I).

References: A. J. Taunton, J. D. Peart, J. T. Rose, H. L. Briggs, T. E. Storey, N. M. Hall.

de CHAZAL—PHILIPPE MARC, of Arvida, Que. Born at Johannesburg, South Africa, July 26th, 1907; Educ.: B.Sc. (Engrg.), McGill Univ., 1931; 1929-30, Shawinigan Engrg. Co.; 1930-40, not engaged in engrg. work; 1940 to date, with Aluminum Company of Canada, since 1941 engr. i/c of mech. mtce.

References: M. G. Saunders, B. E. Bauman, A. T. Cairncross, H. J. Racey, E. Brown, R. DeL. French, G. J. Dodd.

EMERY—CHARLES LESLIE, of 112 Prospect St., Port Arthur, Ont. Born at Hamilton, Ont., Oct. 16th, 1912; Educ.: B.Sc. (Mining and Met.), Queen's Univ., 1936; 1936-37, mill engr., Kelowna Exploration Co., Hedley, B.C.; 1937-38, asst. prof. in metallurgy, Queen's Univ.; 1938-39, chief metallurgist, Kerr-Addison Gold Mines, Larder Lake, Ont.; 1938-39, consultant metallurgist, Acadia Gold Mines; 1939-40, mgr., Moira Fluorspar Mines, Madoc, Ont.; 1940-41, engr., Dominion Fluorspar Ltd., Madoc; 1942 (July-Aug.), engr., Carter Halls Aldinger; 1941 to date, teacher of surveying and dfting., Port Arthur Technical School.

References: E. J. Davies, E. L. Goodall, J. M. Fleming, S. E. Flook.

EVAN-JONES—WALTER, of 540 Russell Hill Road, Toronto, Ont. Born at Toronto, Sept. 12th, 1913; Educ.: I.C.S. Diplomas in Chemistry and Electricity; 1934-37, radio engrg. dept., R.C.A. Victor Co., Toronto; 1937-40, field testing and installn. of theatre sound systems, Dominion Sound Equipments, Toronto (Northern Electric Co.); 1940-42, special products divn., Toronto office, Northern Electric Co., design and testing of sound systems, supervn. of installn. of same for use in large broadcasting stations, factories and outdoor locations, gen. radio engrg. work; 1942 to date, asst. communications engr., H.E.P.C. of Ontario, radio and electronic design and supervn. of installn. and field testing.

References: H. E. Brandon, C. A. Smith, H. V. Armstrong, J. W. Falkner, E. C. Higgins.

HARRISON—THOMAS BLACKER, of Amherstburg, Ont. Born at Maple Creek, Sask., Jan. 22nd, 1911; Educ.: B.Sc. (Mech.), Univ. of Sask., 1934; R.P.E. of Ont.; 1934-36, lubrication and mtce. in smelter and other surface operations, Noranda Mine, Que.; 1936-39, design and supervn. of mtce. and constrn. work, structl. and mech., etc., Fort Frances Pulp & Paper Co., Fort Frances, Ont.; 1939 to date, test engr., design and supervn. of mtce. and some constrn., material handling and mech. power, etc., Brunner Mond Canada Ltd., Amherstburg, Ont.

References: W. M. Mitchell, J. E. Hinchcliffe, H. L. Johnston, A. H. Pask.

LENOIR—JEAN AUGUSTE, of 60 College St., St. Laurent, Que. Born at Montreal, July 12th, 1895; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1922. R.P.E. of Que.; 1922, res. engr., 1922-42, divn. engr., and 1942 to date, district engr., Dept. of Roads, Prov. of Quebec.

References: E. Gohier, A. Gratton, J. A. Lalonde, H. Labrecque.

MacCONNELL—HOWARD BRUCE, of 211 So. John St., Fort William, Ont. Born at Springbrook, Ont., Aug. 14th, 1886; Educ.: Corres. courses. Private study; 1908-12, rly. constrn. in Ontario and on Gaspé coast; 1912-14, designing reinforced concrete bridges, for W. A. O'Connor, county engr. (Ontario); 1920-21, reinf. conc. bridge design, Dept. Highways, Ont.; 1919-22, contract and gen. constrn. on Prov. Highways, Ontario; 1922, design and spec., 10 room school, twp. of Whitby; 1922-23, i/c breakwater, Dept. of Public Works, at Thessalon; 1923-27, estimator, millwork, Detroit; 1927-28, i/c bldg. constrn., General Motors; 1929-31, and 1936-38, i/c contracts on various projects, incl. design and constrn.; at present, estimator and gen. supt. for Barnett-McQueen Co. Ltd., General Contractors, Fort William, Ont.

References: J. M. Fleming, B. A. Culpeper, E. M. G. MacGill, R. B. Chandler, W. H. Small, W. L. Bird.

MAGNAN—STANLEY FEARON, of Caledonia, Ont. Born at Kingston, Jamaica, B.W.I., June 18th, 1896; Educ.: Private tuition, with trade and corres. schools; R.P.E. of Ont., 1938; 1912-14, Public Works Dept., Govt. of Jamaica; 1914-15, Railway & Engrg. Services, Jamaica; 1915-18, active service, Egypt, France, Belgium, Italy; 1919-22, supt. of roads and works, Parish of Clarendon, Jamaica; 1926-28, stationary engr. i/c of steam plant, Steel Co. of Canada, Swansea; 1928-38, mech. supt., i/c of mech. steam and elec. plants, Hamilton Cotton Co. Ltd., Hamilton, Ont.; 1938 to date, i/c steam plant (850 h.p.), compressed air, water services and cupolas, Gypsum, Lime & Alabastine Co. of Canada Ltd., Caledonia Plant.

References: A. S. Wall, H. G. Acres, G. Moes, M. B. Watson.

MATHIEU—OLIER, of L'Assomption, Que. Born at Montreal, Sept. 5th, 1907; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1932. R.P.E. of Que.; 1933-36, constrn. of roads and pavements, Raymond, McDonnell & Co. Ltd.; 1937 to date, divn. engr., Dept. of Roads, Prov. of Quebec.

References: E. Gohier, A. Gratton, J. A. Lalonde, L. Trudel, J. O. Martineau.

MURRAY—FREDERICK ROBERT. of 4515 Melrose Ave., Montreal, Que. Born at Dalbeattie, Scotland, August 24th, 1903; Educ.: B.Sc. (Civil Eng.), Glasgow Univ., 1923. Diploma (Civil Eng.), Royal Technical College, 1923; R.P.E. of Que.; 1923-28, field engr., asst. engr. and asst. to res. engr. on various projects for the Shawinigan Engineering Company, Montreal; 1928 to date, structl. engr., asst. to district mgr. (Montreal), and at present, district mgr. (Quebec, Maritimes and Nfld.), Truscon Steel Co. of Canada Ltd., Montreal.

References: E. V. Gage, A. L. Harkness, C. R. Lindsey, J. A. McCrory, P. L. Pratley, R. A. Rankin, G. M. Wynn.

McHENRY—GORDON MORRIS, of Peterborough, Ont. Born at Toronto, May 4th, 1917; Educ.: B.A.Sc., Univ. of Toronto, 1940; 1940-41, asst., test dept., and 1941 to date, asst. to switchgear engr., Can. Gen. Elec. Co. Ltd., Peterborough, Ont.

References: G. R. Langley, B. I. Burgess, D. V. Canning, A. R. Jones, D. J. Emery.

PATRICK—KENNETH ROLAND, Wing-Commander, R.C.A.F., of 5044 Victoria Ave., Montreal, Que.; born at Saint John, N.B., June 12th, 1914; Educ.: 1932, New Haven Coll., New Haven. 1932-33, Lamb Engrg. Sch., New Haven. 1933-38, factory courses, R.C.A., Philco Co., United American Bosch; 1938-40, elec. engrg., R.C.A.F., Trenton; 1941-42, ultra high frequency technique, U.S. Army Air Corps; 1942-43, symposium of communication engrg., McGill Univ., 1943, R.D.F. officers specialist course (R.A.F.) British. (Radio location equipment development); 1932-34, radio mtce., Police Radio Installn., State of Mass.; 1934-39, mgr., radio labs., Acme Sound Systems, Southbridge, Mass.; 1939 to date, signal officer, R.C.A.F. (Radio Engrg.), and 1940 to date, chief instructor, No. 1 Wireless School, Montreal, respons. for training of ground radio personnel for R.C.A.F., writing of syllaubs, texts, etc., i/c of staff of 200 instructors.

References: A. B. Hunt, S. Sillitoe, C. A. Peachey, E. S. Kelsey, S. T. Fisher, R. D. Harkness.

PERLEY—ERNEST CLINT, of 418 Claremont Ave., Westmount, Que. Born at Wolseley, Sask., Jan. 25th, 1905; Educ.: B.Sc., McGill Univ., 1928; R.P.E. of Ont.; 1926-27 (summers), constrn. and factory work, Backus-Brooks Constrn. Co., Packard Motor Car Co.; 1928-42, with the English Electric Co. of Canada Ltd., as follows: 1928-31, estimating dept., Toronto, 1931-34, estimating dept., St. Catharines, 1934-36, mgr., apparatus sales dept., 1936-42, gen. sales mgr. (1938, acting gen. mgr., during illness of gen. mgr.); 1942, chief production engr., and 1942-43, director of production, tank production br., and Jan. 1943 to date, director of production, automotive and tank production br., Dept. of Munitions & Supply, Montreal.

References: C. V. Christie, R. E. Jamieson, H. A. Cooch, W. E. Ross, G. Kearney.

PETERS—ARTHUR W., of Trois-Rivières, Que. Born at Fredericton, N.B., Nov. 25th, 1898; Educ.: B.Sc., McGill Univ., 1923; R.P.E. of Que.; 1920-21 (summers), ap'tice, Canadian Westinghouse Co.; 1922 (summer), Geodetic Surveys; with the Shawinigan Water & Power Company as follows: 1923-24, power house dftsman., 1924-27, operating dept., head office, gen. elec. distribution engrg., North Shore Power Co., 1930-42, distribution engrg., incl. design and constrn. of substations, etc., and at present, distribution engr. i/c of dept.

References: A. C. Abbott, C. V. Christie, C. R. Reid, E. V. Leipoldt. J. A. McCrory, R. E. Heartz.

RIGG-STORY—LESLIE, of 2180 Orchard Ave., Niagara Falls, Ont. Born at Longstown, England, March 12th, 1890; Educ.: B.Sc. (Eng.), Elec. 1912, Civil 1913, Rutherford College, Newcastle-on-Tyne; 1908-12, ap'ticeship, A. Reyrolle & Co. Ltd., switchgear engrs., Hebburn-on-Tyne; 1912-14, post-graduate course, Electric Supply Co., Newcastle-on-Tyne; 1919-26, development engr., British Thomson Houston Co. Ltd., Willesden, London, England; 1926-30, constrn. engr., P. Lyall Constrn. Co., Thorold, Ont.; 1930-36, short contracts, engrg. and supting. bridge constrn., etc., for Aiken, Innes & MacLachlan, and Ontario Constrn. Co., St. Catharines, Goldie Constrn. Co., Toronto, Dept. of Transport, Ottawa, & Structural Steel Co., New York; 1936-39, dftsman. designer, Can. Gen. Elec. Co. Ltd., Peterborough; 1939-42, with H.E.P.C. of Ontario, Toronto; 1942 to date, designer, H. G. Acres & Co., Niagara Falls, Ont. Also Survey Instructor, 42nd Regt. R.C.A. (Res.). Toronto, Ont.

References: G. F. Vollmer, A. W. F. McQueen, J. H. Ings, C. A. O. Dell, H. E. Barnett, H. G. Acres.

SEABURY—GEORGE T., of New York, N.Y. Born at Newport, R.I., U.S.A., April 12th, 1880; Educ.: S.B. in C.E., Mass. Inst. Tech., 1902; R.P.E. of New York State; 1902-06, asst. engr., Subway Constrn. Co., New York, O'Rourke Engrg. & Contracting Co., i/c field work and design, United Engrg. & Contracting Co., field engr. for C. Rodgers, contractor, Hildreth & Co., consltg. engr., City Waste Disposal Co., surveys and design; 1906-15, with Board of Water Supply on New York water supply, 2 years as first asst. to divn. engr. on surveys and field study, 2 years as one of two special assts. to chief engr. of Catskill water supply, 5 years, first asst. to divn. engr. i/c of constrn. of section of Catskill Aqueduct; 1915-18, divn. engr., Board of Water Supply, Providence, R.I.; 1918-19, Major, U.S. Army, Constrn. Divn., as supervising constructing quartermaster; 1919-23, gen. contractor as president and gen. mgr., George T. Seabury Inc., specializing in heavy constrn.; 1923-24, mgr., Providence Safety Council; 1925 to date, secretary, American Society of Civil, Engrs.

References: J. B. Challies, E. A. Cleveland, G. H. Duggan, J. M. R. Fairbairn, T. H. Hogg, O. O. Lefebvre, S. G. Porter, A. Surveyer.

TRUDEAU—ROGER T., of Papineauville, Que. Born at Montreal, March 17th, 1914; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1938. R.P.E. of Que.; 1935-37 (summers), surveying for F. A. Gaby & C.N.R., and instr'mentman; 1938-41, res. engr., and 1941 to date, divn., engr., Dept. of Roads, Prov. of Quebec.

References: A Circé, E. Gohier, J. A. Lalonde, L. Trudel, H. Gaudefroy.

VAN EVERY—HUGH DAVIDSON, of 82 Cambridge St., Halifax, N.S. Born at Montreal, June 9th, 1917; Educ.: 1935-36, Montreal Technical Institute. 4 year course in mech. and structl. design and maths., Dominion Bridge Co., corres. course in mech. engrg.; 1936-42, mech. and structl. dftsman., Dominion Bridge Company, Lachine, Que.; Nov. 1942 to date, steel designer and constrn. supervisor, Dept. of Naval Construction, Halifax Dockyard.

References: F. Newell, R. S. Eadie, J. H. Maude, K. O. Whyte, S. W. Gray.

WILSON—ROBERT, of 26 Finchley Road, Hampstead, Que. Born at Clydebank, Scotland, Sept. 12th, 1897; Educ.: 1919-22, Royal Technical College, Glasgow. Evening classes in maths., mechanics., and naval architecture drawing; 1914-20, ap'ticeship as ship dftsman., John Brown & Co. Ltd., Clydebank (1915-19, in the army); with the Northern Electric Co. Ltd., Montreal, as follows: 1923-25, dftsman., 1926-29, dial systems engr., preparation of specs. for dial central offices; 1929-32, supervisor, dial frame equipment engr. i/c 20 engrs.; 1932-34, supervisor, dial systems engr. i/c engrs. on equipment, cabling and layouts; 1934-42, telephone equipment engr. i/c of dial manual, toll and P.B.X. engrs.; at present, telephone engr. i/c all telephone central office, transmission and apparatus engrg. and design.

References: J. S. Cameron, J. W. Fagan, H. H. Vroom, A. B. Hunt, C. A. Peachey, E. S. Kelsey, J. J. H. Miller.

WRIGHT—RALPH WALLACE, of 481 Gilmour St., Peterborough, Ont. Born at Halifax, N.S., Jan. 1st, 1918; Educ.: B. Eng. (Mech.), McGill Univ., 1941; summers—1936, Caribou Mines, N.S., 1937-39, Topogl. and Geol. Surveys, 1940, Halifax Shipyards; 1941-42, test course, 1942, engrg. design dept., and July 1942 to date, plant engrg. dept., Can. Gen. Elec. Co. Ltd., Peterborough, Ont.

References: I. F. MacRae, G. R. Langley, C. H. Wright, W. P. Copp, W. M. Cruthers.

ZIEGLER—LESTER WILLIAM, of 55 Francis St. So., Kitchener, Ont. Born at Kitchener, April 4th, 1915; Educ.: B.Sc. (Mech.), Tri-State College, Angola, Indiana, 1941; 1934-38, ap'ticeship course in machinist toolmaking, Rubber Machinery Shops, Kitchener; 1941-42, boiler and steam engine design and testing, Babcock Wilcox & Goldie McCulloch, Galt, Ont.; 1942, testing mach. shop and maths. (night school) for Dominion-Provincial War Emergency Classes, Kitchener; 1942-43, plant engr., Sunshine Waterloo Co. Ltd., Waterloo, Ont.; at present, plant production planning engr., Dominion Electrohome Industries Ltd., Kitchener, Ont.

References: S. Shupe, M. Pequegnat, A. M. Snider.

### FOR TRANSFER FROM JUNIOR

HAINES—NEIL ST. CLAIR, of 373 Broadway Ave., Toronto, Ont. Born at Cheltenham, Ont., Jan. 22, 1910; Educ.: B.A.Sc., Univ. of Toronto, 1935; 1933-34 (summers), mine development, Algoma Summit Gold Mines; 1935-36, instr'man and dftsmn, sub foreman on airport constrn., Dept. of National Defence; Sept. 1936-Mar. 1937, quarry engr., Gypsum Lime & Alabastine Co. Ltd.; 1937, Mar.-July, quarry engr., North American Cyanamid Co.; 1937, July-Aug., instr'man, and 1938, May-Dec., res. engr., Scarboro Twp. Engrg. Dept., design and constrn. of streets and sewers; 1937, Aug.-Dec., instr'mn. on constrn. Ontario Dept. of Highways; 1938, Jan.-Apr., surveying and dftng., Sylvanite Gold Mines; 1939-40, research asst., Consolidated Mining & Smelting Co., Smoke Control Dept.; 1940 to date, asst. engr., Hydro Electric Power Commission of Ontario, Hydraulic Dept., estimating and designing hydraulic structures, canals, etc. (Jr. 1938).

References: O. Holden, S. W. B. Black, A. E. Nourse, J. R. Montague, H. E. Brandon, C. R. Young.

LEFRANCOIS—J. GERMAIN, of 128 Chambly Rd., Longueuil, Que. Born at St. Felix de Valois, Que., Aug. 8, 1909; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1936; 1935 (summer), Dept. of Roads, Prov. of Quebec; with Canadian Fairbanks Morse as follows: 1936-37, machine shop practice, 1937-38, diesel and pump instllns., (1938 (6 mos.), supt.'s asst., 1938-40 i/c of instllns. and service on commercial refrigeration and stokers; 1940 to date, i/c industrial stokers and installn. and service boilers and boiler room equipment, Volcano Ltd., Montreal. (Jr. 1937).

References: L. Trudel, M. Gerin, A. Circé, C. E. Gélinas, R. Bélanger, J. A. Kearns, R. E. MacAfee.

SOMERS—CLAUDE JUDSON, of 114 York St., Cornwall, Ont. Born at Moncton, N.B., March 19th, 1910; Educ.: B.Sc., Univ of N.B., 1936; 1934-35 and 1936-37, highway inspector, Milton Hersey Co.; 1937-42, design and mtce. engr., Howard Smith Paper Mills, Cornwall; 1942, field engr. on constrn. Carter-Halls-Aldinger Co. Ltd.; 1943 to date, safety engr., Stormont Chemicals Ltd., Cornwall, Ont. (St. 1936, Jr. 1937).

References: H. E. Meadd, A. L. Farnsworth, M. F. MacNaughton, E. O. Turner

### FOR TRANSFER FROM STUDENT

ANDRE—KENNETH B., of 6 Couper St., Kingston, Ont. Born at Kingston, Sept. 29, 1915; Educ.: B.Sc., Queen's Univ., 1937; R.P.E. Ontario; with Dept. of Highways as follows: 1936 (summer), asst. on const. survey, Barriefield, 1937-39 instr'mn. on highway constrn., 1939 (May-Dec.), engr. i/c specialized work, mtce. of concrete highways, Toronto, Barrie and Hamilton, 1940 (5 mos.), levelman, aerodrome survey; 1940-41, instr'mn., and 1941-to date, res. engr., on aerodrome survey and constrn., Dept. of Transport, Kingston, Ont. (St. 1937).

References: W. L. Malcolm, D. S. Ellis, W. F. Noonan, L. T. Rutledge, F. B. Whitely.

BEDFORD-JONES—CHARLES EDWARD, of 351 Brock Ave. North, Montreal West, Que. Born at Brockville, Ont., May 1st, 1910; Educ.: B.A.Sc., Univ. of Toronto, 1933; 1929 (summer), fabric work and assembly, Ottawa Car Mfg. Co., Aircraft Divn., Ottawa; 1930-31 (summers), field asst., Dept. of Mines, Ottawa; 1933-35, parts dept. clerk, Chevrolet Motor Sales, Ottawa; 1935-37, mgr., Parts Dept., R. O. Morris, General Motors Dealer, Hull, Que.; with F. S. B. Heward & Co. Ltd., Montreal, as follows; 1937-39, engr., engaged in sale, service and instlln. of steam power plant equipment, land and marine, from Sept. 1939 to date, district mgr., also since Jan. 1941, district mgr. of Heward Production Co. Ltd., a company incorporated to arrange, engineer and supervise the mnfr. in Canada of British Marine auxiliaries under license. (St. 1932).

References: F. S. B. Heward, W. L. Yack, N. E. D. Sheppard, F. A. Combe, R. C. Flitton, H. C. Karn.

CAMERON—ALASTAIR DUNCAN, of 284 Waterloo Row, Fredericton, N.B. Born at Fredericton Oct. 28th, 1920; Educ.: B.Sc. (Civil), Univ. of N.B., 1942; summers—1939, N.B. Geol. survey party, 1940, instr'mn. and dftsmn., D.N.D. Camp constrn., 1941, chief of survey party, Bell Tel. Co. of Canada; 1942 to date, Reg't'l survey officer, 21 Fld. Regt, R.C.A., C.A., with rank of Lieutenant. (St. 1942).

References: C. C. Kirby, J. Stephens, E. O. Turner, J. D. MacKay, B. H. Hagerman.

GROTHE—P. ANDRE, of 6803 St. Denis St., Montreal. Born at Montreal, Que., Sept. 11th, 1911; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1941; R.P.E. Quebec; 1936-41, inspector, Industrial & Commercial Labs., Montreal; 1942, Defence Industries, Ltd., Ste. Thérèse; at present, Aeronautical engr., No. 3 Training Command, R.C.A.F., Montreal, with rank of Flying Officer. (St. 1940).

References: L. Perrault, L. Trudel, P. Lebel, H. Gaudefroy, R. E. Matte.

HARKNESS—ANDREW DUNBAR, of 2205 Hampton Ave., Montreal. Born at Ottawa, Ont., Sept. 19th, 1914; Educ.: B. Eng., McGill Univ. 1942; summers, 1938 constrn. of R.R. subway, 1940-41, dftng. and designing, Consumers Glass Co.; May 1942 to date, requisitioning material, Hull Dept., United Shipyards Ltd. (St. 1942).

References: E. Brown, A. R. Roberts, C. M. McKergow, G. J. Dodd.

HOPKINS—HERBERT ARTHUR, of 35 McFarland Ave., Toronto, Ont. Born at Toronto, Jan. 2, 1918; Educ.: B.S. (Elec.), Detroit Institute of Technology, 1940; 1940-41, electl. engr., Amalgamated Electric Corp. Ltd., Toronto, on switchboard and panelboard design, estimating and dftng.; 1941, July-Sept., electl. dftsmn., Rogers Majestic Corp. Ltd.; 1941-42, student course, and at present supervisor of Transformer Test Dept., Canadian General Electric Co. Ltd., Toronto. (St. 1942).

References: C. E. Sisson, D. Norman, W. H. Hooper, W. M. Cruthers, A. L. Malby.

MORRIS—ROBERT McCOUL, of Rockliffe Park, Ottawa, Ont. Born at Trenton, N.S., Sept. 20, 1915; Educ.: B.Eng., N.S. Tech. Coll., 1940; summers—1935-36, electl. mtce., Eastern Car Co., Trenton, N.S., 1938, Engineering Service Co., Halifax, N.S., 1939, electl. mtce., Pictou County Power Board, Stellarton, N.S.; 1940-41, electl. dftsmn., Shawinigan Engineering Co., Montreal; 1941 to date, junior research engr., National Research Council, Ottawa, Ont. (St. 1940).

References: B. G. Ballard, R. E. Heartz, H. W. McKiel, J. R. Kaye, C. J. Mackenzie, D. S. Smith.

SHECTOR—LINDLEY, of 2241 Maplewood Ave., Montreal. Born at Montreal, Oct. 4, 1914; Educ.: B. Eng., (Civil), McGill Univ., 1937; 1932-37 (summers), rodman, transitman, and carpenters' apprentice on sewer and bldg. constrn., Argus Construction Co.; 1937-39, detailer and designer, reinforced concrete structures, Truscon Steel Co. of Canada, Montreal; 1939-40, field engr. on constrn. of Sir Arthur Currie Memorial Gymnasium, Walter G. Hunt Co. Ltd.; 1940 to date, structural designer on industrial bldgs., res. engr. on constrn. of addition to Canadian Allis-Chalmers plant at Lachine, Que., for T. Pringle & Son, Ltd., Montreal. (St. 1937).

References: R. E. Jamieson, G. J. Dodd, W. G. Hunt, G. M. Wynn, A. L. Harkness.

SWEENEY—JOHN BARTHOLOMEW, of Souris, Man. Born at Hazenmore, Sask., Feb. 11th, 1920; Educ.: B.Eng. (Chem.), Univ. of Sask., 1941; 1938-39 (summers) constrn. of grain elevators and mtce. and instlln. of machinery, McCabe Bros. Grain Co., Winnipeg; 1940 (summer), inspector of paving in constrn. of R.C.A.F. airport at Saskatoon, Dept. of Transport; 1941 (May-Oct.), asst. to chief chemist, and 1941-42, dftsmn. engineering office, Consolidated Paper Corp., Grand'-Mère, Que.; 1942 (Sept.-Nov.), squadron technical officer, R.C.A.F. Station, C.P.A. O. No. 3, and at present officer commanding, Repair Squadron, No. 17 S.F.T.S. (R.C.A.F.), Souris, Man., with rank of Pilot Officer. (St. 1941).

References: I. M. Fraser, C. J. Mackenzie, V. Jepsen, F. Young, H. J. Ward.

THOMPSON—ALVIN HENRY, of Pictou, N.S. Born at Pictou Apr. 30, 1914;

Educ.: B. Eng. (Mech.), N.S. Tech. Coll. 1942; summers—1936—highway survey. Prov. Govt., 1938-40, highway and airport constrn., Storms Const. Co., Toronto, 1940, asst. to master mechanic repairing marine steam engines and auxiliaries and 1941 miscellaneous designs of approved life boats, etc., Pictou Foundry and Machine Co. Ltd.; 1942 to date, hull supt., detailing steel drawings for pre-fabrication, Pictou Shipyards, Pictou. (St. 1942).

References: J. B. Ferguson, N. S. Swan, A. A. Ferguson, R. P. Freeman, F. L. West, F. Binns, H. W. McKiel.

WEBSTER—GORDON FREDERICK, of Niagara Falls, Ont. Born at Elbow, Sask., Aug. 3, 1915; Educ.: B. Eng., Univ. of Sask., 1942; 1935-36, mech. equipment, Canada Permanent Mortgage Co., Regina; 1936-37, Dept. of Highways, Prov. of Sask.; summers—1939, rodman, 1941, instr'mn., Federal Dept. Agriculture, Regina, 1940 airport constrn., Dept. of Transport; 1942-43, Lieut., R.C.E., at present, engrg. dept., Canadian Carborundum Co., Niagara Falls, Ont. (St. 1942).

References: R. A. Spencer, E. K. Phillips, W. G. Worcester, J. I. Mutchler, W. E. Lovell.

## LIBRARY NOTES

*Continued from page 380*

### MICROMERITICS, THE TECHNOLOGY OF FINE PARTICLES

*By J. M. DallaValle. Pitman Publishing Corp., New York and Chicago, 1943. 428 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $8.50.*

This work is intended as a general guide to the behavior and characteristics of fine particles, and thus treats a subject of interest to workers in many fields of science and engineering. Methods of particle measurement, size distribution and packing arrangements are considered, and a general theory concerning the physical properties of fine particles is presented. Industrial applications of the subject matter, as in the transportation of fine materials, in fine grinding and the treatment of dust and smoke, are discussed. There is an extensive bibliography.

### MISCELLANEOUS PHYSICAL TABLES—PLANCK'S RADIATION FUNCTIONS AND ELECTRONIC FUNCTIONS

*Prepared by the Federal Works Agency, Work Projects Administration for the City of New York, conducted under the sponsorship and for sale by the National Bureau of Standards, Washington, D.C., 1941. 58 pp., charts, tables, 11 x 8 in., cloth, $1.50.*

These tables give the values of Planck's radiation functions to five significant figures, and of the electronic function to six figures. The tables are the work of the WPA of New York.

### MODERN MARINE ENGINEER'S MANUAL, Vol. 2

*Edited by A. Osbourne and others. Cornell Maritime Press, New York, 1943. 1,200 pp., paged in sections, illus., diagrs., charts, tables, 7½ x 5 in., fabrikoid, $4.00.*

The second and final volume of this work is, like the first, prepared by a number of specialists. It concludes the study of engines by a section on marine Diesel engines. Other sections deal with marine refrigeration, heating, ventilation, insulation, steering gear, deck machinery, electricity, instruments, propellers, tests and trials. A collection of useful tables is given. The book is a practical guide for the operation and maintenance of ship machinery.

### POTASH IN NORTH AMERICA (American Chemical Society Monograph Series No. 91)

*By J. W. Turrentine. Reinhold Publishing Corp., New York, 1943. 186 pp., illus., diagrs., charts, maps, tables, 9½ x 6 in., cloth, $3.50.*

In 1926 Mr. Turrentine published a review of the results of research work carried on between 1911 and 1926 for the purpose of establishing a domestic potash industry. The present book continues the story from 1926 to to-day, when America produces a supply ample for its own needs and at low price. The book is largely a compilation, in which the geological, technological and statistical aspects of the industry are presented by specialists.

### QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book VI—Water Treatment, Corrosion and Safety Rules

*Compiled by H. C. Dinger. (Marine Engineering and Shipping Review), Simmons-Boardman Publishing Corp., New York, 1943. 136 pp., tables, 8½ x 5 in., paper, $1.00.*

These questions and answers deal with the problems of feed-water treatment, corrosion, lubrication and fire prevention as they confront the marine engineer. They have been selected from those that have appeared during recent years in the "Marine Engineering and Shipping Review."

In addition the pamphlet gives information on obtaining marine engineering licenses and recent examination questions.

### QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book VII — DIESEL ENGINES — ELECTRICAL EQUIPMENT

*Compiled by H. C. Dinger. Marine Engineering and Shipping Review, Simmons-Boardman Publishing Corp., New York, 1943. 130 pp., diagrs., tables, 8 x 5 in., paper, $1.00.*

These questions and answers, compiled from "Marine Engineering and Shipping Review," cover many practical questions which have puzzled marine engineers in operating and maintaining marine Diesel engines and the electrical equipment found on small ships.

### ROAD TESTS OF AUTOMOBILES USING ALCOHOL-GASOLINE FUELS (Iowa Engineering Experiment Station Bulletin 158.)

*By R. G. Paustian. Iowa State College, Ames, Iowa, 1942. 56 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, gratis.*

This bulletin presents the results of careful comparative tests of cars using alcohol-gasoline blends with those using gasoline alone. The fuel mileage, accelerating ability, anti-knock properties and oil consumption with alcohol-gasoline blends are reported in detail. Blends containing not more than twenty per cent of alcohol were found to be satisfactory.

### SAE HANDBOOK 1943 Edition

*Society of Automotive Engineers, 29 West 39th St., New York, 1943. 810 pp., illus., diagrs., charts, tables, 8½ x 5½ in., fabrikoid, $5.00.*

The new edition follows closely the model of the earlier ones, but the standards have been brought up to date, and the other data carefully revised.

### SECONDARY RECOVERY OF OIL IN THE UNITED STATES

*Sponsored by various committees of the American Petroleum Institute, 50 West 50th St., New York, 1942. 259 pp., illus., diagrs., charts, maps, tables, 11 x 8 in. fabrikoid, $3.50.*

This volume contains a collection of papers upon the recovery of petroleum by injecting air and gas into underground reservoirs or by flooding them with water. The papers contain the best information available at present on the economics of the methods, on the porosity, permeability, thickness and area of oil-producing reservoirs and on the amounts of oil recovered and recoverable by these methods. Each paper is by an author with practical experience in the field of which he writes.

### SUB-ATOMIC PHYSICS.

*By H. Dingle. Ronald Press Co., New York, 1943. 272 pp., illus., diagrs., charts, maps, tables, 8 x 5 in., cloth, $2.25.*

As used here, sub-atomic physics includes those divisions of physics (light, electricity and magnetism) in which the structure of the atom is fundamental. This text, with the companion volume on mechanical physics, presents a course in which physical principles are presented in a manner that enables their application to aeronautical and related studies to be readily understood. The book is intended especially for students preparing for the air services.

### TECHNIQUE OF PRODUCTION PROCESSES

*By J. R. Connelly. McGraw-Hill Book Co., New York and London, 1943. 430 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

The aim of this book is to give the student a knowledge of the elementary principles of industrial operations which will provide a background for advanced specialized work. Attention is concentrated on the operations of casting, forming, material removal and joining, which are described and illustrated. Auxiliary services, such as material handling, stores, plant services, standardization and gaging, methods and job study, are explained. A final chapter discusses the economics of new equipment.

### VECTOR AND TENSOR ANALYSIS

*By H. V. Craig. McGraw-Hill Book Co., New York and London, 1943. 434 pp., diagrs., tables, 9 x 6 in., cloth, $3.50.*

This text is intended primarily for those who use vector and tensor analysis as a tool. For them it provides a fairly rigorous course which does not call for a thorough knowledge of modern advanced calculus, but only for acquaintance with the standard first course in the subject. The book opens with a section that supplies the necessary mathematical background. This is followed by a section on elementary vector analysis, and one on tensors and extensors. The final section considers some applications to classical dynamics and to relativity.

### WAVES AND WAVE ACTION, a Bibliography of Books, Periodicals, and Society Publications appearing from 1687 through February 1943

*Compiled by C. C. Lee, 1315 First North St., Vicksburg, Miss., May, 1942, revised February, 1943, typewritten, 10½ x 8 in., paper, $5.00.*

This bibliography lists over 800 references to papers dealing with waves and wave action which appeared during the years 1687 to 1942 inclusive. The entries are arranged by authors and are, in most cases, briefly abstracted or annotated. Subject and chronological indexes are provided.

### MANUAL OF EXPLOSIVES, MILITARY PYROTECHNICS AND CHEMICAL WARFARE AGENTS

*By J. Bebie. The Macmillan Co., New York, 1943. 171 pp., diagrs., tables, 8½ x 5½ in., cloth, $2.50.*

This manual is a convenient source of information on the composition, properties and uses of explosives and war chemicals. The articles are arranged in alphabetical order, with cross references to service symbols, trade names and other synonyms. Composition, properties and uses are stated concisely. There is a bibliography.

### MOTION STUDY FOR THE SUPERVISOR

*By N. R. Bailey. McGraw-Hill Book Co., New York and London, 1942. 111 pp., diagrs., charts, tables, 8 x 5 in., cloth, $1.25.*

The object of this little book is to explain the basic principles of motion economy as simply and logically as possible, including a method of observation that permits an operation to be studied easily. The work is intended for foremen and aims to give them a sound and sympathetic understanding of motion-study principles. (*Continued on page 384*)

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

SALES ENGINEER AND BRANCH MANAGER required for Ottawa office of firm specializing in sale of engineering supplies. Either French or English. Permanent employment, fine prospects. References required. Apply to Box No. 2635-V.

ASSISTANT PLANT SUPERINTENDENTS required by well-established firm engaged in the manufacture of building materials. One vacancy in Montreal plant and the other in a small town near Montreal. In the latter case, knowledge of French is essential. Apply giving record of education and experience to Box No. 2640-V.

MECHANICAL ENGINEER for the position of chief draughtsman, middle-aged person experienced in draughting office detail and capable of directing activities of 12 to 15 draughtsmen. Location Niagara Peninsula. Apply to Box No. 2644-V.

### SITUATIONS WANTED

GRADUATE ENGINEER of proven administrative and executive ability desires position entailing greater responsibility and scope for initiative. Presently supervising the production of precision tools. Experienced in personnel work and all phases of maintenance engineering work. Apply to Box No. 2450-W.

GRADUATE ENGINEER, University of Toronto, with seven years experience along lines of general mechanical draughting and design with accent on electric motors, instruments and small tools. Also considerable experience in electric instrument laboratory. Due to re-organization of his present company, services are not being fully utilized. Apply to Box No. 1486-W.

### FOR SALE

Thacher Calculating Rule in mahogany case, good condition. Apply to Box No. 49-S.

### FOR SALE OR RENT

TRANSIT, W. & L. E. Gurley, complete with tripod, 5" dia. horizontal circle. In excellent condition. Apply to Box No. 51-S.

### CAMERA WANTED

A member of the Institute, who has to undertake an extensive reconnaissance survey, wishes to purchase a second-hand camera provided it is in first-class condition.

The minimum requirements are:

1. At least f4.5 Anastigmat lens or better.
2. Shutter speed to at least 1/150 of a second.
3. Positive sighting, or reflecting, type of finder.
4. Picture size 2¼ x 3¾" or next larger.
5. Use of standard films.
6. Focusing scale easily read and set.

A No. 1-A Junior F 6.3 camera could be traded-in if desired. Reply giving specifications and price to Box No. 52-S.



### FOR SALE

Transits, theodolites, compasses, levels, clinometers, hand-levels, pickets, tapes, rods (10', 15' and 20' slab), other accessories. Draughting boards and instruments; planimeters, electric-motored erasers, plan-binders, scales, etc. Apply to Ralph Kendall, M.E.I.C., 93 Maynard Street, Halifax, N.S. Telephone 4-2849.

---

## LIBRARY NOTES

(*Continued from page 383*)

**AEROSPHERE 1942**

*Aircraft Publications, 370 Lexington Ave., New York, 1942. 1,156 pp., paged in sections, illus., diagrs., tables, 12 x 8½ in., cloth, $12.50.*

This edition of this useful reference work provides a detailed survey of aircraft throughout the world, with special emphasis on military aviation. Under the topics: The U.S. War Effort; Modern Aircraft of the World; Modern Aircraft Engines of the World; Aircraft Armament; Aircraft Statistics; Buyer's Guide; the entire industry is covered. Each airplane and each engine are described and illustrated by photograph or drawing. The book will answer almost any question in its field.

**AIRCRAFT LOFTING AND TEMPLATE LAYOUT with Descriptive Geometry**

*By H. Thrasher. Aviation Press, San Francisco, Calif., 1942. 212 pp., illus., diagrs., charts, tables, 10 x 7½ in., stiff paper, spiral binding, $3.50.*

This bok is intended for beginners, primarily those entering the aircraft industry, but also useful to those entering shipbuilding. The first section deals with descriptive geometry. In section two, template theory and practice are discussed. Section three is devoted to lofting, and a final section gives some useful general information.

**ALFRED NOBEL, Dynamite King—Architect of Peace**

*By H. E. Pauli. L. B. Fischer, New York, 1942. 325 pp., 8½ x 5½ in., cloth, $3.00.*

This interesting biography of the inventor gives a detailed account of his life. His work in originating high explosives, through which he accumulated a vast fortune, his interest in world pacifism, and his endeavours to promote peace by founding the Nobel prizes, are described in full. A sympathetic account of a strange genius.

**ELECTRICAL COUNTING, with special reference to counting Alpha and Beta Particles**

*By W. B. Lewis. University Press, Cambridge, England; Macmillan Co., New York, 1942. 144 pp., diagrs., charts, 9 x 5½ in., cloth, $2.50.*

Describes the technique of this method, which is an essential aid in research in nuclear physics. Much of the text, dealing with amplifiers, oscillograph recording, stabilizers and circuits will also be of interest to others who use vacuum-tube circuits.

**ESSENTIAL MATHEMATICS FOR SKILLED WORKERS**

*By H. M. Keal and C. J. Leonard. John Wiley & Sons, New York; Chapman & Hall, London, 1942. 293 pp., illus., diagrs., charts, tables, 7½ x 5 in., cloth, $2.00.*

Provides a concise review covering the computations used by workers in applied science. Intended for shop workers, students without college training and those wishing a practical reference book.

**4,000 YEARS OF TELEVISION, the Story of Seeing at a Distance**

*By R. W. Hubbell. G. P. Putnam's Sons, New York, 1942. 256 pp., diagrs., 7½ x 5 in., cloth, $2.25.*

A popular account of television and its development from the earliest experiments to the present time, with a prophecy of its future.

**GALVANÓMETRO DE RESONANCIA (Publicación No. 5, 1942)**

*By S. Gerszonowicz. Institute de Electrotécnica, Facultad de Ingenieria, calle Cerrito 73, Montevideo, R. O. del Uruguay. 45 pp., diagrs., 9½ x 6½ in., paper, apply.*

This pamphlet presents the theory of the vibration galvanometer, discusses its uses and describes the various types that have been devised. A note on the telephone is appended.

**GOALS FOR AMERICA, a Budget of Our Needs and Resources**

*By S. Chase. The Twentieth Century Fund, New York, 1942. 134 pp., tables, 8 x 5½ in., cloth, $1.00.*

In this little volume the Twentieth Century Fund presents an exploratory report in which the author lays down some economic specifications for the postwar United States. Our needs and resources are catalogued with respect to basic wants such as food, shelter, clothing, health, education and public works. Intended for the general reader.

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### PIPE JOINT COMPOUND

LaSalle Builders Supply Ltd., Montreal, Que., have for distribution a folder entitled "Overcoming the Litharge and Glycerin Shortage," issued by the X-Pando Corporation. This folder outlines the value of the "X-Pando" pipe joint compound, not only as a substitute for litharge and glycerin, but as an improvement over this combination for use in ending pipe leaks permanently. This compound expands as it sets, and is offered for use in ammonia, brine, oxygen, and freon lines and works as a seal for all types of joints in all types of metal pipe.

### MECHANICAL REMOTE CONTROL

"Teleflex Controls," a 94-page, looseleaf catalogue, published by Teleflex Limited, Toronto, Ont., describes the company's complete line of mechanical remote controls, which have a wide variety of applications in aircraft, marine field, and in such industrial plants as electric power stations, pulp and paper mills, explosive factories, etc. The material in the book is segregated into seven sections dealing with; applications, description, design, general information and sufficient engineering data to serve as a guide to the selection of the "Teleflex" parts best suited to any particular requirement.

### METALLIC AND FABRIC PACKINGS

Atlas Asbestos Company, Ltd., Montreal, Que., have prepared a 155-page catalogue showing the complete line of Atlas packings, including mechanically correct metallic and fabric packings for every industry. With n its pages, which are profusely illustrated in colour, is embodied all the information for which an engineer would ask. It contains engineering data and shows complete service recommendation charts. For ready reference it is indexed by classifications and cross-indexed by service use.

### STEEL CONSULTANT HONOURED

Mr. J. G. Morrow, Chief Metallurgist of The Steel Company of Canada Ltd., Hamilton, has been made a Member of the Order of the British Empire in the King's Birthday honours. Recognition has been given Mr. Morrow for his work as Steel Consultant in connection with war production. Mr. Morrow is also acting Vice-President of Atlas Plant Extension Ltd., a Crown Company incorporated to augment Canada's supply of alloy steel and gun forgings.

J. G. Morrow, M.B.E.



Thos. D. Robertson

### MONTREAL TRAMWAYS APPOINTMENT

Mr. Thos. D. Robertson, formerly executive assistant, has been appointed assistant secretary-treasurer of the Montreal Tramways Company. He graduated from McGill University in 1930 with the degree of B.A. and in 1934 with the degree of B.C.L., and practised law in Montreal until 1937.

### WAR PRODUCTION REVIEW

Canadian Fairbanks-Morse Company, Ltd., Montreal, have issued a 28-page booklet entitled "Winning the Battle of Production," which concisely and vividly portrays the contribution of Canada's aircraft, shipbuilding, motor vehicle, ammunition, gun, construction, metal, lumber, textile, food and railroad industries to the cause of the United Nations. Latest facts and figures relative to the contribution of each of these industries is reviewed in turn. Graphic support is given to the text matter by inclusion of a related company advertisement on the page opposite to each industry's review.

### RECENT APPOINTMENT

Mr. Wilbur A. McCurdy was recently appointed Assistant Director of Purchases, Dominion Rubber Co. Ltd., head office, Montreal, in accordance with an announcement by Mr. H. R. Nixon, Director of Purchases. Starting with Dominion Rubber in 1916, Mr. McCurdy has been connected with manufacturing units in Granby, Que., and Montreal, and became customs auditor at the Company's head office before joining the purchasing department in 1920.

### ACQUIRES E. B. EDDY INTERESTS

Mr. Willard Garfield Weston, Canadian-born member of the British House of Commons, has taken over Viscount Bennett's controlling interest in The E. B. Eddy Co. Ltd., of Hull, and subsequently all minority interests. Confirmation of the transaction, of both British and Canadian significance, was given by Mr. Weston on a recent visit to Hull.

Mr. Weston announced that in assuming complete ownership of the company it was not his intention in any way to change its policies; that actual operation would continue with the officials who have been in charge for many years past.

"Our chief objective," he said, "will be to continue the place of The E. B. Eddy Company in Canada's industrial life, to maintain the high standards of the company's products, and to increase its usefulness to its customers throughout the Dominion. Gordon Gale, the president, and W. S. Kidd, the general manager, who have consented to remain in their respective posts, will go on with their excellent work."

Mr. Weston, in his 45th year, was born and educated in Toronto. He fought through World War I with the engineers and upon returning home entered the biscuit manufacturing business conducted by his father, the late George Weston. He became president and general manager of George Weston Limited and directing head of a number of allied and subsidiary companies, developing their activities both in Canada and the United States. Ten years ago he went to England to launch an enterprise which has since become the largest food manufacturing industry in the British Empire. In 1939 he was elected by acclamation to the British House of Commons, sitting for the constituency of Macclesfield.

Willard Garfield Weston
*(Copyright by Karsh)*

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### ELECTRONIC LABORATORY FORMED

Mr. John D. Gordon, formerly general manager of the Taylor-Winfield Corporation, has announced the formation of Detroit Electronic Laboratory with headquarters at 10345 Linwood Ave., Detroit, Mich.

The new company, which Mr. Gordon will direct as general manager, is concentrating on the development and manufacture of special purpose electronic tubes. Among the special tubes under development is a line designed primarily for control equipment for resistance welding.

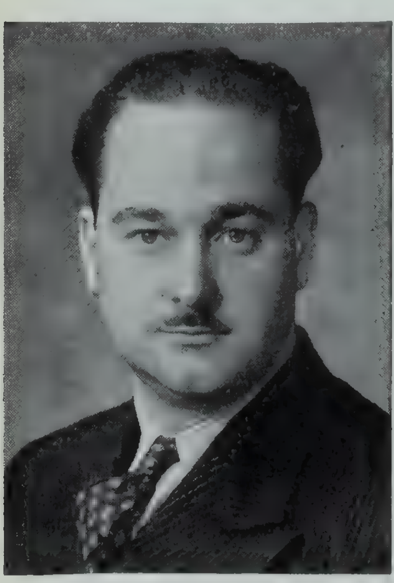
In recognition of the difficulty in obtaining ignitron tubes at the present time due to the fact that they contain large amounts of critical materials, Detroit Electronic has also announced a "Victory Repair Service" for such tubes. The new service, designed to conserve such critical materials will also eliminate long delays in obtaining new tubes.

### PHOSPHORIC ACID WATER SOFTENER REAGENT

Cochrane Corporation, Philadelphia, Pa., have issued a reprint of a paper describing, in simple language, the use of phosphoric acid as the reagent in single or two-stage water softeners, which takes the place of mono-sodium, di-sodium and tri-sodium phosphate, resulting in better control of the alkalinity at a much lower cost of reagents. With this method of operation, feedwater has been treated and is satisfactory for 1400-lb. boilers, reducing the hardness to approximately ½ ppm. Claimed to be a step in advance on operation of the hot process softener, it produces a water of a hardness so low that all accumulation of sludge in boilers is avoided and is satisfactory for the most critical operation. Comparison of chemical costs are given as well as data showing the effectiveness of this treatment in typical installations.

### ELECTED PRESIDENT

Mr. T. H. Dowsett, advertising manager, Trane Company of Canada Ltd., Toronto, Ont., was elected President of the Industrial Advertisers Association of Ontario at the annual meeting recently held in Toronto. Other officers and directors elected were: Vice-President—H. A. Standing; Secretary—E. J. Hayes; Treasurer—J. G. Beare; Directors—R. J. Avery, I. M. Gringorten, W. H. Evans, E. J. L. Stinson, D. McCrimmon. Mr. Dowsett and Mr. McCrimmon were appointed to represent the I.A.A.O. on the Board of Directors of the National Industrial Advertisers Association of which the Ontario Association is a chapter.



**T. H. Dowsett**

**A. F. Horn**

### RECENT APPOINTMENT

Mr. A. F. Horn was recently appointed Air Brake Inspector, Canadian Westinghouse Co. Ltd. Mr. Horn's headquarters are at Winnipeg, Man. This appointment is the outcome of Mr. Horn's predecessor, Mr. H. E. Parker, assuming the position of Chief Air Brake Inspector for the company at Montreal.

### CARBOLOY TRAINING COURSE

Recognizing the vital importance to Canadian war production of a thorough technical knowledge of cemented carbide tools and dies, Canadian General Electric Co. Ltd. has inaugurated a special intensive Carboloy Training Course for key men from plants using cemented carbide tools.

The course, which is complete and practical, has been devised to train key men in the manufacture, application and use of cemented carbide tools and dies, so that they in turn can lead organized carbide training programmes in their own plants.

The course requires four days and covers not only the theory of cemented carbides but includes practical shop instruction in brazing, grinding, designing, chip-breaker grinding and the putting of cemented carbide tools to work.

Included in the course are lectures, practical work, discussions, as well as visits to the Carboloy plant. A series of six special films on carbide tool technique are an important feature of the training schedule. All who attend the course are supplied with a set of booklets which provide a permanent reference source.

To ensure that all trainees receive thorough and personally supervised training, classes are limited to six students. The course is held at Carboloy Works of Canadian General Electric, 1025 Lansdowne Avenue, Toronto, Ont. Tuition is free including materials and use of equipment, but the trainee's living expenses—lodging, meals, transportation—must be provided by the company sending the trainee.

Any men who use cemented carbide tools and dies are eligible to enroll in the course—key men who will become instructors on carbide application and maintenance; toolmakers engaged in design, tipping or maintenance of carbide tools; tool-room supervisors. It is desirable that those selected be quick to learn, receptive and competent to instruct others.

A new class starts every Monday. The course prospectus and enrollment forms are available from any C.G.E. office.

### APPOINTED CANADIAN DISTRIBUTORS

The appointment of Gunite & Waterproofing Ltd., Montreal, Que., as Canadian distributors for Amercoat has just been announced by American Pipe & Construction Co., Los Angeles, Calif., manufacturers of corrosion-resistant thermoplastic coatings for steel, concrete and wood. Gunite & Waterproofing Ltd. will handle distribution of Amercoat products in Canada, serving war industries, food and chemical industries, general industry and the marine field.

### ELECTRICAL CONNECTORS

Cannon Electric Company, Ltd., Toronto, Ont., have issued an 84-page catalogue devoted to detailed specifications of the "Cannon" type AN connectors for radio, instrument and general electrical circuits of aircraft applications. These connectors are available as wall, box and integral mounting receptacles, and straight and 90° angle plugs. Pages on junction shells, cable clamps dust caps, dummy or stowage receptacles, and the "Cannon" catalogue condensed supplement is contained in a separate section. Illustrations, insert arrangement drawings and dimensional drawings, accompany complete specifications.

### TEXT ON PLYWOOD

I. F. Laucks Ltd., Vancouver, B.C., have issued a 250-page book entitled "Technique of Plywood," which was written by Charles B. Norris, formerly chief engineer of Lauxite Corp., Lockport, N.Y., now principal engineer of the Division of Timber Mechanics U.S. Forest Products Laboratory. The book, written from a technical standpoint, is primarily for engineers, designers, and users of plywood, covers all phases of plywood manufacture, contains also a chapter on "General Scientific Principles of Gluing" by I. F. Laucks.

### GUTTA PERCHA APPOINTMENT

Mr. J. Ross Belton has been appointed to the position of General Manager of Gutta Percha & Rubber Ltd. Mr. Belton has been Assistant General Manager since 1936. In 1920 he joined Gutta Percha and for the past twenty-three years has occupied positions of increasing importance in both the factory and head office.

**J. Ross Belton**

# ARMSTRONG, WOOD & CO.

MECHANICAL . . . ELECTRICAL
CIVIL . INDUSTRIAL ENGINEERS

TEMPLE BUILDING
BAY AT RICHMOND ST.
TORONTO, CANADA

SPECIAL TOOL &
MACHINE DESIGN

June 5, 1943.

To The Industrial Manufacturers
of Canada —

Gentlemen:

Perhaps the better way to tell you about our Engineering facilities would be with photographs, and so on the next three pages we present some of the members of our staff, together with general views of the Mechanical Engineering and Tool Design offices, located in the Temple Building, and Victory Building, respectively, Richmond St. W., Toronto.

It is our War job to create new combat equipment and munitions of a wide variety, for the armed forces; to design them, together with the special machinery and other tools required for mass production. Some are now in service on the fighting fronts, others are in the designing or production stage.

If you have a production problem requiring jigs and fixtures, mechanical, electrical, civil or industrial engineering, or special machinery, then we should like to help you.

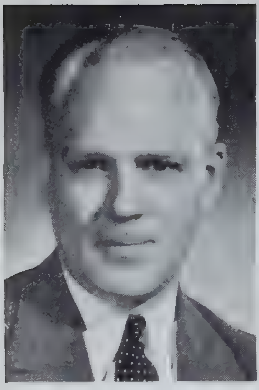
ARMSTRONG, WOOD & COMPANY.

Henry Armstrong

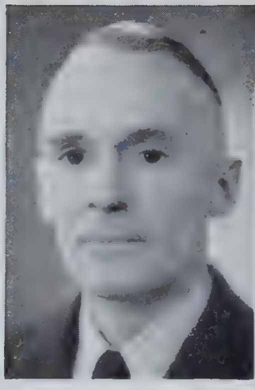
Henry Armstrong,
General Manager.

HA-bp

*For names of Registered Engineers see next page.*



HENRY ARMSTRONG
General Manager



C. A. MEADOWS, R.P.E., Ont.
Chief Mechanical Engineer

D. W. KNOWLES, B.A.Sc.

J. C. STOCKTON

R. S. JONES

SAMUEL T. WOOD
Manager
Tool Design Division

E. L. O'NEIL

C. WINTERMARK

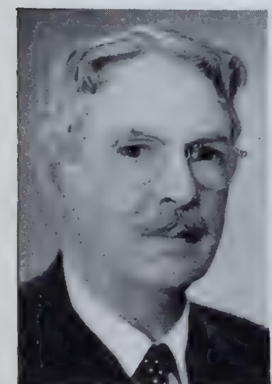
P. J. R. RINGERT

J. O. LEMAIRE

H. MONKTON
Management Executive

In the group of men represented by these photographs, Armstrong, Wood & Company are very fortunate, having obtained a combination of both young men with University training, older men with years of practical experience, and many with both advantages. Collectively, these men can give complete development to almost any phase of an engineering problem, from a creative standpoint through to the shop manufacturing processes.

Because of such resources many knotty problems concerning the manufacture of munitions have been successfully undertaken and completed for our clients.



M. B. JACKSON, B.Sc.

R. V. ANDERSON, B.A.Sc.

E. HEALEY

A. A. KEMENY

D. F. CICCONE, B.A.Sc.

D. B. NAZZER, B.A.Sc.

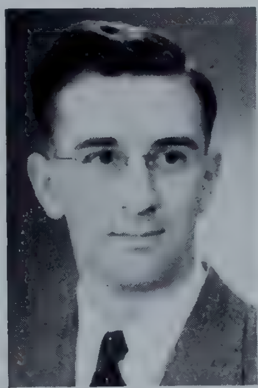
D. CRITOPH
Registered Professional Engineer

T. MORRISON
Registered Professional Engineer

W. D. DRUMMOND, B.A.Sc.

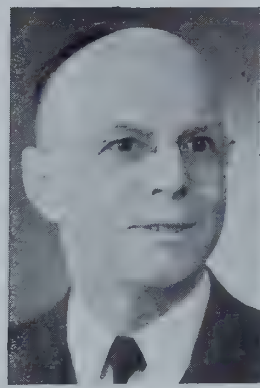
R. W. H. JOHNSON, B.Sc.
Registered Professional Engineer

L. DINOFF

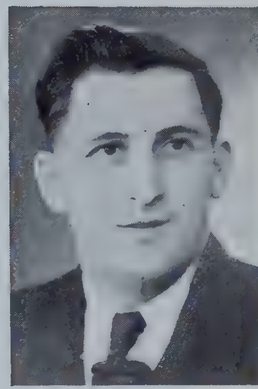


W. TWIDALE

W. H. ALLEN



A. GOLIGHTLEY



P. TROJAN

In terms of War Effort this has meant that many of the "Tools for the Job" for our Armed Forces, have been engineered and produced quickly, from the plans and specifications of Armstrong, Wood & Co.

There is little doubt but that this group, brought together by War, will have an important contribution to make in the postwar development of Canada, and in the rehabilitation of all parts of the War-torn World.

A. D. MISENER, M.A., Ph.D.

S. J. BURWELL

G. J. J. CROSSLAND

E. G. JOHNSON, C.E.

A. ALLEN

E. COCKBURN

# PURCHASERS' CLASSIFIED DIRECTORY

## A SELECTED LIST OF EQUIPMENT, APPARATUS AND SUPPLIES

FOR ALPHABETICAL LIST OF ADVERTISERS SEE PAGE 48

### A

**Acids:**
Canadian Industries Limited.

**Accumulators, Hydraulic:**
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.
Smart-Turner Machine Co. Ltd.

**Alloy Steels:**
Algoma Steel Corp. Ltd.
The Steel Co. of Canada, Ltd.

**Ammeters and Voltmeters:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
Crompton Parkinson (Canada) Ltd.

**Angles, Steel:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Apparatus Bushings:**
Can. General Electric Co. Ltd.
Canadian Ohio Brass Co. Ltd.

**Asbestos:**
Can. Johns-Manville Co. Ltd.

**Ash Handling Equipment:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
United Steel Corp. Ltd.

**Asphalt:**
Barrett Co. Ltd.
Imperial Oil Ltd.

### B

**Ball Mills:**
Canadian Allis-Chalmers Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
Foster Wheeler Ltd.

**Balls, Steel and Bronze:**
Can SKF Co. Ltd.

**Barking Drums:**
Can. Ingersoll-Rand Co. Ltd.
Horton Steel Works Ltd.

**Barometers, Indicating:**
Taylor Instrument Cos. of Cda.Ltd.

**Barrels, Steel:**
Smart-Turner Machine Co. Ltd.

**Bars, Steel and Iron:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
Canadian Car & Foundry Co. Ltd.
The Steel Co. of Canada, Ltd.

**Bearings, Ball and Roller:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Belting, Transmission, Conveyor, Elevator:**
Canadian Allis-Chalmers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Dominion Rubber Co. Ltd.
Gutta Percha & Rubber Ltd.

**Billets, Blooms, Slabs:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Bins:**
Canada Cement Co. Ltd.
Canadian Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.
Horton Steel Works Ltd.

**Blasting Materials:**
Canadian Industries Limited.

**Blowers, Centrifugal:**
Can. Ingersoll-Rand Co. Ltd.
Northern Electric Co. Ltd.
Reavell & Co. (Canada) Ltd.

**Blue Print Machinery:**
Montreal Blue Print Co.

**Boilers:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Vickers Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.
Vulcan Iron Wks. Ltd.

**Boilers, Electric:**
Can. General Elec. Co. Ltd.
Dominion Engineering Co. Ltd.
English Electric Co. of Canada Ltd.

**Boilers, Portable:**
Foster Wheeler Ltd.
United Steel Corp. Ltd.

**Boxes, Cable Junction:**
Northern Electric Co. Ltd.

**Braces, Cross Arm, Steel, Plain or Galvanized:**
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.

**Brackets, Ball Bearings:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Brakes, Air:**
Canadian Controllers Ltd.
Can. Westinghouse Co. Ltd.

**Brakes, Magnetic Clutch:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.

**Bridge-Meggers:**
Northern Electric Co. Ltd

**Bridges:**
Canada Cement Co. Ltd.
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.

**Bucket Elevators:**
United Steel Corp. Ltd.

**Building Materials:**
Canadian Johns-Manville Co. Ltd.

**Buildings, Steel:**
Canadian Bridge Co. Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd

### C

**Cables, Copper and Galvanized:**
Can. General Electric Co. Ltd.
Canadian Telephones & Supplies Ltd.
Northern Electric Co. Ltd.

**Cables, Electric, Bare and Insulated:**
Can. General Elec. Co. Ltd.
Canadian Telephones & Supplies Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd

**Caissons, Barges:**
Canadian Bridge Co. Ltd
Dominion Bridge Co. Ltd.
Horton Steel Works Ltd.

**Cameras:**
Associated Screen News Ltd.

**Capacitors:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd

**Castings, Aluminum:**
Aluminum Co. of Canada Ltd.

**Castings, Brass:**
Canada Metal Co. Ltd.
Dominion Engineering Co. Ltd.
The Superheater Co. Ltd.

**Castings, Iron:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Dominion Engineering Co. Ltd.
Foster Wheeler Ltd.
The Superheater Co. Ltd.
Vulcan Iron Wks. Ltd.

**Castings, Steel:**
Canadian Car & Foundry Co. Ltd.
Vulcan Iron Wks. Ltd.

**Catenary Materials:**
Can. Ohio Brass Co. Ltd.

**Cement Manufacturers:**
Canada Cement Co. Ltd.

**Chains, Silent and Roller:**
Can. Fairbanks-Morse Co. Ltd.
Hamilton Gear & Machine Co.
Lyman Tube & Supply Co. Ltd.
United Steel Corp. Ltd.

**Channels:**
Algoma Steel Corp. Ltd.
Bethlehem Steel Export Corp.
The Canada. Steel Co. Ltd.

**Chemical Stoneware:**
Doulton & Co. Ltd.

**Chemicals:**
Canadian Industries Limited.

**Chemists:**
Milton Hersey Co. Ltd.

**Chippers, Pneumatic**
Can. Ingersoll-Rand Co. Ltd.

**Circuit Breakers:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Clarifiers, Filter:**
Bepco Canada Ltd.

**Clutches, Ball Bearing Friction:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Clutches, Magnetic:**
Bepco Canada Ltd.
Northern Electric Co. Ltd.

**Coal Handling Equipment:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
United Steel Corp. Ltd.

**Combustion Control Equipment:**
Bailey Meter Co. Ltd.

**Compound, Pipe-Joint Seal:**
Crane Packing Co.

**Compressors, Air and Gas:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Can. Ingersoll-Rand Co. Ltd.
Reavell & Co. (Canada) Ltd.
Smart-Turner Machine Co. Ltd.
Swiss Electric Co. of Can. Ltd.

**Concrete:**
Canada Cement Co. Ltd.

**Condensers, Surface:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Can. Ingersoll-Rand Co. Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.
Smart-Turner Machine Co. Ltd.

**Condensers, Synchronous and Static:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Conditioning Systems, Air:**
Can. General Electric Co. Ltd.

**Conduit:**
Can. General Elec. Co. Ltd.
Can. Johns-Manville Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.
Phillips Electrical Works Ltd.

**Conduit, Underground Fibre, and Underfloor Duct:**
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.

**Controllers, Electric:**
Amalgamated Electric Corp. Ltd.
Canadian Controllers Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Controllers, Temperature:**
Taylor Instrument Cos. of Cda.Ltd.

**Controls, Thermostatic:**
Taylor Instrument Cos. of Cda.Ltd.

**Conveyor Systems:**
Mathews Conveyer Co. Ltd.
United Steel Corp. Ltd.

**Couplings:**
Dart Union Co. Ltd.
Dresser Mfg. Co. Ltd.
The Steel Co. of Canada, Ltd.

**Couplings, Flexible:**
Canadian Controllers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
Dresser Mfg. Co. Ltd.
Hamilton Gear & Machine Co.
Peacock Bros. Ltd.
United Steel Corp. Ltd.

**Crane Girders:**
Canadian Bridge Co. Ltd.

**Cranes, Hand and Power:**
Canadian Bridge Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Dominion Bridge Co. Ltd
Hamilton Bridge Co. Ltd.
Herbert Morris Crane & Hoist Co. Ltd

**Cranes, Shovel, Gasoline Crawler, Pillar:**
Canadian Vickers Ltd.

**Crowbars:**
B. J. Coghlin Co. Ltd

**Crushers, Coal and Stone:**
Canadian Allis-Chalmers Ltd.
Can. Ingersoll-Rand Co. Ltd.

**Culverts, Corrugated:**
Canada Ingot Iron Co. Ltd.
Pedlar People Ltd.

### D

**Dimmers:**
Northern Electric Co. Ltd.

**Disposal Plants, Sewage:**
United Steel Corp. Ltd.

**Ditchers:**
Dominion Hoist & Shovel Co. Ltd.

**Drawing Pencils:**
Dixon Pencil Co. Ltd.
Eagle Pencil Co. of Canada, Ltd.
Eberhard Faber Pencil Co. Canada, Ltd.
Venus Pencil Co., Ltd.

**Drills, Pneumatic:**
Can. Ingersoll-Rand Co. Ltd.

**Dynamite:**
Canadian Industries Limited.

### E

**Economizers, Fuel:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Ltd.
Peacock Bros. Ltd.

**Elbows:**
Dart Union Co. Ltd

**Electric Blasting Caps:**
Canadian Industries Limited.

**Electric Railway Car Couplers:**
Can. Ohio Brass Co. Ltd.

**Electrical Supplies:**
Can. General Elec. Co. Ltd.
Can. Ohio Brass Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Electrification Materials, Steam Road:**
Can. Ohio Brass Co. Ltd.

**Engines, Diesel and Semi-Diesel:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
English Electric Co. of Canada Ltd.
Ruston & Hornsby Ltd.

**Engines, Gas and Oil:**
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd
English Electric Co. of Canada Ltd

**Engines, Steam:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Vickers Ltd.

**Evaporators:**
Foster Wheeler Ltd.
Peacock Bros. Ltd.
United Steel Corp. Ltd

**Expansion Joints:**
Dresser Mfg. Co. Ltd
Foster Wheeler Ltd.

**Explosives:**
Canadian Industries Limited.

### F

**Feed Water Heaters, Locomotive:**
The Superheater Co. Ltd

**Ferrules, Condenser Tube:**
Crane Packing Co.

**Finishes:**
Canadian Industries Limited.

**Fire Alarm Apparatus:**
Northern Electric Co. Ltd.

**Floodlights:**
Amalgamated Electric Corp. Ltd
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Flooring, Industrial:**
Canadian Johns-Manville Co. Ltd.

**Floor Stands:**
Jenkins Bros. Ltd.

**Flooring, Rubber:**
Dominion Rubber Co. Ltd

**Floors:**
Canada Cement Co. Ltd.

**Foil, Aluminum:**
Aluminum Co. of Canada Ltd.

**Forcite:**
Canadian Industries Limited.

**Forgings:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Foundations:**
Canada Cement Co. Ltd.

### G

**Gaskets, Asbestos, Fibrous, Metallic, Rubber:**
Anchor Packing Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Johns-Manville Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Robb, Joseph, & Co. Ltd.

**Gasoline Recovery Systems:**
Foster Wheeler Ltd

**Gates, Hydraulic Regulating:**
Canadian Vickers Ltd
Dominion Bridge Co. Ltd.

**Gauges, Draft:**
Bailey Meter Co. Ltd.
Bristol Co. of Can. Ltd.

**Gear Reductions:**
Dominion Engineering Co. Ltd.
Hamilton Gear & Machine Co.
Peacock Bros. Ltd.
United Steel Corp. Ltd.

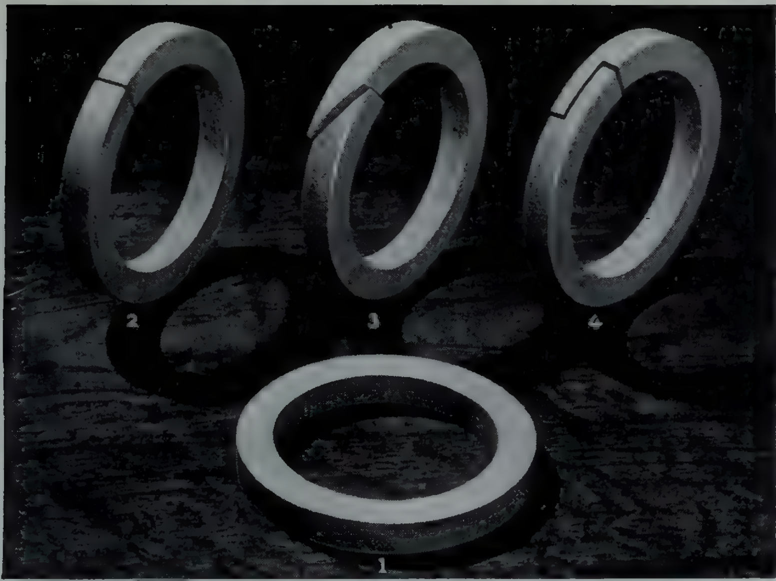
**Gears:**
Dominion Bridge Co. Ltd.
Dominion Engineering Co. Ltd.
Hamilton Gear & Machine Co.
United Steel Corp. Ltd.

**Generators:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

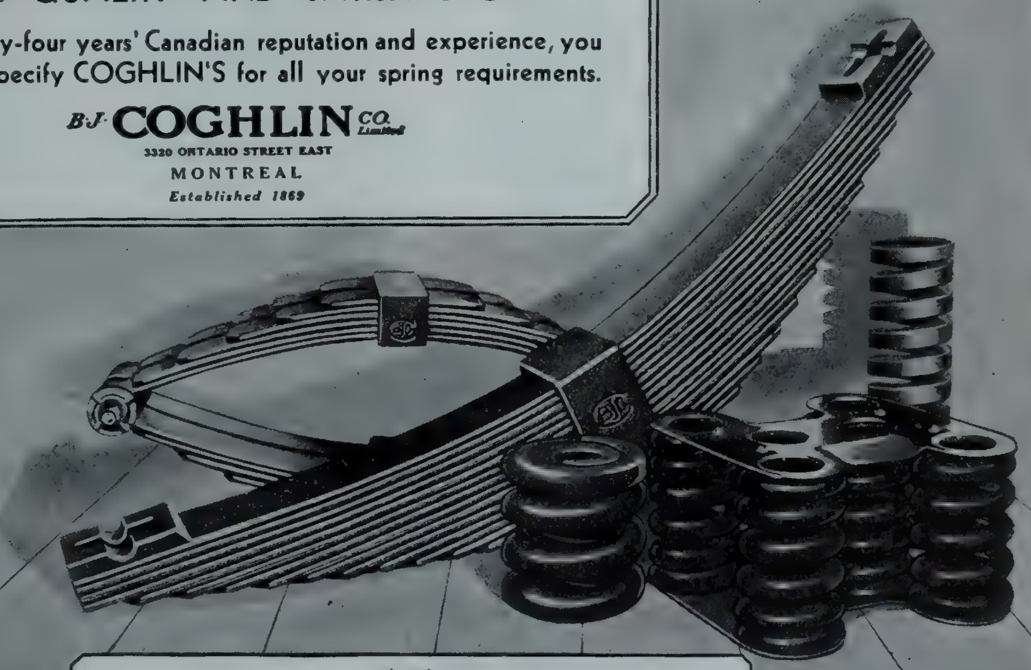
**Governors, Pump:**
Bailey Meter Co. Ltd.
Peacock Bros. Ltd.

**Governors, Turbine:**
Canadian Allis-Chalmers Ltd.
Dominion Engineering Co. Ltd.

**Gratings:**
Canada Ingot Iron Co. Ltd.
Dominion Bridge Co. Ltd


2
3
4
1





## Purchasers' Classified Directory

H

**Hangers, Ball and Roller Bearing:**
Can. Fairbanks-Morse Co. Ltd.
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Headlights, Electric Railway:**
Can. General Elec. Co. Ltd.
Can. Ohio Brass Co. Ltd.
Can. Westinghouse Co. Ltd.

**Heat Exchange Equipment:**
Foster Wheeler Ltd.
Horton Steel Works Ltd.
United Steel Corp. Ltd.

**Heaters, Convection:**
Chatham Malleable & Steel Products Ltd.

**Heaters, Unit:**
Chatham Malleable & Steel Products Ltd.

**Hoists, Air, Steam and Electric:**
Can. Ingersoll-Rand Co. Ltd.
Canadian Vickers Ltd.
Mathews Conveyer Co. Ltd.
United Steel Corp. Ltd.

**Hose, Rubber:**
Dominion Rubber Co. Ltd.

I

**Indicator Posts:**
Jenkins Bros. Ltd.

**Industrial Electric Control:**
Canadian Controllers Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Injectors, Locomotive, Exhaust Steam:**
The Superheater Co. Ltd.

**Inspection of Materials:**
Milton Hersey Co. Ltd.

**Instruments, Electric:**
Bepco Canada Ltd.
Bristol Co. of Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Insulating Materials:**
Can. General Electric Co. Ltd.
Canadian Industries Limited.
Can. Johns-Manville Co. Ltd.
Spun Rock Wools Ltd.

**Insulators, Porcelain:**
Can. General Electric Co. Ltd.
Can. Ohio Brass Co. Ltd.
Northern Electric Co. Ltd.

**Intercoolers:**
Foster Wheeler Ltd.

J

**Journal Bearings and Boxes, Railway:**
Can. SKF Co. Ltd.

L

**Lacquers:**
Canadian Industries Limited.

**Lantern Slides:**
Associated Screen News Ltd.

**Leading Wire:**
Canadian Industries Limited.

**Library Films:**
Associated Screen News Ltd.

**Lighting Equipment, Industrial and Street:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Lightning Arresters:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Line Materials:**
Can. General Electric Co. Ltd.
Can. Ohio Brass Co. Ltd.
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.

**Liners and Linings, Rubber:**
Dominion Rubber Co. Ltd.

**Linings, Brake and Clutch:**
Atlas Asbestos Co. Ltd.
Ferodo Limited.
J. C. McLaren Belting Co. Ltd.

**Locomotives, Electric:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co. of Canada Ltd.

**Lubricants:**
Imperial Oil Ltd.

M

**Machinery, Hydraulic:**
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.

**Magnetic Separators:**
Bepco Canada Ltd.
Northern Electric Co. Ltd.
Peacock Bros. Ltd.

**Material Handling Equipment:**
Can. Fairbanks-Morse Co. Ltd.
Mathews Conveyer Co. Ltd.
United Steel Corp. Ltd.

**Mats and Matting, Rubber:**
Dominion Rubber Co. Ltd.

**Meters, Boiler and Coal:**
Bailey Meter Co. Ltd.
Peacock Bros. Ltd.

**Meters, Electric:**
Bristol Co. of Can. Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Meters, Flow:**
Bailey Meter Co. Ltd.
Bristol Co. of Canada Ltd.
Neptune Meters Ltd.
Peacock Bros. Ltd.

**Meters, Liquid (Hot or Cold):**
Bailey Meter Co. Ltd.
Bristol Co. of Canada Ltd.
Neptune Meters Ltd.
Peacock Bros. Ltd.

**Mine Cars:**
Canadian Vickers Ltd.

**Mining Machinery:**
Canadian Allis-Chalmers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
United Steel Corp. Ltd.

**Motion Pictures:**
Associated Screen News Ltd.

**Motors, Electric:**
Bepco Canada Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.
Swiss Electric Co. of Can. Ltd.

**Moulded Goods, Rubber and Asbestos:**
Can. Johns-Manville Co. Ltd.
Dominion Rubber Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Gutta Percha & Rubber Ltd.

O

**Oil Burning Equipment:**
Bethlehem Steel Export Corp.
Peacock Bros. Ltd.

**Oil Refining Equipment:**
Foster Wheeler Limited.
Horton Steel Works Ltd.
United Steel Corp. Ltd.

**Ornamental Iron:**
Vulcan Iron Wks. Ltd.

P

**Packing, Acid:**
Crane Packing Company.

**Packing, Condenser:**
Crane Packing Company.

**Packing, Metallic and Semi-Metallic:**
Crane Packing Company.

**Packing, Rod, Piston, Valve, Etc.**
Crane Packing Company.

**Packing, Stern Tube:**
Crane Packing Company.

**Packing, Superheat:**
Crane Packing Company.

**Packing, Turbine Shaft:**
Crane Packing Company.

**Packings, Asbestos, Cotton and Flax, Metal, Rubber:**
Anchor Packing Co. Ltd.
Atlas Asbestos Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Johns-Manville Co. Ltd.
Dominion Rubber Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Gutta Percha & Rubber Ltd.
Robb, Joseph, & Co. Ltd.

**Paints, all purposes:**
Canadian Industries Limited.

**Paving Materials:**
Barrett Co. Ltd.

**Pencils:**
Dixon Pencil Co. Ltd.
Eagle Pencil Co. of Canada Ltd.
Eberhard Faber Pencil Co. Canada Ltd.
Venus Pencil Co. Ltd.

**Penstocks:**
Canadian Allis-Chalmers Ltd.
Canadian Vickers Ltd.
Hamilton Bridge Co. Ltd.
Horton Steel Works Ltd.

**Photographs, Commercial and Portrait:**
Associated Screen News Ltd.

**Piling, Steel Sheet:**
Algoma Steel Corp. Ltd
Bethlehem Steel Export Corp.

**Pillow Blocks, Plain, Ball and Roller Bearing:**
Can. Fairbanks-Morse Co. Ltd.
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

## Purchasers' Classified Directory

**Pinions:**
Dominion Engineering Co. Ltd.
Hamilton Gear & Machine Co.
United Steel Corp. Ltd.

**Pipe, Clay, Vitrified:**
Alberta Clay Products Co. Ltd.
Clayburn Co. Ltd.
National Sewer Pipe Co. Ltd.
Standard Clay Products Ltd.

**Pipe, Iron, Corrugated:**
Canada Ingot Iron Co. Ltd.
Pedlar People Ltd.

**Pipe, Steel:**
Horton Steel Works Ltd.
The Steel Co. of Canada, Ltd.

**Pipe Coils:**
The Superheater Co. Ltd.

**Pipe Couplings and Nipples:**
Dart Union Co. Ltd.
The Steel Co. of Canada, Ltd.

**Plates, Steel:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Pneumatic Tools:**
Can. Ingersoll-Rand Co. Ltd.

**Pole Line Hardware:**
Can. General Electric Co. Ltd.
Can. Ohio Brass Co. Ltd.
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd.

**Polishes:**
Canadian Industries Limited.

**Powder, Black and Sporting:**
Canadian Industries Limited.

**Power Switchboards:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

**Preheaters, Air:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.

**Presses, Hydraulic:**
Dominion Engineering Co. Ltd.
Hydraulic Machinery Co. Ltd.
United Steel Corp. Ltd.

**Projectors:**
Associated Screen News Ltd.

**Pulleys:**
United Steel Corp. Ltd.

**Pulleys, Ball Bearings, Loose:**
Can. SKF Co. Ltd.
United Steel Corp. Ltd.

**Pulleys, Magnetic:**
Bepco Canada Ltd.

**Pulp and Paper Mill Machinery:**
Can. General Elec. Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Can. Westinghouse Co. Ltd.
Dominion Engineering Co. Ltd.
Canadian Vickers Ltd.
English Electric Co. of Canada Ltd.
Hydraulic Machinery Co. Ltd.
United Steel Corp. Ltd.

**Pulverized Fuel Systems:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Bethlehem Steel Export Corp.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.

**Pump Valves, Rubber:**
Garlock Packing Co. of Can. Ltd.

**Pumps:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Bepco Canada Ltd.
Canadian Allis-Chalmers Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Dominion Engineering Co. Ltd.
Canadian Vickers Ltd.
Foster Wheeler Ltd.
Hydraulic Machinery Co. Ltd.
Northern Electric Co. Ltd.
Smart-Turner Machine Co. Ltd.

**Pyrometers, Electric, Indicating:**
Taylor Instrument Cos. of Cda. Ltd.

### R

**Radiator Air Vents and Traps:**
Jenkins Bros. Ltd.

**Radiator Valves:**
Can. Ohio Brass Co. Ltd.
Jenkins Bros. Ltd.

**Radio Masts:**
Canadian Bridge Co. Ltd.

**Radio Receiving Sets:**
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
Northern Electric Co. Ltd.

**Rail Bonds:**
Can. Ohio Brass Co. Ltd.

**Rail Braces and Joints:**
B. J. Coghlin Co. Ltd.

**Rails and Rail Fastenings:**
Algoma Steel Corp. Ltd.
The Steel Co. of Canada, Ltd.

**Railway Equipment:**
Can. General Elec. Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.
Can. Ohio Brass Co. Ltd.
English Electric Co. of Canada Ltd.
Hydraulic Machinery Co. Ltd.

**Receivers, Air:**
Can. Ingersoll-Rand Co. Ltd.
Horton Steel Works Ltd.

**Recorders:**
Bailey Meter Co. Ltd.
Bristol Co. of Can. Ltd.
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd.
Peacock Bros. Ltd.

**Refractories:**
Atlas Asbestos Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Canadian Johns-Manville Co. Ltd.
Canadian Refractories Ltd.

**Refrigerating Machinery:**
Can. General Electric Co. Ltd.
Can. Fairbanks-Morse Co. Ltd.
Can. Ingersoll-Rand Co. Ltd.

**Regulators, Feed Water:**
Bailey Meter Co. Ltd.
Peacock Bros. Ltd.

**Regulators, Temperature, Time-Vacuum:**
Taylor Instrument Cos. of Cda. Ltd.

**Reinforcing Bars:**
Algoma Steel Corp. Ltd.
The Steel Co. of Canada, Ltd.

**Reservoirs:**
Canada Cement Co. Ltd.
Horton Steel Works Ltd.

**Riveted Pipe:**
Dominion Bridge Co. Ltd.
Horton Steel Works Ltd.

**Roads:**
Canada Cement Co. Ltd.

**Road Machinery:**
Can. Fairbanks-Morse Co. Ltd.
United Steel Corp. Ltd.

**Rock Wool:**
Canadian Johns-Manville Co. Ltd.
Spun Rock Wools Ltd.

**Rods:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.

**Roll Covers, Paper Mill:**
Dominion Rubber Co. Ltd.

**Rollers, Inking:**
Dominion Rubber Co. Ltd.
Gutta Percha & Rubber Ltd.

**Rolls, Paper Machine:**
Dominion Engineering Co. Ltd.

**Roofing Materials:**
Barrett Co. Ltd.
Canadian Johns-Manville Co. Ltd.

**Roofing, Prepared:**
Barrett Co. Ltd.

**Roofs, Built-up:**
Barrett Co. Ltd.

**Rope, Wire:**
Dom. Wire Rope & Cable Co. Ltd.

**Rubber Liners and Linings:**
Dominion Rubber Co. Ltd.
Gutta Percha & Rubber Ltd.

### S

**Scales:**
Can. Fairbanks-Morse Co. Ltd.
Peacock Bros. Ltd.

**Screening Equipment:**
Canadian Allis-Chalmers Ltd.
Can. Ingersoll-Rand Co. Ltd.
Foster Wheeler Ltd.
United Steel Corp. Ltd.

**Seals, Aircraft:**
Crane Packing Company.

**Seals, Mechanical**
Crane Packing Company.

**Seals, Oil and Fuel Pump:**
Crane Packing Company.

**Seals, Pipe-Joint:**
Crane Packing Company.

**Seals, Plastic Lead:**
Crane Packing Company.

**Seals, Water Pump:**
Crane Packing Company.

**Separators, Electric:**
Northern Electric Co. Ltd.

**Sewers:**
Canada Cement Co. Ltd.

**Sheets, Aluminum:**
Aluminum Co. of Canada Ltd.

**Shingles, Prepared Asphalt:**
Barrett Co. Ltd.

**Shovels — Powered, Electric or Gasoline:**
Canadian Vickers Ltd.

**Smokestacks:**
Canada Cement Co. Ltd.
Canadian Vickers Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.

# ALL DEALERS IN NEW OR USED MACHINE TOOLS MUST OBTAIN LICENCE FROM MACHINE TOOLS CONTROLLER

TO assure Canadian war industry of the most equitable distribution and use of machine tools, the Machine Tools Controller has ordered that on and after July 1, 1943, except under permit, no person other than a machine tool dealer holding a licence issued by the Machine Tools Controller as provided by Order M.T.C. 3 may sell any new or used machine tool.

The order also provides that the only free movement of machine tools after that date will be from a licenced dealer to a consumer. Except under permit from the Controller, there shall be no movement of machine tools:

1. Between dealers.
2. Between consumers.
3. From a consumer to a dealer.

Only the power operated metal-working machine tools listed in the order are covered. Wood-working equipment and hand tools are not affected.

*Except under permit, orders for machine tools for export may not be accepted, nor may anyone in Canada place an order for machine tools outside of Canada.*

Applications for dealer licences should be forwarded to:

Machine Tools Controller,
1020 Dominion Square Building,
Montreal, Quebec.

THE DEPARTMENT OF MUNITIONS AND SUPPLY

Honourable C. D. HOWE — Minister

## Purchasers' Classified Directory

**Sporting Powder:**
Canadian Industrial Limited.
**Springs — Automobile, Railway, Wire:**
B. J. Coghlin Co. Ltd.
**Stains:**
Canadian Industries Limited.
**Steam Plant Equipment:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Allis-Chalmers Ltd.
Combustion Engineering Corp. Ltd.
English Electric Co. of Canada Ltd.
Foster Wheeler Limited.
Harland Eng. Co. of Can. Ltd.
**Steel Flooring:**
Canada Ingot Iron Co. Ltd.
**Steel Plate Construction:**
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.
United Steel Corp. Ltd.
**Steel Steps:**
Canada Ingot Iron Co. Ltd.
**Stokers:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
**Stoneware, Chemical:**
Doulton & Co. Ltd.
**Structural Iron and Steel:**
Algoma Steel Corp. Ltd.
Canadian Bridge Co. Ltd.
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.
United Steel Corp. Ltd.
Vulcan Iron Works Ltd.
**Superheaters:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Foster Wheeler Limited.
The Superheater Co. Ltd.
**Switchboards, Power Lighting:**
Amalgamated Electric Corp. Ltd.
Bepco Canada Ltd.
Canadian Controllers Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.

T

**Tanks:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canada Cement Co. Ltd.
Canada Ingot Iron Co. Ltd.
Canadian Bridge Co. Ltd
Canadian Vickers Ltd.
Dominion Bridge Co. Ltd.
Foster Wheeler Ltd.
Horton Steel Works Ltd.
Vulcan Iron Wks, Ltd
**Tees:**
Dart Union Co. Ltd.
Horton Steel Works Ltd.
**Telegraph Line Material:**
Can. General Electric Co. Ltd.
Northern Electric Co. Ltd
**Thermometers, Indicating, Recording:**
Taylor Instrument Cos. of Cda. Ltd.
**Thermometers, Recording:**
Bailey Meter Co. Ltd.
Bristol Co. of Can. Ltd.
Peacock Bros. Ltd.
**Tiles:**
Canada Cement Co. Ltd
**Tinplate:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd
**Towers, Cooling, Fractionating:**
Foster Wheeler Limited
Horton Steel Works Ltd.
**Track Tools:**
B. J. Coghlin Co. Ltd.
**Transformers, Instrument Testing, Distribution:**
Bepco Canada Ltd.
Can. General Electric Co. Ltd.
English Electric Co. of Canada Ltd
Northern Electric Co. Ltd
**Transformers, Lighting and Power:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd
**Transmission Poles and Towers:**
Canadian Bridge Co. Ltd
Dominion Bridge Co. Ltd.
Hamilton Bridge Co Ltd
**Trolley Materials:**
Can. Ohio Brass Co. Ltd.
**Tubes, Aluminum:**
Aluminum Co. of Canada Ltd.
**Tubes, Boiler, Lapwelded, Steel and Iron:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Canadian Vickers Ltd.
**Tubes, Rubber, Ventilating**
Dominion Rubber Co. Ltd.
**Tubes, Steel, Electrically Welded:**
Standard Tube Co. Ltd.
**Turbines, Hydraulic:**
Canadian Allis-Chalmers Ltd.
Canadian Vickers Ltd.
Dominion Engineering Co. Ltd.
English Electric Co. of Canada Ltd.
**Turbines, Steam:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
English Electric Co. of Canada Ltd.
Harland Eng. Co. of Can. Ltd.
Swiss Electric Co. of Can. Ltd.
**Turbo-Generators:**
Bepco Canada Ltd.
Can. General Elec. Co. Ltd.
Can. Westinghouse Co. Ltd.
English Electric Co of Canada Ltd.
Northern Electric Co. Ltd.
Swiss Electric Co. of Can. Ltd.
**Turntables:**
Canadian Bridge Co. Ltd.
Dominion Bridge Co. Ltd.
Hamilton Bridge Co. Ltd.

U

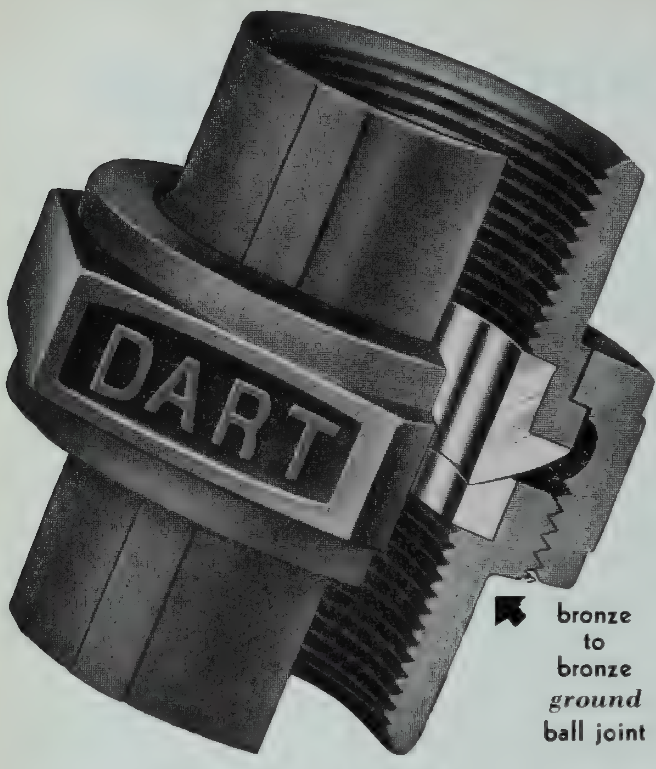
**Unions**
Dart Union Co. Ltd.

V

**Valve Controls:**
Northern Electric Co. Ltd.
**Valve Discs, Rubber:**
Dominion Rubber Co. Ltd.
Garlock Packing Co. of Can. Ltd.
Jenkins Bros. Ltd.
**Valves:**
Can. Fairbanks-Morse Co. Ltd.
Can. Ohio Brass Co. Ltd.
Crane Limited
Dominion Engineering Co. Ltd
Hydraulic Machinery Co. Ltd.
Jenkins Bros. Ltd.
Peacock Bros. Ltd.
Smart-Turner Machine Co. Ltd.
**Valves, Diaphragm:**
Taylor Instrument Cos. of Cda. Ltd.
**Valves, Relief:**
Crane Limited
Neptune Meters Ltd.
Smart-Turner Machine Co. Ltd.
**Varnishes:**
Canadian Industries Limited.
**Ventube:**
Canadian Industries Limited

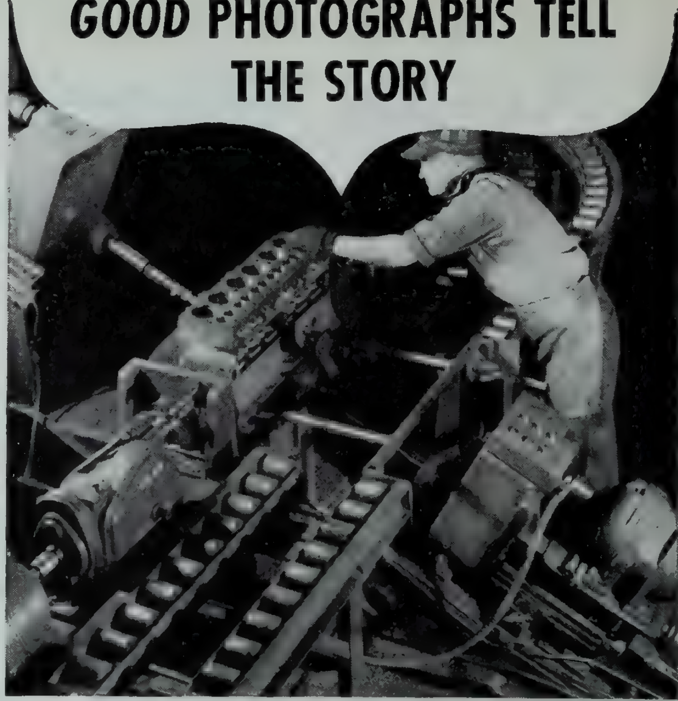
W

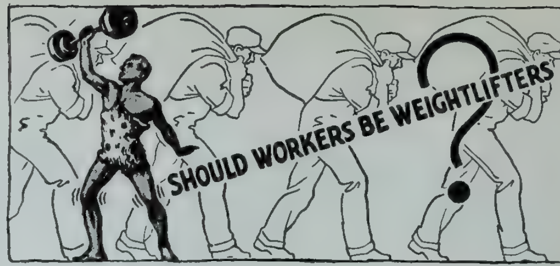
**Washers, Air:**
Can. Ingersoll-Rand Co., Ltd.
**Washers, "Teepelite" Composition:**
Crane Packing Company.
**Water Cooled Furnaces:**
Babcock-Wilcox & Goldie-McCulloch Ltd.
Combustion Engineering Corp. Ltd.
Foster Wheeler Limited.
**Welding Machines, Electric and Accessories:**
Can. General Elec. Co. Ltd.
Can. Ohio Brass Co. Ltd
Can. Westinghouse Co. Ltd.
Commonwealth Electric Corp. Ltd.
English Electric Co. of Canada Ltd.
Northern Electric Co. Ltd.
The Steel Co. of Canada, Ltd
**Wheels, Fly and Gear:**
Hamilton Gear & Machine Co.
United Steel Corp. Ltd.
**Winches, Stop-log and Headgate:**
Canadian Vickers Ltd.
United Steel Corp. Ltd.
**Wire:**
Bethlehem Steel Export Corp.
The Steel Co. of Canada, Ltd.
**Wire, Electric, Bare and Insulated:**
Can. General Elec. Co. Ltd.
Northern Electric Co. Ltd.
Phillips Electrical Works Ltd.
**Wire Rope:**
Dom. Wire Rope & Cable Co. Ltd.
**Wire Springs:**
B. J. Coghlin Co. Ltd.
**Wood Preserving:**
Osmose Wood Preserving Co of Canada Ltd.
**Worm Gears:**
Hamilton Gear & Machine Co.
Peacock Bros. Ltd.
United Steel Corp. Ltd.


DART
bronze
to
bronze
ground
ball joint

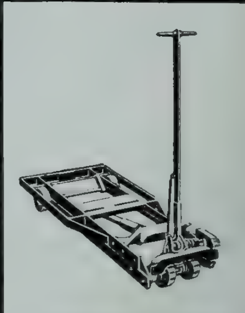










*Yale Hand Lift Truck*



## INDEX TO ADVERTISERS

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, JULY 1943 | NUMBER 7


"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."

★ ★ ★


PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL





**Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.**




## CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**

†W. P BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**

*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**

†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

### FINANCE
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

### LEGISLATION
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

### PAPERS
L. F. GRANT, *Chairman*

### LIBRARY AND HOUSE
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

### PUBLICATION
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

### BOARD OF EXAMINERS AND EDUCATION
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

### GZOWSKI MEDAL
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

### DUGGAN MEDAL AND PRIZE
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

### PLUMMER MEDAL
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

### LEONARD MEDAL
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

### JULIAN C. SMITH MEDAL
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

### MEMBERSHIP
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

### PROFESSIONAL INTERESTS
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

### STUDENTS' AND JUNIORS' PRIZES

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

### INTERNATIONAL RELATIONS
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

### THE YOUNG ENGINEER
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

### POST-WAR PROBLEMS
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

### WESTERN WATER PROBLEMS
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M WARDLE

### ENGINEERING FEATURES OF CIVIL DEFENCE
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

### INDUSTRIAL RELATIONS
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

### DETERIORATION OF CONCRETE STRUCTURES
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

### BORDER CITIES
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY A. H. PASK
A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR
H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY,
1614 Ontario Street,
Walkerville, Ont.

### CALGARY
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE
H. R. HAYES
A. HIGGINS
W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS
G. P. F. BOESE
H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL,
803-17th Ave. N.W.,
Calgary, Alta.

### CAPE BRETON
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN,
60 Whitney Ave., Sydney, N.S.

### EDMONTON
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN
J. W. JUDGE
E. D. ROBERTSON
J. D. A. MACDONALD
I. F. MORRISON
H. W. TYE
*(Ex-Officio),* D. HUTCHISON
E. NELSON
*Sec.-Treas.,* F. R. BURFIELD,
Water Resources Office,
Provincial Government,
Edmonton, Alta.

### HALIFAX
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE D. C. V. DUFF
G. J. CURRIE L. E. MITCHELL
J. D. FRASER P. A. LOVETT
J. W. MacDONALD
G T. MEDFORTH
J. E. CLARKE
R. B STEWART
K. L. DAWSON
*(Ex-Officio),* J. R. KAYE S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY,
Wartime Bureau of Technical
Personnel, 84 Hollis Street,
Halifax, N.S.

### HAMILTON
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON
R. J. G. SCHOFIELD
NORMAN EAGER
A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID
STANLEY SHUPE
A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN,
91 Barnesdale Blvd.,
Hamilton, Ont.

### KINGSTON
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN
J. R. CARTER
J. D. LEE
*(Ex-Officio),* T. A. McGINNIS
L. F. GRANT A. JACKSON
*Sec. Treas.,* R. A. LOW,
Dept. of Civil Engineering,
Queen's University,
Kingston, Ont.

### LAKEHEAD
*Chairman,* MISS E. M. G. MacGILL
*Vice-Chair.,* E. J. DAVIES
*Executive,* J. I. CARMICHAEL
R. B. CHANDLER
S. E. FLOOK
O. J. KOREEN
S. T. McCAVOUR
W. H. SMALL
E. A. KELLY
J. S. WILSON
*(Ex-Officio),* B. A. CULPEPER
H. G. O'LEARY
*Sec. Treas.,* W. C. BYERS,
c/o C. D. Howe Co. Ltd.,
Port Arthur, Ont.

### LETHBRIDGE
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON G. S. BROWN
N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE,
McKenzie Electric Ltd.,
706, 3rd Ave. S., Lethbridge, Alta.

### LONDON
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT
W. C. MILLER
F. T. TAYLOR
F. C. BALL
V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN
J. A. VANCE
*Sec. Treas.,* H. G. STEAD,
60 Alexandra Street,
London, Ont.

### MONCTON
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS H. W. HOLE
A. GORDON G. C. TORRENS
G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE
G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT,
Engrg. Dept., C.N.R.
Moncton, N.B.

### MONTREAL
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE
R. C. FLITTON
G. D. HULME
G. E. GELINAS
K. G. CAMERON
G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD
J. E. ARMSTRONG
R. E. HEARTZ
W. G. HUNT
J. A. LALONDE
G. MacL. PITTS
E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL,
40 Kelvin Avenue,
Outremont, Que.

### NIAGARA PENINSULA
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR
C. G. MOON
G. F. VOLLMER
H. E. BARNETT
J. W. BROOKS
G. MORRISON
D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE
A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS,
2135 Culp Street,
Niagara Falls, Ont.

### OTTAWA
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY
G. A. LINDSAY
R. YUILL
W. H. B. BEVAN
J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY
K. M. CAMERON
N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON
Dept. of Mines & Resources,
Ottawa, Ont.

### PETERBOROUGH
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN
A. L. MALBY
F. R. POPE
C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY
H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD,
308 Monaghan Road,
Peterborough, Ont.

### QUEBEC
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD G. ST-JACQUES
L. GAGNON A. E. PARÉ
G. W. WADDINGTON Y. R. TASSÉ
*(Ex-Officio),* H. CIMON
R. B. McDUNNOUGH
P. MÉTHÉ
L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT,
Colonization Department,
Room 333-A, Parliament Bldgs.,
Quebec, Que.

### SAGUENAY
*Chairman,* R. H. RIMMER
*Vice-Chair.,* C. MILLER
*Executive,* W. E. COOPER B. BAUMAN
J. FRISCH G. B. MOXON
*(Ex-Officio),* M. G. SAUNDERS
N. F. McCAGHEY
J. W. WARD
*Sec.-Treas.,* ALEX. T. CAIRNCROSS,
P.O. Box 33,
Arvida, Que.

### SAINT JOHN
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN
C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH
J. P. MOONEY
D. R. SMITH
G. W. GRIFFIN
*Sec.-Treas.,* G. L. PHILLIPS,
Saint John Dry Dock &
Shipbldg. Co. Ltd.,
East Saint John, N.B.

### ST. MAURICE VALLEY
*Chairman,* J. H. FREGEAU
*Vive-Chair.,* R. DORION
*Executive,* G. B. BAXTER
E. BUTLER
A. G. JACQUES
R. D. PACKARD M. EATON
E. T. BUCHANAN J. JOYAL
W. E. A. McLEISH H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN
H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS,
Shawinigan Water & Power
Company,
P.O. Box 190,
Three Rivers, Que.

### SASKATCHEWAN
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN
E. K. PHILLIPS
J. I. STRONG
F. C. DEMPSEY
N. B. HUTCHEON
J. G. SCHAEFFER
R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG,
P.O. Box 101, Regina, Sask.

### SAULT STE. MARIE
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK
C. R. MURDOCK
G. W. MacLEOD
K. G. ROSS
H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG
A. E. PICKERING
L. R. BROWN
*Sec. Treas.,* O. A. EVANS,
159 Upton Road.
Sault Ste. Marie

### TORONTO
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR R. F. LEGGET
E. G. HEWSON A. H. HULL
C. F. MORRISON E. A. CROSS
*(Ex-Officio),* H. E. BRANDON W. S. WILSON
T. H. HOGG C. R. YOUNG
N. MacNICOL
J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. deJONG,
Dept. of Civil Engineering,
University of Toronto,
Toronto, Ont.

### VANCOUVER
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER H. P. ARCHIBALD
R. E. POTTER I. C. BARLTROP
E. S. JONES H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT
C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN,
2099 Beach Avenue,
Vancouver, B.C.

### VICTORIA
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD
A. N. ANDERSON
F. C. GREEN
J. H. BLAKE
*(Ex-Officio),* E. W. IZARD
A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING,
41 Gorge Road West,
Victoria, B.C.

### WINNIPEG
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING
N. M. HALL
B. B. HOGARTH
R. H. ROBINSON
R. A. SARA
*(Ex-Officio),* W. P. BRERETON
J. W. SANGER
D. M. STEPHENS
*Sec.-Treas.,* T E. STOREY,
55 Princess Street,
Winnipeg, Man.

# PRESERVATION OF NIAGARA FALLS

Paper presented at a joint meeting of the American Society of Civil Engineers and The Engineering Institute of Canada. at Niagara Falls, Ont., on October 15th, 1942

## A — THE PROBLEM IN GENERAL

NORMAN MARR, M.E.I.C.

*Chief Hydraulic Engineer, Dominion Water and Power Bureau, Surveys and Engineering Branch, Department of Mines and Resources, Ottawa*

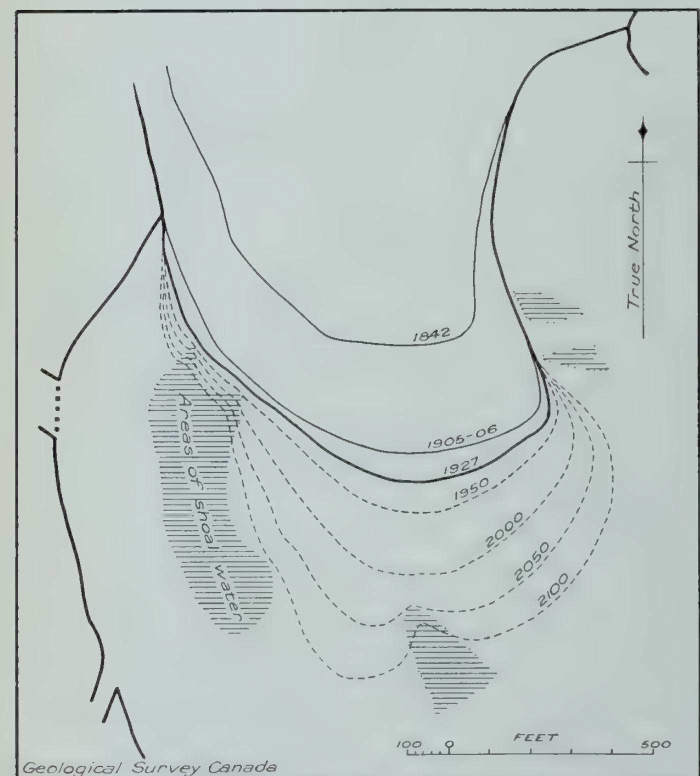
The falls of Niagara, together with the cascades and rapids above the falls and the whirlpool and rapids in the lower river gorge, constitute one of the outstanding and best known scenic spectacles in the world. Throughout the years, countless millions of people have been drawn to Niagara to view the majesty of the falls and the grandeur of the cascades and rapids. The same conditions that combine to create this scenic spectacle provide an enormous power potentiality; a potentiality not far short of 6,000,000 continuous hp. if the mean flow of the river could be utilized for the development of power through the total head of 310 ft. comprising the 55 ft. of fall in the mile of rapids above the falls, the 160 ft. in the sheer descent of the falls themselves and the drop of 95 ft. in the six miles of rapids below the falls.

The extent to which power development could be carried without impairing the integrity of the scenic spectacle has been a problem since the latter part of the nineteenth century when large scale power development began to assume importance at Niagara Falls and, as the Niagara river constitutes the boundary between Canada and the United States, the problem is one of international significance and has engaged the attention of the authorities of both countries for many years.

### Scenic Surroundings at Niagara

Before dealing particularly with the preservation of the scenic spectacle at Niagara, as it is affected by the diversion of water for the production of power, brief reference will be made to the steps that have been taken to improve the scenic surroundings at Niagara.

In the latter part of the nineteenth century, conditions in the vicinity of Niagara had reached a deplorable state. Government reservations had not yet been made on either side and the exploitation of the grandeur of the falls for private gain had proceeded to such an extent that it was said no view of the falls could be had from a foot of United States soil without paying for the privilege, and conditions were little better on the Canadian side. Industrial enterprise, too, had been allowed to establish itself on shores and islands in a manner most detrimental to the scenic surroundings. In 1878, due to the joint interest of Lord Dufferin, Governor General of Canada, and Governor Robinson of New York State, and to the widespread support of public spirited individuals in both countries, a movement was started which resulted in the Governments of the State of New York and of the Province of Ontario taking action, respectively, to appoint commissions and to acquire lands on both sides of the river for the purpose of establishing park reservations and restoring, as far as possible, the natural beauties of the setting as a fitting place for the public to view the grandeurs of Niagara untrammelled by commercial exploitation. The splendid results achieved by the commissions are to be seen to-day in the treatment of the foreshores of the river and of the islands in the American channel embraced in the New York State Reservation at Niagara and of the system of parks and boulevards included in the Queen Victoria Niagara Falls Park which extends along the Canadian foreshore from Fort Erie at the head of the river to Niagara-on-the-Lake at the river's mouth.




**Recession of Horseshoe falls showing approximate position of future crest lines. (From Final Report, Special International Niagara Board, June 22, 1928)**

### Restriction of Water Diversion for Power Development

In regard to the problem of the preservation of the scenic integrity of the falls themselves, there was growing public apprehension in the early years of the present century, arising from the rapid increase in power development then taking place and from numerous other power projects in prospect, that the falls would be so denuded of water as greatly to detract or indeed possibly to nullify completely their value as a scenic spectacle. Taking cognizance of this apprehension the Congress of the United States, on June 29, 1906, passed the Burton Act "for the control and regulation of the waters of Niagara river, for the preservation of Niagara falls, and for other purposes." The act assumed jurisdiction of the Niagara river to the international boundary line and limited the diversion of water from the falls for power production on the United States side to the amounts required to operate the power enterprises then in operation or in actual construction, with such limitation on the importation of power from Canada as would, it was then believed, equitably equalize the diversions on both sides of the river.

A few years later a treaty was concluded by His Majesty the King and the United States. Known as the Boundary Waters Treaty of 1909, it provided for the settlement of boundary waters problems between Canada and the United States. Article V of the treaty dealt with diversions from the Niagara river and provided that the total withdrawal of water from above the falls for power purposes was not to exceed in the aggregate a daily diversion at the rate of

56,000 cu. ft. per sec.; 20,000 cu. ft. per sec. on the United States side and 36,000 cu. ft. per sec. on the Canadian side. The limitations of the Boundary Waters Treaty still govern except for certain increases in diversions during the present war emergency which have been agreed upon by Canada and the United States and which will be referred to later.

### Power Development

Power development on the United States side of the Niagara river is recorded as far back as 1725 when a French settler erected a water-driven saw-mill at the edge of the rapids above the falls. During the next 125 years a number of other small saw-mills, grist-mills and a paper-mill operated with power developed from the rapids but it was not until 1853 that the first attempt was made to utilize the falls themselves. After nearly twenty-five years of effort this undertaking failed to achieve economic success. The successful exploitation of power from the falls dates from 1877 with the initiation of development by the Niagara Falls Hydraulic Power and Manufacturing Company, which, in addition to having its own power station, supplied water from its canal to several tenant companies. Another company, The Niagara Falls Power Company, commenced construction operations in 1890 and, in 1895, was producing power at its first development which was completed in 1900. A second development began producing power in 1902 and was completed in 1904, by which time machinery to generate 110,500 hp. had been installed in the company's two stations. In the meantime the hydraulic company's progress was less rapid but in various new stations and extensions a total capacity of 167,200 hp. had been installed by 1914. As the limit of permissible water diversion was being reached and as many of the installations were using water inefficiently, it was realized that the only way in which a much needed increment of power could be secured was by united action. This was accomplished by a consolidation, in 1918, of the existing companies into The Niagara Falls Power Company, which, by abandoning a number of units and using the available water in new developments designed to utilize, to the maximum, the power available has resulted in the existing efficient station below the falls known as the Schoellkopf Station, with an installed capacity of 452,500 hp. and the retention, for standby or emergency use, of the older and less efficient installation of 110,500 hp. in what is known as the Adams Station.

Power development on the Canadian side of Niagara falls was begun in 1893 with an installation of 2,000 hp. for the International Railway Company. Early in the new century, however, three companies—The Canadian Niagara Power Company (a subsidiary of the Niagara Falls Power Company), the Ontario Power Company, and the Electrical Development Company — had developments under construction. The first unit of these developments came into operation in 1904 and, in every year thereafter until 1914, there was an increase in installation. Additions were made in 1916 and 1919 and by that time the installed capacity in all plants had reached a total of half a million horse-power. In the meantime, spurred by the then urgent war demands for additional supplies of power the Hydro-Electric Power Commission of Ontario had commenced the construction of its Chippawa-Queenston development designed to utilize as much as possible of the entire descent between Lakes Erie and Ontario. In 1921, the first unit of this development came into operation and, in 1925, nine units had been installed with a tenth or reserve unit being added in 1930, giving the station a maximum normal plant capacity of 500,000 hp. During this period, also, the Commission acquired the properties of both the Ontario and Electrical Development Companies so that it has at present, in the three stations, a combined maximum normal plant capacity of 830,000 hp. The Canadian Niagara Power Company's plant with a normal output of 100,000 hp. from an installed capacity of 121,000 hp. is the only other plant now operating on the Canadian side.

The full operation of all installations on both sides of the river would require a total diversion of water in excess of the limit of 56,000 cu. ft. per sec. imposed by the Boundary Waters Treaty of 1909. On the United States side, such full operation would require the diversion of approximately 32,500 cu. ft. per sec. and on the Canadian side about 50,000 cu. ft. per second. To ensure observance of treaty limitations, water diversions for power purposes are supervised and controlled by an International Niagara Board of Control constituted by the Governments of the United States and Canada in July 1923. These treaty limitations have been strictly observed and, as a result, the various power organizations have used their respective shares of the permissible diversion in the most efficient manner possible.

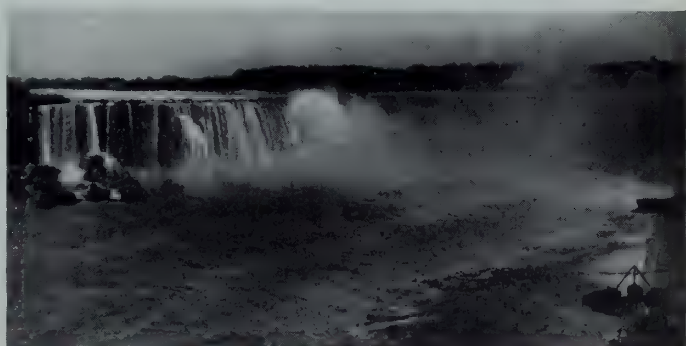
### Plans for Preservation of the Falls

Arising from the concern of the Governments of Canada and the United States regarding deterioration in scenic effects at Niagara Falls resulting from erosion and diversion of water, a Special International Niagara Board was constituted by the two governments early in 1926 to conduct an extensive investigation into the preservation of the scenic beauty of the falls, and an analysis of all factors relative thereto. The United States members of the Board were DeWitt C. Jones (then Major), Corps of Engineers, United States Army, district engineer at Buffalo; and J. Horace McFarland, past-president of the American Civic Association and chairman of the Art Commission of the State of Pennsylvania. The Canadian members were Charles Camsell, then deputy minister of the Department of Mines, and J. T. Johnston, then director, Dominion Water Power and Reclamation Service, Department of the Interior.

The objective of the Special Board was, in brief, to determine how the scenic beauty of Niagara falls and rapids could best be maintained, by what means and to what extent the impairment thereof by erosion or otherwise could be overcome and, consistent with the preservation of the scenic beauty of the falls and river, to determine what quantity of water, additional to that permitted to be diverted by the Boundary Waters Treaty, might be diverted either temporarily or permanently.

The Board's investigations which extended over a period

**Goat Island flank of Horseshoe falls from Canadian side. (*Above*) November 26, 1925, discharge over Horseshoe, 106,000 cu. ft. per sec. (*Below*) April 30, 1913, discharge 198,000 cu. ft. per sec.**



of more than two years embraced all features of the scenic spectacle including the rapids above the falls, the falls themselves, the Maid of the Mist pool, the Whirlpool and Lower rapids. Special field methods were devised and used to determine, by photographic surveys, the position of the crest line of the Horseshoe and American falls. Float surveys determined the mean depths of water and the velocities and discharges in each 100-ft. panel along the crest of the Horseshoe falls. Meterings were made of the discharge over the American falls. Aeroplane photographs were taken from which a mosaic was made of the American and Horseshoe falls and of the rapids above disclosing with accuracy the location of the cascades, obstructions and shoals, direction of currents and general characteristics of the rapids.

Special geological investigations were conducted and a scientific study was made of the colour effects on the falling curtain of water at the falls. An exhaustive analysis was made of all discharge and gauge records of the Niagara river and studies were made of ice problems with special reference to the effect of ice on the operation of power plants and to the discharge required in the river to carry off ice. At the same time, the Board reviewed and gave careful consideration to all available earlier investigations which had been made into conditions at the falls and which had a bearing on their recession and preservation. Views and suggestions were also invited from engineers who had previously given time and study to the problem and much valuable information was secured in this way.

Following the submission to the two governments of an interim report on December 14, 1927, designed to further the construction of initial remedial works, the Board's final report was completed and signed June 22, 1928.

In this final report, the Board found that the scenic beauty of Niagara falls had been adversely affected by the development of three conditions:

(a) Erosion and recession of the crest line upstream.

(b) Low flows in the Niagara river resulting from low cycles of levels in the Great Lakes system.

(c) The withdrawal of water from the Great Lakes and the Niagara river for power, navigation and sanitary purposes.

In regard to erosion and recession, its studies indicated that the mean rate of recession of the central part or "apex zone" of the Horseshoe falls had been 3.8 ft. per year from 1842 to 1905-06 and, from 1905-06 to 1927, 2.3 ft. per year. A statement which had received wide circulation "that the Horseshoe falls is 'committing suicide' and is in danger of destroying itself as a spectacle by cutting a narrow 'notch,' destroying the symmetry of the Horseshoe, possibly degenerating into a cascade and eventually draining the American falls," was found by the Board to be quite unwarranted for the following reasons:

First—For some years the recession of the crest has tended to move upstream along the course of two diverging deep water channels on either side of a central shoal, with the result that the "toe" of the Horseshoe is growing broader rather than cutting into a single "notch."

Second—The floor of the upper rapids and the crest of the falls is a very hard and thick stratum of limestone. Recession occurs through the falling of large blocks of this limestone as it is undercut through the wearing away of softer underlying strata. The thickness of this upper stratum increases from about 78 ft. at the present crest line to about 130 ft. at the head of the upper rapids. As the crest moves upstream, the increased thickness of this stratum will decrease the rate of recession.

Third—As the falls recede, the active part of the crest will increase in length, and the flow per unit of crest will decrease. This natural thinning out of the flow will tend to decrease the rate of recession.

Fourth—During recent years, a large part of the flow has been diverted for power purposes. This fact has probably decreased the rate of recession.

For these reasons, the Board concluded that the active part of the Horseshoe will broaden out and the crest line lengthen in graceful curves and that, if adequately supplied with water, the main part of the Horseshoe, 100 or 200 years hence, should present an appearance equal or superior to the present. It was estimated that recession will not progress to the point of draining the American falls for at least 2,000 years.

Recessions of the Horseshoe falls, however, were found to have adverse effects on scenic values on the Goat island and Canadian flanks. If left to nature, the Goat Island shelf would soon be completely dry, even in high water seasons, and would take its natural place as a part of the wall of the gorge. The same condition would take place at the Canadian flank but in less degree.

The recession of the American falls was found to be negligible as the flow over the crest had never been sufficient to cause any material wearing away of the talus at the foot of the falls which, so long as it exists, prevents undercutting and consequent erosion. On January 17, 1931, however, subsequent to the Board's Final Report, a fall of about 76,000 tons of rock took place at the centre of the American falls extending for a distance of 280 ft. along the face of the falls and producing a maximum indentation in the crest line of 70 ft. In a supplementary report of November 10, 1931, the Board dealt with this fall of rock, expressing the opinion that it did not result from any sudden cause but was the culmination of a very slow and gradual process of weathering and erosion extending over a very long period of time, probably hundreds of years.

In regard to the adverse effect of low lake stages of the Great Lakes system on scenic values at the falls such as were being experienced during the period of the Board's investigations, a study was made of the long term meteorological records and it was concluded that recurrent and dependable periods of average and high flows in the Niagara river are to be anticipated with only rare periods of abnormally low flow.

Diversions of water for power, sanitary and navigation uses were found to have operated proportionally to injure the scenic integrity of Niagara and had been a large factor in thinning the flow at the flanks of the Horseshoe falls.

To remedy or prevent existing or prospective impairment of the scenic beauty of the falls, the Board gave consideration to what measures or works might be undertaken. It was concluded that the flanks of the Horseshoe and the rapids immediately upstream therefrom could be reclothed with an adequate flow and kept covered for many hundreds of years by the construction of works to abstract water from the deep channels now feeding the central portion of the Horseshoe and to divert such water to the flanks. The rate of recession of the central portion of the Horseshoe which was already found to be decreasing could be further decreased in some measure by abstracting water from the central heavy flow; this recession, however, would not become an active menace to scenic effects for several hundreds of years. Elaborate works designed to fix the Horseshoe in its present position were considered unnecessary and if undertaken would be only partially successful and would probably destroy some of the present important scenic effects. The injuries to the rapids in the vicinity of Three Sisters islands and in the American channel and to the American and Luna falls could be overcome by works located above the first cascade, designed to raise the level of the Grass Island pool and throw more water against the head of Goat island and into the American channel.

The works proposed by the Board to reclothe the flanks of the Horseshoe consisted of submerged irregular weirs built from near the shores of the rapids just upstream from the flanks and extended into the adjacent heavy flows which now feed the central portion of the Horseshoe far enough to intercept the desired amount of water and guide it toward the flanks. The effect of the weirs would be reinforced by the excavation of such shoals and high areas near the shore as now tend to force the flows from the flanks toward the centre. To restore the scenic effects at the Three Sisters islands and at the American falls it was proposed to construct a deeply submerged rubble mound weir above the first cascade extending from near the Canadian shore toward the shoal at the head of Goat island and designed to raise the elevation at Grass Island gauge in the Grass Island pool one foot at standard low stage and under the then existing conditions of diversion. The cost of the works was estimated at $1,750,000. In conjunction with the construction of these works it was proposed to test their efficacy by the withdrawal, on a temporary basis, through power stations on both sides, of 20,000 cu. ft. per sec. in addition to the limits imposed by the Boundary Waters Treaty of 1909.

In regard to the question of what additional quantities of water might be permitted to be diverted for the development of power consistent with the preservation of the scenic beauty of the falls and river, the Board was not prepared to make an exact statement. It suggested, however, that additional diversions might be made experimentally and progressively on a temporary basis under governmental observation and control, and in conjunction with possible extensions of remedial works, to determine to what extent diversions might be made without undue disadvantage to the scenic spectacle. The Board hazarded the opinion that an aggregate total diversion from the falls of 100,000 cu. ft. per sec. during daylight hours would be close to, if not past, the danger line of subordinating scenic attractiveness to power possibilities. It also suggested that power diversions around the Whirlpool and Lower rapids should not exceed 70,000 cu. ft. per sec. during daylight hours until observations of the rapids under the new conditions should have indicated that scenic values would not be impaired by additional diversions.

### International Action

Following the submissions of the Special International Niagara Board to the Governments of Canada and the United States, a convention, known as The Niagara Convention and Protocol, was signed by representatives of the two governments at Ottawa on January 2, 1929. This convention provided that remedial works should be constructed in the Niagara river above Niagara falls designed to distribute the waters of the river so as to ensure at all seasons unbroken crest lines on both the Canadian and American falls and an enhancement of their present scenic beauty; also that, concurrent with the construction of remedial works and as a temporary and experimental measure, diversions (through existing water passages) of an additional 10,000 cu. ft. per sec. on the United States side of the river and 10,000 cu. ft. per sec. on the Canadian side of the river should be permitted for a seven-year period beginning each year on the first day of October and ending the 31st day of March the following year. It was also provided that the cost of the works would be borne by the Hydro-Electric Power Commission of Ontario on the Canadian side and by the Niagara Falls Power Company on the United States side.

The Niagara Convention and Protocol was approved by the Parliament of Canada on May 20, 1929, but upon submission to the Foreign Relations Committee of the United States Senate it was reported against by that body on February 18, 1931.

No further international action was taken until 1941 when, on March 19, the Great Lakes-St. Lawrence Basin Agreement was signed at Ottawa by representatives of the Governments of the United States and Canada. This agreement was wide in scope and embraced virtually all matters related to the utilization of the water in the Great Lakes-St. Lawrence basin. Article IX of the agreement provided for the construction of remedial works in the Niagara river and for the immediate diversion on each side of the river of an additional 5,000 cu. ft. per sec. of water for power purposes. Provision was also made for testing the effects of the remedial works under a wide range of conditions by a Great Lakes-St. Lawrence Basin Commission to be established by the two governments under the terms of the agreement and for recommendations by the Commission respecting diversions of water from Lake Erie and the Niagara river.

The Great Lakes-St. Lawrence Basin Agreement has not yet been approved by either government. In the meantime, however, urgent war emergency demands in both countries for additional power in the area tributary to the Niagara river resulted in the authorization, by successive exchanges of notes between the two governments, of increased diversions of water for power purposes on both sides. The latest exchange of notes, that of October 27, 1941, brought the authorized diversions to virtually the maximum capacities of the existing generating plants; 32,500 cu. ft. per sec. on the United States side and 50,000 cu. ft. per sec. on the Canadian side; the increase on the Canadian side including an amount equivalent to the water which is being or is shortly to be diverted by Ontario from the Albany river watershed to the Great Lakes system; an amount estimated to average 5,000 cu. ft. per sec.

In authorizing these temporary additional diversions, the two governments recognized the importance of undertaking immediately the construction of remedial works in the Niagara river above the falls not only for the protection of scenic values but also for the improvement of power-producing facilities during the war emergency. In the exchange of notes it was agreed that the total cost of remedial works undertaken would be divided equally between the two governments, and temporary advisory committees which had been constituted by each government in October 1940 in connection with the Great Lakes-St. Lawrence Basin project were instructed to concert for the purpose of recommending to the two governments (1) the exact nature and design of the remedial works that should be constructed in 1942 and (2) the allocation of the task of construction as between the two governments. The committees submitted a joint report on January 23, 1942, recommending the immediate construction, at an estimated cost of $803,000, of a submerged weir in the Grass Island pool, designed to raise the water surface in the pool one foot more or less at 'standard low water' as envisaged by the Special International Niagara Board. The report pointed out that, in addition to improving conditions for the generation of power, the construction of this weir would also improve the scenic beauty of the falls by diverting additional water to the American falls and over the Goat Island flank of the Horseshoe falls.

It is not the purpose here to discuss the design of the submerged weir or the construction methods proposed by the committees as these are to be dealt with in a separate paper. It is sufficient to say, that the governments accepted the joint recommendations of the committees and work is proceeding on the construction of the weir, on the United States side under the direction and control of the United States Army Corps of Engineers and, on the Canadian side, by the Hydro-Electric Power Commission of Ontario under the control of the Dominion Department of Transport.

Observation of the effects of the submerged weir on the distribution of flow below the first cascade will afford useful information in connection with determining the nature of the further work required to reclothe the flanks of the Horseshoe falls with water and to preserve and improve the scenic beauty of the falls.

---

# B — HYDRAULIC ASPECTS OF THE REMEDIAL WEIR

C. G. CLINE, M.E.I.C.
*Senior Assistant Engineer, Dominion Water and Power Bureau, Surveys and Engineering Branch, Department of Mines and Resources, Niagara Falls, Ont.*

It has been explained in the first part of this paper how the submerged weir now being built in the Niagara river fits into the general plans for the preservation of Niagara falls. This section of the paper deals with the weir from the hydraulic standpoint. However, before discussing the problems presented by the weir construction, the general hydraulic conditions in the Niagara river will be reviewed.

### Hydraulic Conditions in Niagara River

Due to the natural regulation provided by Lake Erie and the upper Great Lakes, the flow of the Niagara river is remarkably steady and does not have the great fluctuations common to most streams. The discharge is controlled primarily by the elevation of Lake Erie at its outlet at Buffalo, which is subject to change from day to day, from season to season and from year to year. Slow changes in the mean elevation of the whole lake result from differences between the run-off into the lake and the out-flow. More rapid changes at any one point may result from oscillations of the lake surface caused by wind or by differences in barometric pressure; usually these changes are small but occasionally a severe storm may cause a rise or fall of several feet at the lake outlet within a few hours. All fluctuations in lake level at Buffalo, whether slow or fast, cause corresponding fluctuations in the stage and discharge of the river.

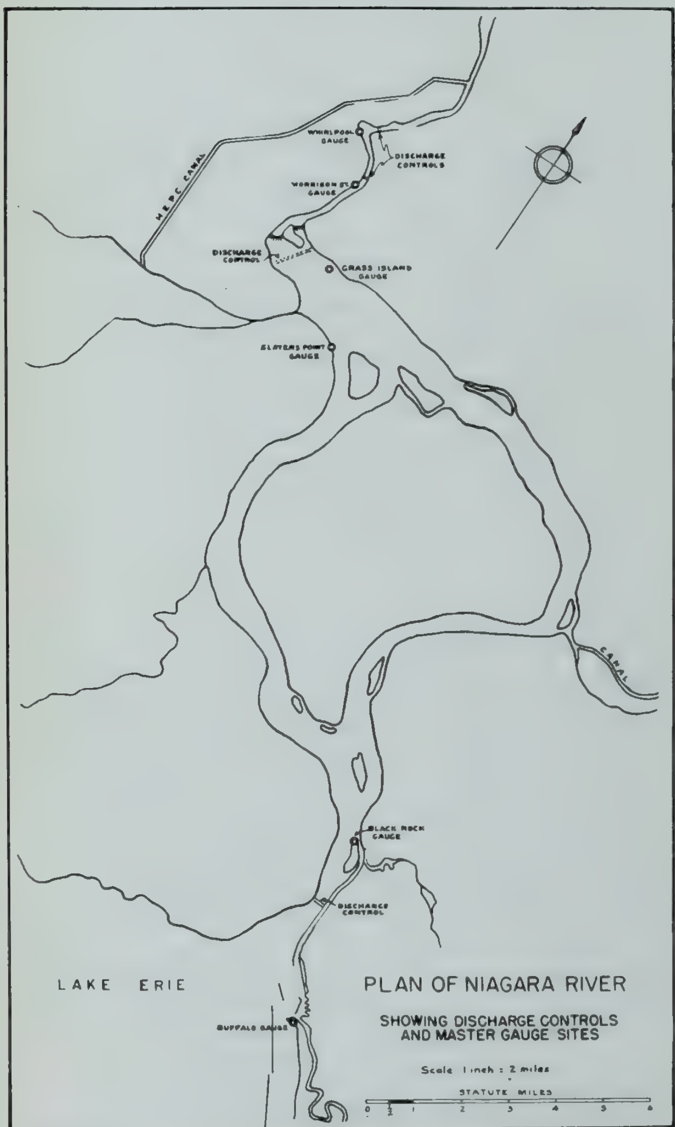



**Fig. 1—Plan of Niagara river.**

Between Lake Erie and the falls, there are 22 mi. of unbroken water followed by 3,500 ft. of cascades that form the approach to the falls themselves. The flow from Lake Erie is controlled by a limestone ledge at the outlet of the lake, Fig. 1. In the first four miles, there is a fall of five feet with relatively high velocities; an additional five feet is distributed over the remaining 18 mi. with much lower velocities. Under these conditions, the control at the lake outlet acts as a submerged weir: the discharge is controlled primarily by the headwater elevation of Lake Erie at Buffalo and secondarily by the tailwater elevation below Black Rock. Thus it follows that the discharge from the lake, and also the level of the lake itself, are affected slightly by anything that interferes with normal flow conditions at any point between the lake and the cascades.

Several sets of meterings of the river discharge have been made at various times during the past 50 years at, or near, the Fort Erie-Black Rock railway bridge by field parties of the United States Lake Survey and the Dominion Water and Power Bureau. The most recent meterings were made by the Lake Survey in 1931; following this work, previous discharge equations for the Niagara river were reviewed by the Lake Survey and a new equation was derived which includes a term for the fall between the Buffalo and Black Rock gauges as follows:—

$$\textit{Discharge} = 1{,}989\ (\textit{Buffalo} - 556.78)^{3/2}\ (\textit{Buffalo} - \textit{Black Rock})^{0.3} \quad \ldots\ldots (1)$$

Coming downstream, the river is divided into two channels by Grand island, about 60 per cent of the flow passing down the west channel.

Below Grand island, the wide portion of the river extending for some three miles to the head of the cascades, is known as the "Chippawa-Grass Island pool," though the designation "pool" is somewhat of a misnomer since the slope in this portion of the river is considerably steeper than in the channels above. From this pool, Fig. 2, water is diverted at Chippawa, on the Canadian side of the river, for the Queenston power plant; also near Grass island, on the United States side, for the two plants of the Niagara Falls Power Company. The upper crest of the cascades, which forms the control for this pool, is divided into two parts by Goat island, ninety-five per cent of the river flow passing south of the island and over the Horseshoe falls and the remaining five per cent passing north of the island and over the American falls. From the upper end of Goat island, a rock shoal extends upstream for 3,000 ft. or more, and the water for the American falls passes north of this shoal.

Through the cascades and Horseshoe rapids, there is a fall of 50 ft., each line of white water forming an independent control that prevents any change in water level from being transmitted upstream. In the rapids above the Horseshoe falls, much of the water is carried by two main channels which tend to converge at the crest of the falls but, farther upstream, are separated by an extensive area of shoal water in mid-river.

Below the falls, the water level in the Maid-of-the-Mist pool is controlled by the solid rock stream-bed at the head of the Whirlpool rapids. Through the rapids, there is a fall of 45 ft. in a distance of one mile. There is a similar control at the outlet from the Whirlpool with a fall of 45 ft. below it in a distance of four miles. The remaining seven miles of river has a comparatively flat gradient to Lake Ontario.

### The Remedial Weir

As explained above, the weir being built this season in the upper Niagara river is part of the remedial works recommended by the Special International Niagara Board. Its general purpose is to raise the level of the water in the Chippawa-Grass Island pool. At low water, a rise of several feet might be permissible but too great a rise at high water might cause serious damage by over-topping the parapet along the Niagara Falls Power Company's canal. The allowable amount of rise at low water was specified as one foot at the Grass Island gauge, which is located near the power company's intakes. Because of the hydraulic characteristics of the submerged weir, the rise at high water will be somewhat less than one foot.

The submerged weir is being built in the main channel of the Niagara river about one-half mile upstream from the crest of the first main cascade. From the information originally available, this location was selected as being most advantageous for the purpose desired. The suitability of the adopted location was confirmed when, following the erection of the cableway, reliable soundings and velocity observations were obtained from the cable car. The bottom of the river is flat bed-rock with occasional crevices and some boulders. The cross section is comparatively uniform, Fig. 3, with a maximum depth of 15 ft. at the present stage of the river. The maximum velocity observed was eight feet per second or 5½ mi. per hour. The broken line outlines the part of the cross section that will be occupied by the weir.

The weir is being built of loose rock. The elevation tentatively selected for the crest, as shown in Fig. 3, will give an overflow depth of 6.5 ft. at low water, which should be ample for passing ice. At the Canadian end of the weir, a gap several hundred feet long is to be left between the weir and the shore in order to maintain present water levels at the intakes of the power plants farther downstream. However, both the elevation of the crest and length of weir are still subject to minor changes according to the effect on water levels observed as construction proceeds.

The water levels in the Niagara river will be affected by the remedial weir from the crest of the falls upstream to Lake Erie. The rise of one foot at Grass island will decrease gradually as the distance upstream increases, the expected rise at Lake Erie being about one-tenth of a foot, which will be of some benefit to navigation. However, the points at which it is most important to measure the exact amount of the rise are the intakes of the various power plants on both sides of the river and the crests of the Horseshoe and American falls.

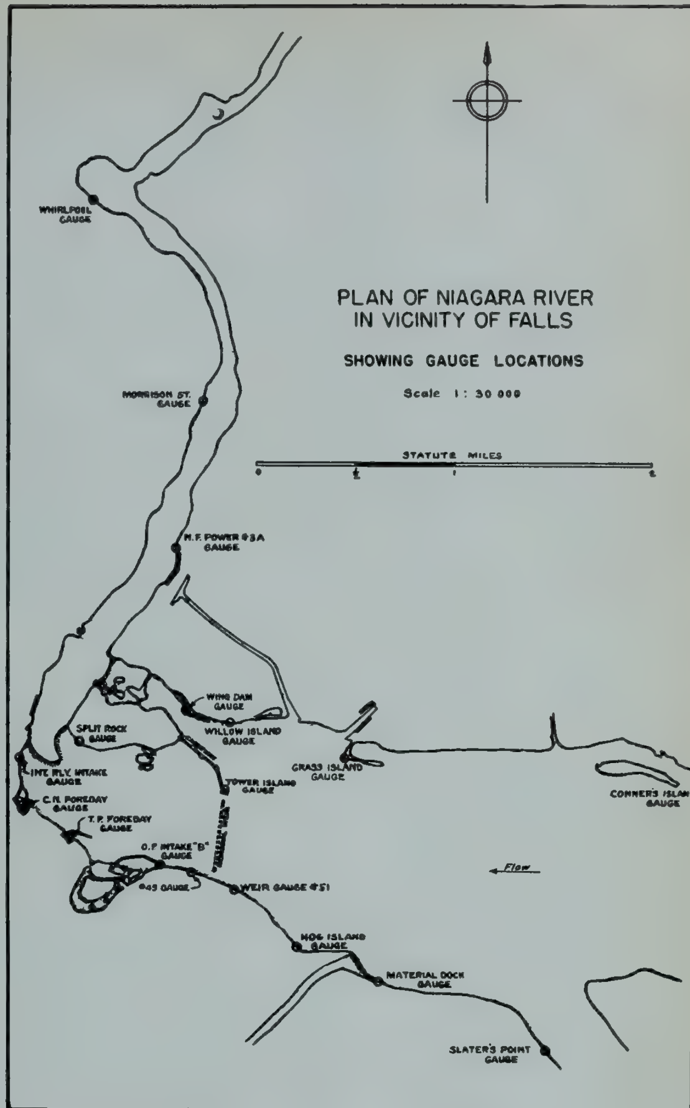


**Fig. 2—Plan of Chippawa-Grass Island pool.**

### Gauge Relation Formulas

The problem is to devise a method of computing the effect of the weir on river levels as construction proceeds and thus determine the final elevation of crest and length of weir that will be required to give the desired rise in water level.

Water level recording gauges have been maintained for many years at numerous sites along the river, so that a great amount of precise water level data are available for hydraulic studies. The construction of the remedial weir, which affects the water level at gauges in the upper river, has no effect at gauges in the lower river. Hence the records of water level at these lower river gauges afford a reliable basis of comparison for determining the effect of the weir at gauges in the upper river.

The Morrison Street gauge in the Maid-of-the-Mist pool near the head of the Whirlpool rapids was adopted as the standard reference gauge for these gauge relation studies. This gauge was established in 1922 and an excellent record is available as it is checked by comparison with the 3A gauge of the Niagara Falls Power Company one mile upstream and also with a gauge at the Whirlpool. The site is very sensitive to changes in river discharge and its permanent discharge control is not affected by weed growth in summer and only rarely by ice in winter. The gauge is used to record the discharge of the lower river, an accurate rating having been developed by transferring downstream the rating of the Buffalo gauge. The discharge formula, given below, was developed by the United States Lake Survey following the meterings made in 1931 and was checked and adopted by the Dominion Water and Power Bureau. Meterings made from the construction cableway in September of this year, with the addition of the discharge over the American falls and the diversion made by the Niagara Falls Power Company, gave a close check on the accuracy of this formula. The Morrison Street discharge does not include the water diverted by the Queenston power plant, which must be added to give the total flow of the river, such as is given directly by formula (1) above. The formula for the discharge past the Morrison Street Gauge is as follows:

$$Discharge = 786\ (Morrison - 301.10)^{3/2} \qquad (2)$$

In developing gauge relation equations between Morrison Street and any given gauge in the upper river, the factors involved are the fluctuations in the river discharge and in the power diversions and the effect of the seasonal cycle. The fluctuations in river discharge are shown by the changes in the Morrison Street gauge height, and the corresponding effect on the upper river gauge is determined by means of what has been designated the "discharge coefficient." Similarly, "diversion coefficients" are used to show the effect of changes in the power diversions. The formulas used are of the following form:—

$$G.H. = K + a\ (M - 336) - b\ Qn - c\ U.S. \qquad (3)$$

where $G.H.$ = computed gauge height at given gauging point in upper river;

$K$ = elevation at given gauge corresponding to elevation 336.0 at Morrison Street when diversion is zero. The numerical value of $K$ varies during the open water season due to the effect of the seasonal cycle, as explained below.

$a$ = dimensionless discharge coefficient, indicating the amount of change at the upper river gauge corresponding to a change of one foot at Morrison Street.

$b$ and $c$ = dimensional diversion coefficients for the Queenston and United States diversions, respectively, showing the amount of lowering in water level at upper river gauge for each 10,000 cu. ft. per sec. of diversion.

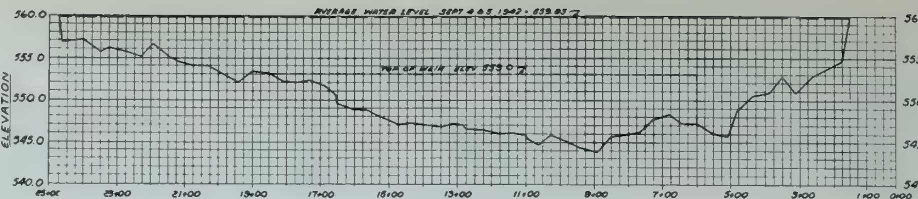


**Fig. 3—Cross section at site of remedial weir**

In order to be able to use formula (3) for comparing the water levels obtaining at any given gauge at various times, it is necessary to find the correct numerical values of the four unknowns: $K$, $a$, $b$ and $c$. The data available for this purpose consist of: the mean daily gauge heights as recorded over a period of years at the Morrison Street gauge and at the given upper river gauge; the mean daily power diversions as recorded at the various power plants. The problem is somewhat similar to an analysis of the tides, in which it is necessary to assign values for the effect of each of the various solar and lunar components. The mathematical process applicable in that case, known as the method of least squares, can be used in this case also. Using the mean daily figures, each day's record of gauge heights and diversions will give the data necessary for one observation equation of the general form of equation (3), in which the mean daily gauge heights and diversions are known and $K$, $a$, $b$ and $c$ are the unknowns. From the selected number of observation equations, the corresponding normal equations are formed in the usual way. As explained in text books on the subject, the solution of the normal equations as simultaneous algebraic equations, will give the most probable set of values for the unknowns, the set that will make the sum of the squares of the residuals a minimum. In this case, the residuals are the differences between the gauge heights actually observed at the given gauge and those calculated by using formula (3) with the set of values found for the unknowns.

The seasonal cycle, apparently due to the growth of aquatic plants, causes a rise in water level during the early summer, which reaches a maximum usually during July or August and then decreases gradually to zero late in the fall. Its general trend is fairly consistent but there are minor variations from year to year in its amplitude and time of incidence. In the Chippawa-Grass Island pool, the average maximum value is two-tenths of a foot. Below the crest of the cascades, no seasonal cycle can be detected.

In solving the normal equations for gauges in the Chippawa-Grass Island pool, because of this seasonal cycle, it is necessary to resort to an expedient not mentioned in the text books: each month, or group of months, must be allowed to have its own independent value of $K$; otherwise incorrect values may be obtained for the coefficients. A similar procedure should be followed whenever there has been any permanent break in the normal gauge relations. Usually the values of the coefficients only are derived by this method, the particular value of $K$ to be used for any given purpose being determined by a different method, as explained below.

The method of least squares has its limitations and must be used with discretion in computing gauge relation formulas. It can determine accurate values of the various discharge and diversion coefficients only if there has been a considerable range of independent variation in river discharge and in each diversion during the period covered by the observation equations. The best results are obtained when there are accurate records extending over a period of several years, because then there will be sufficient variation in river discharge for the accurate determination of the discharge coefficient. A similar opportunity for determining the diversion coefficients is obtained by using periods in which changes have occurred in the power diversions. If the available period of record is short, somewhat more reliable results can be obtained by discarding days in which the normal gauge relationship has been disturbed by storms or other causes; the size of the residuals obtained from a preliminary solution is used as the criterion for discarding doubtful days for the final solution. In any case, all data used should be selected from the open-water season only, when there is no danger of ice disturbances.

## Grass Island Gauge

The Grass Island gauge, located at Grass Island near the intakes on the United States side of the river, is to be used as the main reference gauge for determining the rise in water level that will result from the construction of the remedial weir. The weir, in accordance with the plan submitted by the Board, is to raise the water at this gauge one foot at standard low water, the stage being specified because the effect of the weir will be somewhat less at high than at low stages. In 1926, standard low water was defined on the Lake Survey charts as 570.0 at Buffalo and 560.6 at Grass island, which corresponds to a discharge of 155,000 cu. ft. per sec. from Lake Erie. At that time, the total diversion from the Chippawa-Grass Island pool was about 31,000 so that the discharge over the crest of the cascades, which is the controlling factor on pool levels, was 124,000 cu. ft. per sec. At present, the discharge over the cascades is 145,000 cu. ft. per sec. but, allowing for the usual seasonal decrease, by the end of November, 1942, when the weir is nearing completion, it should be not much greater than 124,000. The discharge from Lake Erie is greater than that for low water but this is balanced by the increase in the diversions from the pool.

The numerical values of the dischage and diversion coefficients in Formula (3) for Grass island were obtained by using the method of least squares, as explained above. In order to complete the formula for use this year, it was necessary to determine the 1942 spring value of the term $K$ prior to the beginning of the causeway construction or while it was in its early stages. For gauges in the Chippawa-Grass Island pool, usually there is a period of about three weeks for determining the spring value of $K$, after the ice effect has ceased and before the start of the rise due to the seasonal cycle. This year, the start of work on the causeway reduced this period for most gauges to about one week near the end of April. The complete formula in use this year (1942) for Grass island is as follows:

$$G.H. = 560.13 + 0.217\ (Morrison - 336.0) - 0.310\ U.S. \ldots (4)$$

In this formula, the value of the $Qn$ coefficient is taken as zero. This does not mean that the Queenston diversion does not have any effect on the water level at Grass island. It does mean that a Queenston diversion of 10,000 cu. ft. per sec., say, would have the same effect as a change of 10,000 in the discharge of the river. At the Material Dock gauge, which is located close to the intake, the draw-down effect of the diversion is somewhat greater than the effect of a decrease in discharge and the $Qn$ coefficient is negative though numerically small. Farther upstream, the effect is less and the $Qn$ coefficient becomes positive. The reason for this, of course, is that the Queenston diversion is not included in the flow past the Morrison Street gauge, as mentioned above.

### Water Level Diagram

This gauge relation formula (4) for Grass island is used with the 1942 recorded Morrison Street gauge heights, and the power diversion figures, to compute the mean daily gauge heights that would have obtained at Grass island if there had been no construction work and no seasonal cycle this year (1942). The difference between these computed gauge heights and those actually observed, will represent the change due to the construction work, except that the effect of the seasonal cycle will be included.

The plotting of these differences between the computed and observed gauge heights at Grass island for 1942 is shown on Fig. 4, starting about the first of May. By June 5th, 1942, the causeway and the foundation of Tower island were finished and the diagram shows a corresponding rise of three-tenths of a foot in the water level at Grass island. During the rest of June, there was an additional rise of three-tenths, followed by a fall of two-tenths during July. Part of this rise and fall may have been due to the seasonal cycle and part to the fact that the effect of causeway and island increases as the stage increases. Also, it may be that it takes time for the river to adjust itself to new conditions. The diagram shows a small additional fall during August so that the net rise by September 8th was about three-tenths of a foot, which may be taken as the net effect of causeway and island, though a small part may be due to the seasonal cycle.

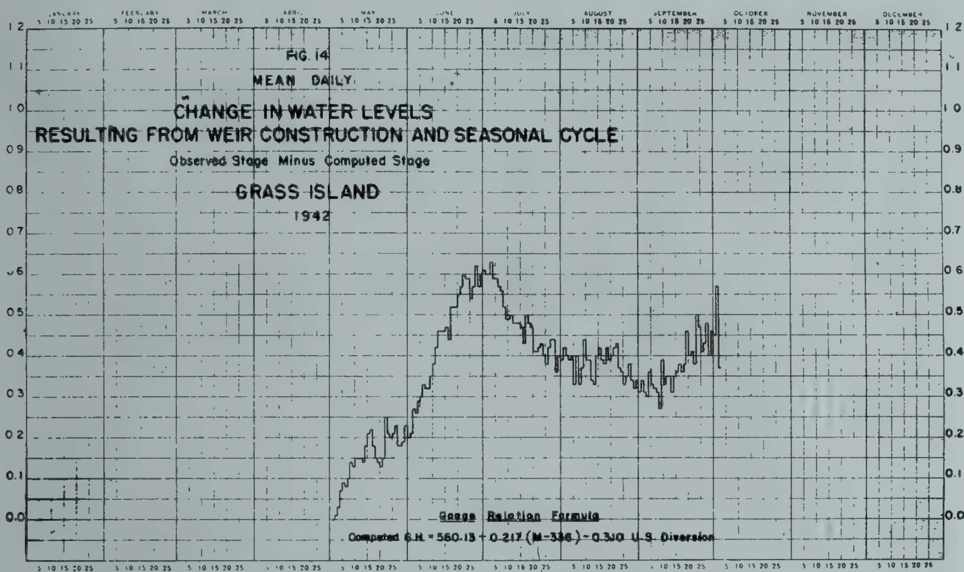



**Fig. 4—Water level diagram for Grass Island.**

Before the end of October, two 100-ft. openings are to be made in the causeway where the water is deepest. This should eliminate most of the rise due to the causeway. Also, the effect of the seasonal cycle diminishes during the fall. Thus, as the weir nears completion, the rise shown by the water level diagram should be mainly that caused by permanent structures, consisting of the weir itself and the small artificial island which is to be landscaped and allowed to remain in place. Ultimately the causeway will be removed entirely.

The placing of rock for the weir itself started on September 8th. The amount of rock placed to date (October 15), is almost exactly half of the estimated total. The corresponding rise in water level at Grass island was 0.25 ft. However, it is natural to expect that the effect of the upper half of the weir will be greater than that of the lower half.

At 14 other gauges above the falls on both sides of the river, similar diagrams are being maintained to show the effect of the weir as construction proceeds.

### Effect of Remedial Weir

The main purpose of the Niagara Board in recommending the construction of the remedial weir was to preserve the beauty of the falls. Its construction at the present time, however, can be justified only because of its effect in increasing the output of power for war use; on that account, it has been given a relatively high priority rating. The rise of one foot, more or less, at the power intakes in the Chippawa-Grass Island pool will produce extra power because it will increase the carrying capacity of the power canals as well as giving a small additional head on the plants. In addition, the rise in water level at the intakes should help to reduce winter ice troubles and consequent power interruptions. It has been estimated that the increase in firm power at all plants affected will exceed 30,000 hp. There are few other industrial areas where such a substantial amount of power could be secured with the use of such small amounts of critical materials.

Notwithstanding this present utilitarian function, the weir will fulfill also its original purpose, as envisaged by the Board, of helping to preserve the beauty of the falls. The scenic value of the American falls and the Three Sisters islands will be enhanced by the resulting increase in the flow around both sides of Goat island and there should be some improvement in appearance at the American end of the Horseshoe falls.

# THE STATISTICAL CONTROL OF QUALITY

**Proceedings of the third professional session of the Fifty-Seventh Annual General Professional Meeting of The Engineering Institute of Canada, held at Toronto, Ont., on February 12th, 1943. Professor E. A. Allcut, M.E.I.C., presiding**

### INTRODUCTION

In his opening remarks, the chairman referred to the vital importance of the production of munitions of war and to the necessity of discussing the technical factors related thereto. The control of quality was one of the most important of these factors as, if the limits of quality were wide, output might be increased, but not necessarily the *useful* output. On the other hand, if the limits were too narrow the quality obtained would be of a higher grade than that required for the job and the *quantity* produced would certainly be less than it should be. It was necessary, therefore, to know where to draw the line so that the requisite standard of quality might be obtained and maintained. Statistical control enabled large quantities of similar products to be kept within the prescribed limits without the necessity of examining every piece. He believed he was correct in saying that the first reference to it appeared in the *Bell System Technical Journal* in 1928, and recently it had received considerable impetus, not only in inspection work but also in helping to specify reasonable manufacturing limits.*

As this method originated with telephone work, it was appropriate that the first speaker should have been for twelve years the inspection superintendent of the Northern Electric Company in Montreal. Mr. Vroom was a native of St. Stephen, N.B., was a graduate of McGill University and had recently been appointed shop superintendent of the Telephone Division of the Northern Electric Company.

## APPLICATION OF STATISTICAL INSPECTION IN THE TELEPHONE INDUSTRY

H. H. VROOM, M.E.I.C.

*Telephone Shop Superintendent, Northern Electric Company, Limited, Montreal*

The following is a brief discussion of statistical methods of inspection which, after years of trial, have proved effective in controlling the quality of telephone apparatus and equipment manufactured by the Northern Electric Company.

### Statistical Sampling Inspection

This method of saving inspection labour and still maintaining satisfactory control over the quality of product has been used by the Northern Electric Company for the past fifteen years. It is employed in cases where it is satisfactory to inspect only a portion of the pieces in a lot and to accept the lot if the inspection results for the sample fall within the required "average outgoing quality limits" (AOQL). For example, a 3 per cent AOQL would mean that a maximum of three per cent of defective pieces is allowable.

Such conditions exist, for example, in the process inspection of component parts of product units, where the purpose of inspection is to ensure that the quality passing on to the next stage is such that no extraordinary effort will be expended on defective parts. Characteristics, whose conformance to specified requirements is of vital importance to the functional quality of the product, and for which 100 per cent inspection is feasible, may not of course be considered for sampling inspection.

As carried out by the Northern Electric Company the scheme requires the systematic collection and examination of two samples from each lot. For each size of lot, "acceptance number," "AN," are assigned for the first and second samples. These numbers are based on experience with the "Process Average" which is the average per cent of defects under normal conditions of the product submitted for inspection over a period of time. The "acceptance number" is greater, the greater the process average, and the larger the lot. Typical values for a AOQL of 3 per cent, and a process average of from 1.141 to 1.520 per cent are shown in Table I for various sizes of lot. Similar double sampling Tables are used for other values of AOQL from 0.5 per cent up to 5 per cent.

In arriving at the process average, conditions of abnormally high percentage of defects are excluded. If the process average is not known, a set of tables based on a process average of 1.901% and over is used.

The steps followed by the inspector in applying the sampling table are shown in Fig. 1.

### Circulating Machine Inspection

This system has replaced statistical sampling inspection in machine departments. It was adopted about five years ago and follows the same principles as statistical sampling except that the samples are collected by the inspector

TABLE I

Universal Double Sampling Scheme

Average Outgoing Quality Limit — 3% Defective

| Process Average | 1.141—1.520% | | | | |
|---|---|---|---|---|---|
| Lot Size | 1st Sample | | 2nd Sample | | |
| | SS | AN | ADD | TOTAL | AN |
| 0—50 | 14 | 0 | 9 | 23 | 1 |
| 51—100 | 17 | 0 | 13 | 30 | 1 |
| 101—200 | 21 | 0 | 29 | 50 | 2 |
| 201—300 | 24 | 0 | 46 | 70 | 3 |
| 301—400 | 25 | 0 | 50 | 75 | 3 |
| 401—500 | 25 | 0 | 75 | 100 | 4 |
| 501—600 | 30 | 0 | 75 | 105 | 4 |
| 601—800 | 30 | 0 | 80 | 110 | 4 |
| 801—1000 | 55 | 1 | 100 | 155 | 6 |
| 1001—2000 | 65 | 1 | 135 | 200 | 7 |
| 2001—3000 | 70 | 1 | 195 | 265 | 9 |
| 3001—4000 | 100 | 2 | 200 | 300 | 10 |
| 4001—5000 | 100 | 2 | 235 | 335 | 11 |
| 5001—7000 | 105 | 2 | 245 | 350 | 11 |
| 7001—10,000 | 110 | 2 | 280 | 390 | 12 |
| 10,001—20,000 | 120 | 2 | 340 | 460 | 13 |
| 20,001—50,000 | 130 | 2 | 420 | 550 | 15 |
| 50,001—100,000 | 175 | 3 | 475 | 650 | 17 |

SS—Total in 1st Sample
AN—Acceptance Number
ADD—Increase in Sample
TOTAL—1st Sample Plus Increase
AN in 2nd Sample is Allowable Defects in Total

* See discussion on "The Application of Statistical Control to the Quality of Materials and Manufactured Products," Jrl. I. Mech. Engrs., June, 1932.

directly from the machine. Before a machine is permitted to run, after being set up, a sample of the product must be approved by the inspector, and during the run he visits the machine at regular intervals and take a sample of five parts. This sample consists of one part directly off the machine and four parts taken from the work produced since his last visit.

If the machine is running continuously on the same operation, the lot size is taken as one day's output. From this the sample size required for any desired AOQL is obtained from the sampling tables. As five parts are taken at each visit the number of visits required during the day is one-fifth of the sample size and visits are timed at regular intervals.

On completion of the run on any part, the machine operator saves the last part made which is taken by the inspector as part of his last sample. This is to determine whether the tools are still in good condition so that regrinding or repair may be done before the tools are returned to stock.

Machine inspection is advantageous under wartime conditions from the standpoint of conservation of materials and labour, as defects are usually detected before a large quantity of defective work is produced. It is, however, subject to criticism on the grounds that it transfers the responsibility for defective work from the operator to the inspector. Although the operators are provided with gauges there is undoubtedly a tendency to rely on the inspector.

### Detail Inspection

Lots of parts which are rejected by the sampling inspection at the machines are sent to inspection benches for detailing; also many of the parts manufactured show some dimensions which must be controlled within narrow limits. The machine inspection is not depended upon to finally pass this work, but after the sample has been passed at the machines it is sent to an inspection bench where a detail inspection for these close requirements is made.

Detail inspection and testing is also performed on all apparatus and equipment, and the defects are classified and recorded for control purposes as described under quality control.

### Check Inspection

When apparatus and equipment is ready for delivery to the customer, a percentage of the shipment ranging from 5 to 10 per cent is checked for the protection of the customer and for the purpose of presenting to the management a picture of the product shipped.

In order to obtain a composite rating based on a combination of the various defects found, the defects are classified according to seriousness and evaluated on a demerit basis as follows:

Class "A" defects—demerit value 100
: These are very serious and render the unit totally unfit for service.

Class "B" defects—demerit value 50
: These are serious and may cause failure in operation, or will surely cause increased maintenance or decreased life.

Class "C" defects—demerit value 10
: These are likely to cause trouble less serious than an operating failure.

Class "D" defects—demerit value 1
: These are minor defects in finish, appearance or workmanship.

The quality of each type of apparatus is recorded in terms of demerits per unit, which is the average number of demerits per complete piece of apparatus inspected for a period of one month. This is plotted each month on a control chart as compared with the expected quality, which is the average quality obtained over a period of years, adjusted to current design and manufacturing conditions

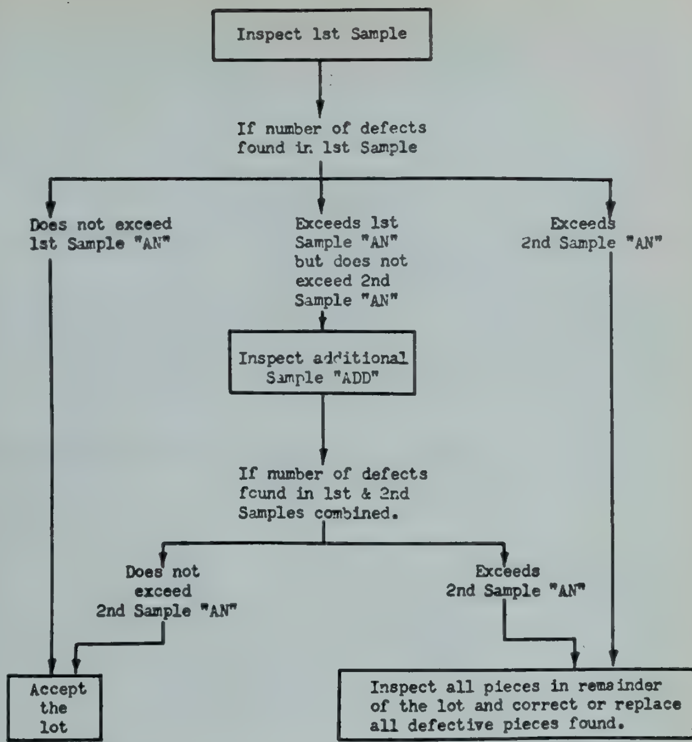



**Fig. 1—Diagram showing sampling procedure.**

and corrected where surveys of equipment in service indicate that the quality is unsatisfactory.

Upper and lower limit lines on this check inspection chart show the boundaries of the range within which sampling results may be expected to fall 95 times out of 100 if the quality of the whole product is actually at the expected quality level.

A single instance (month) where the line approaches the lower limit line is no cause for alarm. Neither is a single instance (month) which goes outside the range necessarily very significant, because even a well controlled product will have some normal variations above or below the expected quality level.

But trends in the monthly sample results are the all important thing. A single wide deviation or a succession of two or more results below the limit line, shows that the control or process of manufacture requires attention. A succession of sample results, even within the limit line but hovering near it, is also significant in the same way.

The fact that even a detail inspection can only be depended upon to screen out a percentage of the defects in the product was illustrated by recent experience with soldered connections in step-by-step equipment.

In the latter part of October and early November 1942 the shop experienced trouble of this kind caused by restrictions on the use of tin in solder and on the tinned wire. Detail inspection and repair of rejections failed to establish normal quality of product, but the serious nature of the trouble was shown by a sudden drop in the quality line on the Check Inspection chart. This resulted in the job being immediately stopped for investigation and the product being returned for rewiring.

The result of the investigation was a change in methods which produced satisfactory soldered connections with solder containing only 15 per cent of tin, a rise in the soldering quality line within control limits in December shows that the quality had been restored to normal.

### Quality Control

With the Check Inspection picture of quality of finished product as a guide, the problem is to control manufacturing operations so that a product of desired quality may be produced continuously.

About six years ago, a plan of Quality Control by "Bogeys" was introduced which has proved to be a decided improvement over former methods. It involves the following steps:—

(1) Each inspector makes a weekly report on each type of product which he inspects, recording the number of defects found on each inspection requirement.

(2) A summary combining the reports of all inspectors on the same product is made weekly.

(3) A Bogey expressed in per cent of defects is set for each requirement. In establishing these bogeys, consideration is given to the quality which has previously been produced; to field experience and to what is considered as the best quality which can reasonably be produced. In order to meet the Check Inspection requirements of expected quality the total bogey must not exceed five times their standard. This is based on experience which shows that the average inspector is from 80 to 90 per cent efficient in picking out defects.

(4) A Quality Control Report is filled in weekly for each product. This shows the bogey and number and per cent of defects found in each inspection requirement. Attention is called to all items in which the defects exceed the bogey.

(5) The Control Reports on each product are totalled at the end of each month and meetings of operating and inspection foremen are held to discuss means of bringing all attention items within control.

# THE USE OF STATISTICAL METHODS IN FORESTRY

T. W. DWIGHT

*Faculty of Forestry, University of Toronto*

Before the science of statistical methods achieved its present popularity and wide application, foresters had a technique of statistical methods of their own which went by the name of "forest mensuration." In the process of measuring the present volume of standing timber, its rate of growth, and probable future volume, foresters had occasion to gather very large amounts of numerical data and to prepare tables based on these data. As a result, they developed considerable statistical technique before they became really conscious of the existence of a theory of probability or a science of statistics.

It may perhaps be of interest to mention that foresters were early venturers into the field of statistical methods. Galton's famous presidential address in which he outlined the mathematical basis of simple linear regression and correlation was delivered in 1885. But forty years before this, in 1846, tables giving the volumes of trees of different diameters and heights for the chief European timber trees had been prepared. The table for Norway spruce was based on the measurement of eighteen thousand trees. The preparation of these tables involved what we now call multiple curvilinear regression. The first table of this sort was published as early as 1804. It was merely an approximation arrived at by taking a uniform percentage of the volumes of cylinders as corresponding to the volumes of trees.

The most important work of the forester to which statistical methods are applied, is the ascertaining of the volume of standing timber. This is done by measuring sample areas comprising usually two-and-one-half or five per cent of the total area. The areas sampled in this way are commonly quite large and, occasionally, surveys are made of tremendous areas. A few years ago, over half the timbered area of northern Ontario was covered in the course of a few years. In Europe, the whole area of the Scandinavian peninsula and of Finland was covered in uniform surveys. In such cases, the percentage samples is only a fraction of one per cent.

With the large amount of data available from these large areas, it might be supposed that there should be little difficulty in calculating the probable error of sampling, but this is not the case. The difficulty is that there are significant trends towards high and low values in different parts of the area. Avoidance of the effect of these trends in the determination of sampling error presents practical difficulties. Since this situation is not likely to be encountered in engineering work or is, there, easily overcome, discussion of the problem here would seem to be inadvisable.

On the sample areas, only the diameters of the trees usually are measured. Their volumes are computed from average heights read from curves and volumes taken from tree volume tables. The construction of these curves and tables involves simple and multiple curvilinear regression, and usually is done by graphic methods.

The forester must however be able not only to estimate the present volume of mature timber, but also the future volume of young growth. In this work, periods are often involved comparable to those handled by the life insurance actuary, but in some cases going beyond one hundred years of age, and so exceeding the periods commonly dealt with by any branch of science except geology and astronomy. These estimates are made by the use of tables, based on the measurement of plots of different ages, whose construction involves special features of multiple regression technique.

Information not only of total volumes, but of the numbers and sizes of the trees at different ages is desired. This is secured by constructing sets of harmonized frequency curves—that is frequency curves which change gradually in form with increase in average diameter. This is the only field that I know of where harmonized sets of frequency curves are constructed. Both graphic and algebraic methods are used.

The diameter distributions of trees in different types of forest are a most prolific and convenient source of frequency curves of all types from normal to J-shaped, and including bi-modal curves. For many years, French foresters have used these frequency curves to check the condition and development of their forests, and in particular their improvement under scientific management. Similar use is made of frequency curves in connection with experimental plots to give a graphic picture of the effects of different experimental treatments on the growth of all different sizes of trees on the plots.

Since every tree in temperate regions contains in its annual rings a complete record of its past growth, it might be supposed that measurement of these rings would give the necessary data for estimating the future growth of an area of timber. A very serious difficulty arises from the fact that in a stand of timber, the increase in the size of the individual trees inevitably causes the death of a certain number of the smaller trees.

An estimate of the future volume of a young stand using rate of diameter growth as a basis would involve a simultaneous estimate of mortality. It is possible that this can be done in an indirect manner, but the method has not been worked out in practice. In general, estimates of diameter growth are confined to short periods, usually of only ten years, or to cases where it may be assumed that mortality will be negligible, as where trees are left growing with plenty of room after removal of part of the stand by logging.

All the cases mentioned have been characterized by plentiful data and there is usually little question of the significance of relationships. Standard errors are however computed to test the comparative efficiency of a new and an old method of correlating data, to determine the importance of the influence of a particular independent variable, or to eliminate doubtful data.

When however one turns to the field of direct experiment, the situation is exactly the opposite. With the establishment of half a dozen permanent forest experiment stations in Canada and fifteen or so in the United States, this type of investigation has increased rapidly. In no field of investigation is so much labour and time involved in conducting experiments. The extreme is reached in permanent sample plots, which are re-measured at five-year intervals. Some of these have been established for thirty-five years and yet each of them furnishes the investigator with but a single figure. Replication of experiments is therefore difficult but in some cases it is possible to apply the tests of significance for small samples.

The forester's experience with freehand curve-fitting seems of particular interest. As was mentioned in the beginning, foresters tackled complicated problems of curve-fitting before the mathematical principles involved had been worked out; as a result they evolved their own technique and at first paid little attention to the later developed algebraic methods. However for the multiple curvilinear regression problems referred to, completely algebraic methods are ruled out because of the volume of arithmetic that would be involved, and even for the fitting of single curves there is a great saving of work if curves can be fitted to plotted averages by graphic methods with sufficient precision. While foresters have used algebraic methods of curve-fitting to a considerable extent, they have improved their graphic methods to such an extent that they secure practically as close precision. This is achieved by careful technique in drawing the curves and systematic checking and adjustment afterwards. Objection is frequently made that the drawing of a curve by purely graphic methods allows too much latitude for individual judgment. It would seem however that objection may be made with equal force, that the selection of an algebraic formula to be fitted by the method of least squares arbitrarily fixes important features of the shape of the curve without much reference to the basic data at all. It may therefore be considered an advantage to have the opportunity which a graphic method affords of applying some personal judgment as to what the final shape of a curve should be.

It should be emphasized that practically all the data we work with in forestry are biological in origin and the resulting relationships cannot be expected to conform to any simple mathematical formulas. The opposite is of course true of many relationships used in engineering work, where the nature of the relationship may most readily be determined by mathematical reasoning. Observational data are then used merely to test the correctness of the mathematical reasoning. The suggestion may perhaps be made from our experience that where a relationship *is* being determined from empirical data, a satisfactory curve may often be secured by graphic methods.

## DISCUSSION

**Further discussion on the subject is invited. Written comments should be addressed to the General Secretary of the Institute, at 2050 Mansfield St., Montreal, Que.**

H. H. Fairfield[1]

The Metallurgical Laboratories in Ottawa, to which I am attached, are dealing with various war problems and receive inquiries from the Department of Munitions and Supply, the Inspection Board, and the Services. We frequently run into cases where the test results have not been interpreted correctly.

An example of the need for correct interpretation came in a couple of weeks ago. An official from the Department of Munitions and Supply asked us to investigate a certain product. It was specified that, if eighty per cent of this product passed a certain test, the material was acceptable. On the examination of the test it was found that ten pieces were taken from a lot of four thousand, and if eight out of ten, or more, passed, the lot was accepted. If six out of the ten or five out of ten passed, it was rejected.

It will easily be realized that, if the product is such that eight out of ten will pass when a sample is taken, there is one chance in five of getting a failure and four chances in five of getting a win. Therefore, if you reject a sample that has only seven wins and accept a sample that has nine wins out of ten, actually those lots of material are exactly the same.

Recently it was pointed out by Colonel Simon, of the United States Ordnance Corps, that many of their existing ordnance specifications were such that lots of material rejected were exactly the same as lots accepted. He proved it and he staked his career on challenging this fact.

He took two lots of shells, one rejected and one accepted on the test they were using at that time. The examination of these shells showed that they were practically identical. That shows the need of interpreting observations.

What quality control is, or what it is claimed that it will accomplish, is that it will reduce the manhours of inspection, reduce the possibilities of defective work, detect the onset of defective material before it exceeds specification, and, for management, it will present production data in a compact form so that the results of hundreds of tests can be appraised at a glance. The relationship between production conditions and the quality of the product could be obtained by correlation technique.

Assuming an inspector in a steel-casting plant pulls test bars and he gets one 110,000 yield strength, and another 126,000—what is he to make of that? The answer is, as Mr. Vroom has pointed out, the knowledge of past conditions. If the nature of that process is such that, with good ingot, yield strength varies over a range of 20,000 or 30,000 lb., then these results will be normal for the process.

Without this background of experience, interpretation of any industrial observations is impossible. By experience is meant either a collection of facts in somebody's mind or put down in the form of frequency distribution.

Another type of interpretation is drawing conclusions from a sample. Let us assume that we are testing two different types of tracks and we have, for example, two hundred lengths in one track and two hundred in another and we run the standard proving ground test. We obtain ten failing lengths in one track and twenty in another. These two tracks being different types of steel, are we to say that one is definitely better than the other, or that the difference is due to chance? Only by a scientific analysis of the sample results can we tell whether they are significantly different or not.

Mistakes in that type of calculation occur frequently. Mr. Vroom has pointed out or explained that the quality control system is based on past experience. In the manufacture of fuses in Westinghouse Electric's Springfield plant, the use of the statistical method has reduced inspection to about twenty per cent and makes it possible to predict when a definite dimension would exceed specifications, sometimes eight hours in advance. Corrective steps can therefore be taken long before defective work occurs.

I was very interested in Mr. Vroom's statement that inspection catches only eighty to ninety per cent of the defective work. That is the reason why a hundred per cent inspection without any analysis of results is not satisfactory.

At the Frankford arsenal, in the United States, where the production of fuses was a hundred per cent inspected, de-

[1] Metallurgist, Bureau of Mines, Division of Metallic Minerals, Department of Mines and Resources, Ottawa, Ont.

fective work was made from time to time. The method was changed and, instead of making a hundred per cent inspection, five samples were taken. The average quality of the five samples was plotted, as well as the range between the greatest and smallest value. The diagram gave the characteristics of the process.

When a group of five samples is found whose average quality is outside of the normal variation of the process, an investigation is made immediately and, often, the operation is corrected before defective work is ever made.

The final result is that a better product is turned out with about twenty per cent of the inspection work, as compared with the previous method of control.

In the case of armour-plate testing, the test destroys the material and delays production. The test consists in shooting projectiles at an increasing velocity until the ballistic limit is determined, i.e., the speed of the projectile that will pierce the plate. In the early stages of the war, an arbitrary value was set and, if the ballistic limit was lower than that value, the succeeding plates that went with the plate tested would be rejected.

The method was erroneous. Firstly, because there is a normal variation of the ballistic limit which is characteristic of the steel plant producing the plate. Either that variation is acceptable, or it is not. If it is acceptable, only occasional tests are required to be sure that the results are in the same range.

The difficulty with that arbitrary test was that the plate fired varied at the lower range and the plates rejected were not necessarily the same. An analysis of the variation of results permitted setting up a sound specification.

The general policy outlined by the United States Ordnance is to study the quality of the material manufactured and find its normal range of variation. If it is acceptable, then all that is necessary is evidence that the range of variation, characteristic of the process, has not been exceeded.

The frequency of inspection can thus be reduced as evidence accumulates to show that the firm can control its production. A list of users of this method would include nearly all the large industrial research laboratories attached to large corporations in the United States—the Bell Telephone, the United States Ordnance, General Electric, Westinghouse, National Steel Casting, General Motors, and many other industries.

Correlation is another part of industrial statistics. What is being done, right now, is that a great many tests on gun tubes are gathered and the correlation between certain tests and the number of rounds a gun tube will fire is established. Similarly, the correlation is made between quality of armour and various tests.

The field of interpreting observations is really research on current industrial problems and through its use a great saving should be made in the man hours of inspection, the delays in production should be obviated, and by the use of correlation technique, a better product can be made.

H. E. McCrudden, m.e.i.c.[2]

I have had a good deal of experience in the matter of inspection and quality control of materials that our firm used during the past 15 years. I can testify as to the efficacy of the methods of inspection used in the factory in the improvement of the quality of the materials produced. Also, by these statistical methods, we have been able, based on experience and observation to set up specifications, particularly in the case of the properties of telephone cable where inevitably we have dispersion and variation of such properties. By studying the effects of such dispersion in the field from a desired minimum or maximum or average level, we have been able to specify reasonable limits, and also to influence the manufacturer to control his products either up or down from, say, the average experience in the past.

Also, in connection with wood products, we have set up methods to determine desirable fibre strength, particularly the fibre strength of red pine or Norway pine. Red pine timber is now extensively used in its treated form as poles by communication companies.

Our investigations have shown that specifications as to minimum fibre strength of red pine poles should not be based purely on the strict arithmetic average of the breaking strength of a large number of tests of Norway pine. One can readily imagine that from the breaking tests, the dispersion of results from many samples is very wide and to take the mathematical average would not be indicative of either the desirable or the proper fibre strength to use in design.

Another interesting example of the application of statistical methods is in connection with the acceptance of a large lot of treated hardwood pins where it was discovered that there were considerable variations from specifications. The problem was whether to reject the whole lot or to decide what was the desirable thing to do. If acceptance was the answer, the final effects of such a decision would not be known for 10 or 15 years. The application of statistical methods, always taking into account past experience, provided means to indicate how far we should go in accepting this rather large lot of non-conforming pins that had certain undesirable properties. We reached a compromise that was quite acceptable to the supplier, as well as to ourselves.

W. P. Dobson, m.e.i.c.[3]

No more timely subject could have been chosen for discussion by the Institute at this time, when efficiency in production of munitions is of transcendent importance. It is timely because the application of statistical methods to the control of quality in production is of very recent date, and its value as a tool for this purpose has not been appreciated by those responsible for production to the extent one would expect. This seems surprising because the underlying theory has been developed for many years and has been applied in other fields.

In the discussion on the statistical control of quality held at the joint meeting of the Institutions of Civil, Mechanical and Electrical Engineers in London, as reported in the January issue of *The Engineering Journal*, Dr. C. G. Darwin, Director of the National Physical Laboratory, stated that he first learned of the method on a visit to the United States, although it had been made use of to some extent in England. This suggests that not sufficient publicity has been given to the subject in Great Britain and the same observation is applicable in Canada.

The first step towards quality control was the introduction of the so-called "go," "no-go" gauges about 70 years ago. This method was obviously inadequate and insufficient because it did not help to reduce the fraction defective of any lot or universe representing a product. Statistical control originated in the endeavour to solve this and another problem:

1. How to minimize the fraction defective.
2. How to select samples for destructive tests, in particular how large a sample was required to give adequate assurance of quality.

The quality of a product can only be determined by inspection. This, however, is only one operation in any industrial process; the other two being specification and production, and these three steps are not independent; they together constitute a scientific procedure in acquiring knowledge of the product.

The outstanding characteristic of the first step (specification) is the necessity of establishing a tolerance range for each characteristic of the product. The establishment of these ranges depends upon what is possible under conditions of production, and thus, steps one and two are inter-

[2] Staff Engineer, Bell Telephone Company of Canada, Montreal, Que.

[3] Chief of Research and Inspection Department, Hydro-Electric Power Commission of Ontario, Toronto.

connected. The results of production, in turn, are revealed by inspection. Thus it is seen that the three steps cannot be taken independently—they must be co-ordinated.

The application of statistical analysis should reveal variations in the quality of a product in respect of any particular characteristic. The application of the theory assisted by engineering judgment should indicate whether these variations are owing to chance or to assignable causes. If all variations, except those due to chance, have been eliminated the product is under statistical control. However, if assignable causes are indicated the detection of these is an engineering problem.

The fundamental operation in inspection is sampling, and it is here that a knowledge of the theory of probability and of statistical methods is most necessary and useful in order to assist the manufacturer and the consumer in attaining assurance of the quality of the product with the minimum of expense. Many specifications requirements are totally inadequate in this respect, since they take no account of the effect of the size of the sample upon the results and of the possible percentage of the defective articles in the product. As a particular example, many acceptance specifications contain a clause reading somewhat as follows: that a sample of ten shall be selected at random from a lot and not more than one shall fail. The application of probability theory shows that this specification may be quite inadequate in that the manufacturer need not make the best possible product to meet it; for example, it cannot be inferred that a sample which is ten per cent defective came from a lot which is ten per cent defective. As a matter of fact it may be shown that samples of ten taken from a large lot which is ten per cent defective are better than the lot considerably more frequently than they are poorer than the lot. To be specific, a lot of fraction effective 0.9 will yield a sample which is perfect 35 per cent of the time and a sample which is 0.9 fraction effective 39 per cent of the time; that is, in 74 per cent of the time, samples might be better than .9 fraction effective although the lot as a whole is not. This example shows how useful statistical analysis may be in answering the problem of sampling.

Statistical control charts may be prepared following well-defined rules by any one without complete knowledge of the mathematical theory underlying the method. The publications of the American Standards Association ("Guide for Quality Control," Z1.1/4 "Control Chart Method of Analyzing Data," Z1.2/41, and "Control Chart Method of Controlling Quality During Production," Z1.3/42, contain very complete instructions for preparing control charts. These have been adopted by the Canadian Engineering Standards Association. The British Standards Institution publication 600 R:1942 also contains instructions for preparing control charts.

I am sure that the papers which have been presented will be of great help in revealing to Canadian engineers the possibilities of the application of statistical methods to engineering problems and I hope the Institute will encourage the presentation of other papers in this field.

I should like to ask Mr. Fairfield whether these methods are being applied in Canada in the control of quality in production and in the inspection work connected with the war effort. If not they should be, and it should be the concern of the Institute as well as of other engineering bodies to urge the authorities to apply them wherever practicable.

The importance which the subject has now attained prompts the suggestion that a knowledge of statistical theory should be part of the equipment of all engineering graduates and that the universities organize courses in the subject.

H. H. Fairfield

As to the application of statistical methods to war production problems, these methods are now in use in a few places in Canada. Armour plate and shell component inspection is being carried out with the aid of statistical methods. The Inspection Board of the U.K. and Canada have armour plate records in quality control form.

Canadian manufacturers and Ordnance establishments lag behind the U.K. and the U.S.A. in the use of this very valuable tool. On one type of gun tube, the U.S. Ordnance saves $200,000 a year on inspection by analyzing a smaller number of test results.

R. F. Legget, m.e.i.c.[4]

In view of Mr. Dobson's remarks upon the important subject of statistical control, it may be of interest to quote an extract from the December, 1942, issue of the *Journal of the Institution of Civil Engineers.* The papers by Sir George Darwin and Sir Frank Gill, published in January issue of *The Engineering Journal* were reproduced from the record of a large meeting held in London. With reference to this meeting and subsequent developments in Great Britain the relevant extract is as follows:

> "Including the joint meeting on the 15th of April, 1942, of the Institutions of Civil, Mechanical and Electrical Engineers, a total of 16 meetings as well as nine lectures courses have been held in England, the aggregate audience numbering over 2,600 engineers, to introduce the subject of quality control to manufacturers, members of the Supply Ministers, teachers in Technical Colleges, and others. Great interest has been shown and a small band of persons who are voluntarily giving their efforts to this subject in the interest of the nation have been greatly encouraged by the response to these meetings.
>
> "Although it is known that a considerable number of organizations are working on the subject, yet this knowledge is not comprehensive, and the Institution, being greatly interested, hopes that its members in the appropriate responsible positions in those organizations which make investigations in the application of quality control will take the trouble to write to the Secretary of the Institution to give the general results of the investigation whether the result is favourable or not, and if some detailed examples are given the report will be the more valuable."

These remarks suggest that there is a definite field of service which The Engineering Institute of Canada might very well enter, particularly at this time, in view of the importance of the methods under discussion in relation to Canada's war effort.

[4] Assistant professor of civil engineering, University of Toronto, Toronto, Ont.

# HEATING OF DWELLINGS

## COMPARATIVE COST OF HEATING WITH COAL, OIL, GAS OR ELECTRICITY

HUET MASSUE, M.E.I.C.

*Engineer, Water Resources and Statistical Department, The Shawinigan Water and Power Company, Montreal*

**Paper presented before the Quebec and the Kingston Branches of The Engineering Institute of Canada, on February 3rd and March 11th, 1943, respectively**

### Temperatures

Under the climatic conditions obtaining in Canada, the heating of dwellings is a most important item in the domestic economy. Because of the very low temperatures experienced, heating installations must be elaborate, and the quantities of heat furnished, considerable.

In Montreal, for example, heating installations must be of sufficient capacity to maintain a house temperature of 70 deg. F. when the outside temperature drops to as much as 30 deg. below zero.

Every year since the beginning of the century—except in 1931—the minimum temperature in Montreal has always been lower than 10 deg. below zero. There were twelve years when the minimum dropped below minus 20 deg. In 1933, an all-time low of 29 deg. below zero was recorded (Fig. 1).

As low as the temperature is in Montreal, it is higher than in most other sections of the province of Quebec where temperatures even lower than minus 50 deg. F. are experienced.

In designing a heating system it is customary to provide for a temperature of from 10 to 15 deg. higher than the lowest recorded outside temperature. In Montreal, a heating system must therefore be designed for a temperature of about 15 deg. below zero, whereas in Amos it must be able to produce the heat required for an outside temperature as low as 40 degrees below zero.

### Heat Requirements

Statistics show that in Montreal, hardly a month goes by without some heat being required to maintain an average inside temperature of 70 deg. F. January requires the most heat, usually 17.6 per cent of the year's total; February is a close second with 15.5 per cent followed by December. Altogether, during a normal year, about 10,000 degree-days* of heat must be provided to maintain a house at an even temperature of 70 deg. By months, these requirements are distributed as shown in Table I.

Table I

MONTHLY HEAT REQUIREMENTS IN MONTREAL

| Month | Average Montreal Temperature (°F.)** | (°F.) Below 70° | Degree-Days Total | % Total |
|---|---|---|---|---|
| July | 69.6 | 0.4 | 12 | 0.08 |
| August | 67.0 | 3.0 | 93 | 0.94 |
| September | 58.8 | 11.2 | 336 | 3.38 |
| October | 46.7 | 23.3 | 722 | 7.25 |
| November | 33.4 | 36.6 | 1,098 | 11.02 |
| December | 19.7 | 50.3 | 1,559 | 15.70 |
| January | 13.5 | 56.5 | 1,752 | 17.60 |
| February | 14.9 | 55.1 | 1,543 | 15.50 |
| March | 26.0 | 43.9 | 1,361 | 13.70 |
| April | 41.4 | 28.6 | 858 | 8.60 |
| May | 55.2 | 14.8 | 459 | 4.65 |
| June | 64.9 | 5.1 | 153 | 1.58 |
| | 42.6 | 27.4 | 9,946 | 100.00 |

The amount of heat which it is necessary to transmit to a dwelling in order to maintain its temperature to 70 deg. varies with the nature of its construction and the supply of air used for ventilation purposes. Normally there is required in Montreal about 750 btu. per degree-day and per thousand cubic feet of house to be heated. Therefore, a house containing 20,000 cu. ft. of net volume*** will require about 150 million btu. each year.

### Sources of Heat

Progress in the art of heating dwellings followed the evolution in the production of energy. At first limited to solid fuels—wood, and later coal—heat became available from gaseous combustibles either natural or obtained from the distillation of solid fuels, then from liquid fuels—natural or distilled petroleums—and lastly, electricity. Of these sources of heat, solid fuels are by far the most utilized. Natural gas wherever available is usually cheap, but not as dependable as solid fuels. Manufactured gas is used for heating whenever competitive rates are available; these rates, however, are usually uneconomical and therefore applicable only wherever a surplus of gas is available. Oil is used for heating in a certain number of industrial plants and commercial establishments; it is also used in a certain number of dwellings. In Montreal, there are about 8,000 residences equipped with oil heating systems.

### Installation Required

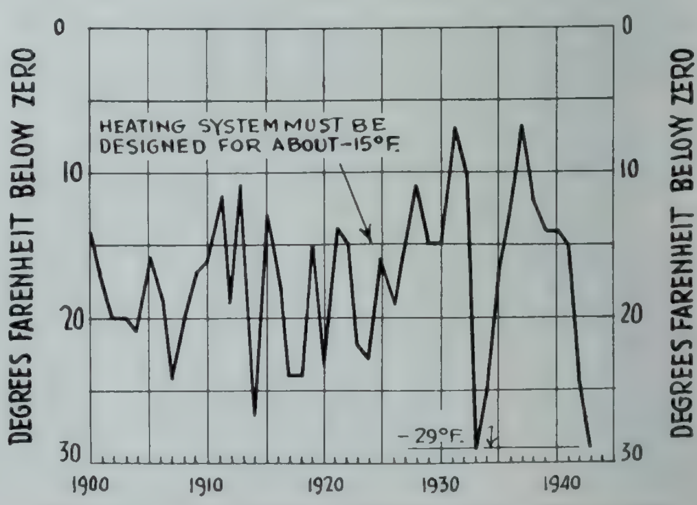
In Montreal, the heating of dwellings by hot water systems necessitates an installation with about one square foot of radiating surface for every 33 cu. ft. of net volume to be heated. It has also been found that the electrical installation required to produce the heat needed on the coldest days amounts to one kilowatt per 20 sq. ft. of radiation. Thus a house in which 20,000 cu. ft. have to be heated, would necessitate about 600 sq. ft. of radiating surface and, if electrically heated, an installation of about 30 kw.

### Quantity of Various Fuels Needed

To transmit the heat required will necessitate the following quantities of fuel—coal, oil, gas or electricity.

COAL

If coal with a heating value of about 12,500 btu. per lb. is used in a furnace with an efficiency of say 50 per cent, each ton of fuel will produce 12.5 million btu. of heat. To produce 150 million btu. will, therefore, require *12 tons of coal*.




**Minimum temperatures in Montreal from 1900 to 1943**

*The degree-day is a unit used to calculate the amount of heat required in any given community to maintain a constant inside temperature. For any given day there exist as many degree-days as there are degrees Fahrenheit difference in temperature between the average outside air temperature, taken over a 24-hour period, and 70 deg.

**The figures given in this table are those reported by the Monthly Record of Meteorological Observation issued by the Federal Government.

***Net volume of a house does not include basement and attic.

OIL

With oil having a heating value of about 167,000 btu. per gal. each gallon used in a furnace with an efficiency of say 60 per cent will produce 100,000 btu. of heat. To produce the 150 million btu. needed to warm the house under study some *1,500 gal. of oil* will be needed.

GAS

With manufactured gas having a heating value of 465 btu. per cu. ft., each thousand cubic feet used in a furnace with a 70 per cent efficiency will produce about 325,000 btu. of heat. In order to obtain the 150 million btu. needed, *445,000 cu. ft.* of gas will be required.

ELECTRICITY

Since every kilowatt-hour of electricity has a heating value of 3,412 btu. at 100 per cent efficiency, to produce the 150 million btu. needed would require about 45,000 kw.h.

## Investment

The investment required depends upon whether the installation considered is new or is a converted one. If, for example, oil is used, a new installation will include a furnace with a high efficiency, whereas if it is a converted coal-burning hot water installation, an oil burner will simply be added to the existing furnace. If electricity were utilized, a new installation would probably consist of tubular heaters, doing away with all water radiators and piping; whereas a converted installation would probably consist of immersion heaters installed in piping or tank in place of the furnace.

Depending on the fuel used and on whether the installation is new or has been converted, the total investment in heating equipment required for a house in which 20,000 cu. ft. of air have to be heated would be approximately as follows:

| *Mode of heating* | Installation | |
|---|---|---|
| House owner's investment | New | Converted |
| Coal—(Hot water) | $ 660 | $ 660 |
| Oil | 1,575 | 1,080 |
| Gas | 880 | 920 |
| Electricity | 970 | 1,210 |
| Supplier's investment | | |
| Electricity | $9,000 | $9,000 |

Of the several methods of heating above listed, coal-fired hot water heating necessitates the smallest investment. Because of the large investment required to generate, transmit and distribute electric power (about $300 per kw.) heating by electricity requires by far the largest investment. Table II lists the various items making up the investment in a heating system for a house of 20,000 cu. ft. volume.

Table II

COMPARATIVE INVESTMENT

| Items considered | Coal | Fuel Oil | Used Gas | Electricity |
|---|---|---|---|---|
| *New installation* | | | | |
| Radiators and piping | $420 | $ 420 | $420 | $ .... |
| Coal furnace | 240 | .... | .... | .... |
| Oil furnace | .... | 1,155 | .... | .... |
| Gas furnace | .... | .... | 460 | .... |
| Generation, transmission and distribution $300/kw | .... | .... | .... | 9,000 |
| Tubular heaters | .... | .... | .... | 970 |
| Total | $660 | $1,575 | $880 | $9,970 |
| *Converted installation* | | | | |
| Radiators and piping | $420 | $ 420 | $420 | $ 420 |
| Coal furnace | 240 | 240 | 240 | 240 |
| Oil burner | .... | 420 | .... | .... |
| Gas burner | .... | .... | 260 | .... |
| Generation, transmission and distribution $300/kw | .... | .... | .... | 9,000 |
| Immersion tank | .... | .... | .... | 550 |
| Total | $660 | $1,080 | $920 | $10,210 |

## Annual Cost of Heating

Under normal conditions, the over-all cost of heating a dwelling in which 20,000 cu. ft. have to be heated is approximately as follows:

| *Mode of Heating* | Quantity Needed | Installation New | Converted |
|---|---|---|---|
| Coal (Hot water) | 12 tons | $ 340 | $ 340 |
| Oil | 1250-1500 gal. | 325 | 300 |
| Gas | 455,000 c.f. | 342 | 346 |
| Electricity | 30 kilowatts | 1,114 | 1,135 |

Whether the installation is new or is a converted one, the over-all annual cost is very much the same, the cost of heating with coal, oil or gas being about comparable and that with electricity from three to four times larger. Actually, in the case of a new installation specifically designed for electric heating, considerable economy in construction would be effected, which, if credited to electric heating, would somewhat lower the cost without however rendering it economical.

It will be noted that in the determination of the cost of electric heating, the installation in kilowatts rather than the utilization in kilowatt-hours was considered. The reason for this is that in the case of electric heating it is the fixed charges, the operating charges and the maintenance of the equipment necessary to produce the heat needed which determine the cost. Equal to about 11 per cent of the investment, these various annual charges—in the case of the standard house considered—amount to about $990. For the various modes of heating considered, the elements making up the annual cost of heating a house are shown in Table III.

Table III

COMPARATIVE ANNUAL COST OF HEATING

| Items of cost | Fuels used | | | |
|---|---|---|---|---|
| *New installation* | Coal | Oil | Gas | Electricity |
| Interest | $ 33 | $ 79 | $ 44 | $ 48 |
| Depreciation | 20 | 48 | 26 | 29 |
| Fuel or electricity | 192 | 134 | 237 | 990 |
| Service | 60 | 29 | .... | 12 |
| Hot water | 35 | 35 | 35 | 35 |
| Total | $340 | $325 | $342 | $1,114 |
| Items of cost | Fuels Used | | | |
| *Converted installation* | Coal | Oil | Gas | Electricity |
| Interest | $ 33 | $ 54 | $ 46 | $ 61 |
| Depreciation | 20 | 33 | 28 | 37 |
| Fuel or electricity | 192 | 161 | 237 | 990 |
| Service | 60 | 17 | 35 | 12 |
| Hot water | 35 | 35 | 35 | 35 |
| Total | $340 | $300 | $346 | $1,135 |

A detailed analysis of this table will show that, when in such comparisons the cost of fuel only is considered, a very incomplete picture of the situation is obtained.

## Impracticability of Generalized Heating with Electricity

Ever since electricity first became available, hope has been expressed that it be used for heating private dwellings. It would indeed be ideal if electricity could be generally utilized for that purpose; available nearly instantaneously, almost 100 per cent efficient and leaving no products of combustion, it is the perfect heating agent. Unfortunately, house heating by electricity under presently known and proven methods of heating, is not economical and practicable, owing to the following four factors:

a. The magnitude of the power requirements.

b. The large investment needed to bring the power to the consumers premises.

c. The limited time during which the full capacity of the installation would be used.

d. The high cost of heating which would necessarily result.

*a. Power Requirements:*

The electric heating of private dwellings would increase the power requirements of retail customers about tenfold.

The present power generated in each province would be far from sufficient to heat only the dwellings in urban centres, as shown in Table IV.

Table IV

ESTIMATE OF POWER REQUIRED TO HEAT ALL URBAN HOUSEHOLDS IN CANADA

| Provinces | Potential Power | Installation at end of 1942 | Power Needed For Heating H.P. |
|---|---|---|---|
| P.E. Island | 7,000 h.p. | 2,617 hp. | 100,000 h.p |
| Nova Scotia | 167,000 | 143,217 | 1,000,000 |
| New Brunswick | 220,000 | 133,347 | 600,000 |
| Quebec | 17,000,000 | 4,839,543 | 8,000,000 |
| Ontario | 9,000,000 | 2,684,395 | 12,000,000 |
| Manitoba | 6,930,000 | 420,925 | 1,500,000 |
| Saskatchewan | 1,410,000 | 90,835 | 1,500,000 |
| Alberta | 1,366,000 | 94,997 | 1,500,000 |
| British Columbia | 7,600,000 | 815,462 | 2,000,000 |
| Canada | 43,700,000 hp. | 9,225,838 hp. | 28,200,000 hp. |

There are only three provinces in which water power resources would be sufficient to meet heating requirements of private dwellings—Quebec, British Columbia and Manitoba.

The heating requirements of the principal cities of the provinces of Ontario and Quebec would compare with the quantity of power now required by the retail users of each of these cities as shown in Table V.

Table V

ESTIMATE OF POWER NEEDED TO HEAT ALL DWELLINGS IN LEADING CITIES OF THE PROVINCES OF ONTARIO AND QUEBEC

POWER REQUIREMENTS

| Cities | Present* Total | Present* Per Capita | Heating Load |
|---|---|---|---|
| Ontario— | | | |
| Brantford | 15,881 hp. | 0.5 hp. | 160,000 hp. |
| Guelph | 10,561 | 0.5 | 110,000 |
| Hamilton | 120,000 | 0.8 | 800,000 |
| Kitchener | 22,658 | 0.7 | 180,000 |
| London | 37,281 | 0.5 | 400,000 |
| St. Catharines | 15,925 | 0.6 | 150,000 |
| Sarnia | 8,806 | 0.5 | 100,000 |
| Toronto | 333,381 | 0.5 | 3,500,000 |
| Windsor | 39,741 | 0.4 | 500,000 |
| Oshawa | 15,258 | 0.6 | 130,000 |
| Total | 619,492 | 0.5 | 6,030,000 |
| Quebec— | (a) | (a) | |
| Montreal | 400,000 | 0.4 | 4,500,000 |
| Quebec | 50,000 | 0.6 | 500,000 |
| Three Rivers | 25,000 | 0.5 | 140,000 |
| Sherbrooke | 15,000 | 0.5 | 150,000 |
| Shawinigan Falls | 10,000 | 0.5 | 70,000 |
| Total | 501,000 | 0.4 | 5,360,000 |

*Retail load only—(a) estimate.

To produce the 3.5 million hp. needed in Toronto alone would require seven Queenston Plants utilizing the 305-ft. head available between Lake Erie and Lake Ontario and delivering units of 50,000 hp. each. Similarly, to heat the private dwellings of Montreal would require seven Beauharnois plants utilizing the 82-ft. head available between Lake St. Francis and Lake St. Louis, and containing 13 units of 53,000 hp. each.

*b. The large investment needed to bring power to the consumers premises:*

It has been stated previously that an investment of $300 per kw. is required to generate, transmit and deliver electricity to the consumer's premises. This figure, which has been used in the above calculations, is much less than that now needed to serve electricity users in Ontario. Table VI indicates that the investment in the ten leading cities of Ontario averages $410 per kw. and varies between a minimum of $303 in St. Catharines and a maximum of $537 in Windsor.

Table VI

INVESTMENT IN POWER DISTRIBUTION IN ONTARIO 1940

| Cities | Generation and Transmission | Distribution | Total | Per kw. |
|---|---|---|---|---|
| Brantford | $ 3,150,000* | $ 1,250,000* | $ 4,400,000* | $368 |
| Guelph | 2,020,000 | 680,000 | 2,700,000 | 345 |
| Hamilton | 21,400,000 | 8,000,000 | 29,400,000 | 330 |
| Kitchener | 4,300,000 | 2,000,000 | 6,300,000 | 374 |
| London | 7,150,000 | 4,250,000 | 11,400,000 | 408 |
| St. Catharines | 2,540,000 | 1,060,000 | 3,600,000 | 303 |
| Sarnia | 2,070,000 | 1,030,000 | 3,100,000 | 473 |
| Toronto | 60,800,000 | 47,100,000 | 107,900,000 | 437 |
| Windsor | 8,800,000 | 7,000,000 | 15,800,000 | 537 |
| Oshawa | 2,820,000 | 660,000 | 3,480,000 | 325 |
| Total | $115,050,000 | $73,030,000 | $188,080,000 | $410 |

*These figures were obtained from the 1940 annual report of the Hydro Electric Power Commission of Ontario.

On the basis of $300 per kw., the power needed to heat private dwellings in Toronto alone would necessitate an investment of eight hundred million dollars. The investment for Montreal would amount to more than one thousand million dollars.

The investment needed to make available to each house the power which electric heating would require would amount to about $750 for each ton of coal which it now uses.

This figure does not, of course, include the investment on the part of the consumer, which would be of the order of about $25 per kw. in the case of a converted system, and of between $30 and $40 per kw. in the case of a new installation.

*c. The limited time during which the fuel capacity of the installation would be required:*

The large quantities of power needed to heat dwellings on the coldest days of the year would only be used a very small percentage of the total time. It is estimated that of the 8,760 kw.h. available yearly from each kilowatt of installation, only about 1,500 would be utilized, that is, a load factor of about 17 per cent only would be obtained.

*d. The high cost of heating which would necessarily result:*

Reference was also made above to the yearly cost of operation being about 11 per cent of the investment. This ratio is the smallest possible which would assure the successful operation of any electrical undertaking, serving a market such as that which would result from the adoption of electric heating. In 1940 the gross income of electrical utilities in the United States was equal to 13.5 per cent of the investment. During the same year the revenues in ten of the leading Ontario cities averaged 12.6 per cent of the investment. Minimum in Kitchener at 11.2 per cent the ratio was maximum in Oshawa at 16 per cent.

The average revenue received in 1940 in those cities amounted to $50 per kilowatt. To produce such a revenue each one of the 1,500 kilowatt hours which electric heating would utilize, per kilowatt of installation, would have to sell at 3.33 cents.

Conclusions

The analysis demonstrates that under the climatic conditions obtaining in Montreal, and the province of Quebec in general, heating private dwellings with electricity would be altogether uneconomical costing as it would from three to four times the cost of heating with other fuels. Generalized electric heating would require very large quantities of power which would only be used during a limited portion of the year.

The high cost of the investment together with the cost of maintenance and operation would necessitate rates for electric heating altogether too high for the ordinary house owner to pay. Unquestionably, as time goes on, more and more electricity will be used for heating purposes, but it will only be as auxiliary to coal, oil or gas.

Methods of Heating Dwellings With Electricity

Of the various methods developed to heat houses with electricity, the following five are the most interesting:

1. The tubular heating system.
2. The ordinary hot water radiator with immersion electric heaters installed in piping or tank in place of coal furnace.
3. The thermal-storage system.
4. The panel system.
5. The reversed refrigeration cycle of heat-pump system.

As succinctly as they may be described, the above systems of heating are as follows:

The Tubular Heating System

This system is more particularly adaptable to new construction or to houses already built without hot water heating system. Essentially it consists of small diameter thin steel tubes, into which is inserted a coiled resistance wire, supported on insulators.

The standard rating of a 2 in. diameter tube is 70 watts, or 240 btu. per lineal foot run of tube, or approximately 134 watts or 460 btu. per sq. ft. of surface. These figures correspond to a maximum operating temperature of 180-200 deg. F. when exposed under natural convection conditions.

The tubular heating system transmits its heat to the occupants of the room partly by direct radiation but largely in the form of convection. This type of heating has been adopted for many of the auxiliary installations made by The Shawinigan Water and Power Company. It has been found more economical in operation than the immersion electric heater system.

The Immersion Electric Heating System

This system is particularly adaptable to dwellings heated with ordinary hot water systems. The immersion heaters are installed in piping or tank in place of the residence fuel-fires hot-water furnace. It supplies heat in the form of hot water to the house radiator system. Many experiments have been made with this system particularly by The Shawinigan Water & Power Company and the Saguenay Electric Company.*

The Thermal-Storage System

This system was developed in England to encourage the use of power during off-peak hours when the generating plant and the distribution system are lightly loaded. Since the specially reduced prices for off-peak power are normally only available during the night—possibly from 10 p.m. to 8 a.m. or 10 hours—means must be provided to take in, and to store sufficient heat units during this period to provide an adequate supply of heat for the remaining 14 hours of the day. Heat must also be supplied to the building during the "charging" period of ten hours.

It is obvious that such a system can only apply to a location where heat requirements are not too large, otherwise the storage facilities would be altogether too expensive. This system has not been tried in the province of Quebec.

The Panel System

This system, the invention of A. H. Barker, an English engineer, dates back to 1908. It has been successfully applied to several important buildings in Europe. It consists of electrical warming panels which may operate as follows:

(a) The high temperature, non-embedded panel, operating at temperatures of the order of 550 deg. F.

(b) The low-temperature, non-embedded panel, operating at temperatures of the order of 100-150 deg. F.

(c) The low-temperature, embedded panel (i.e., incorporated in the plaster or concrete of the structure) operating at temperatures of the order of 80-120 deg. F.

*For the result of the Saguenay Electric Co.'s experiments, refer to the proceedings of The Canadian Electrical Association for 1933 and 1935.

†Journal of the Institution of Electrical Engineers (England) September, 1931 and July 1932.

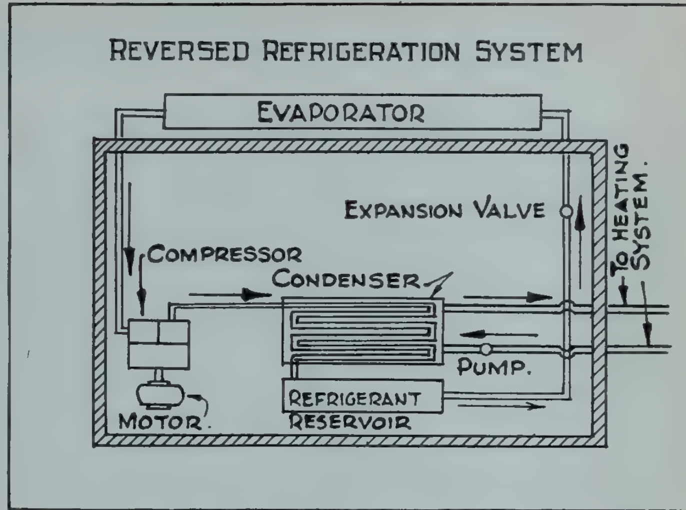



**Diagram showing the cycle of operation of the reversed refrigeration system.**

The panels radiate heat rays which pass through the air without raising its temperature until they strike material substances that are more or less opaque to them. Here the rays are partly absorbed and are also partly reflected, so that the walls, floor, ceiling and furniture are all warmed, and themselves become secondary radiating surfaces. It is due to the convection effect of these surfaces that the air is warmed.

Ronald Grierson, in his study entitled "The Electrical Heating of Buildings†," refers to a typical high-temperature, non-embedded panel installation in England in which one watt per cubic foot is used. This installation, in a locality where the minimum temperature is much higher than it is here, would seem to indicate that the power requirements of panel heating installations would not be far from those of tubular or manifold heater systems. The energy requirements would no doubt be less, but this should not reduce the cost to any extent.

The Reversed Refrigeration Cycle System

Air, water and any other object contain a great deal of heat, even at their lowest usual temperatures. In the process of heating by reversed refrigeration, the apparatus simply absorbs the latent heat of the outside air or water and, by "pumping," transfers the heat to the dwelling.

The quantity of heat thus made available was found to be much greater than that which could be produced by the same amount of electrical energy if converted directly into heat in an ordinary type of heater. There followed the suggestion that the process could possibly be utilized to advantage for the heating of dwellings.

The cycle of operation of the reversed refrigeration system, as applied to the heating of dwellings, is as follows:

As the compressor is put into motion, the refrigerant, from the reservoir in which it is kept, is pumped through an expansion valve where it vaporizes into gas at low temperature. In circulating through the evaporator placed outside the house, this cold gas picks up the heat of the air surrounding it. The warmed up gas is sucked in by the compressor where it is liquified at a higher temperature. Continuing its course this hot liquid goes through the coil of the condensor and transmits its heat to the water of the heating system, which is kept in circulation by pumping. As to the refrigerant itself, it is returned to the reservoir where it had started at the beginning of the operating cycle.

Just what possibility there may be in the application of the reversed refrigerating cycle system to the heating of residences is an open question. Many difficulties have certainly to be overcome before the process can be generally applied on an economical scale under Canadian climatic conditions.

# AUSTRALIAN WAR PRODUCTION

E. R. JACOBSEN, M.E.I.C.
*Deputy Director General, Commonwealth of Australia War Supplies Procurement, Washington, D.C., U.S.A.*

During the last fifteen months, it has been part of my task to study Australian production statistics and to discuss Australian problems with visiting technical missions. In spite of this, it was only after spending some time in Australia and after recently making an extended tour of Australian war industries that I came to any real appreciation of the tremendous job which this country is doing. We flew to Australia in connection with a number of supply problems and the Ministry of Munitions took the opportunity of our visit to make arrangements for an extensive tour of industrial factories, war plants and munitions annexes. Our itinerary, extending over a period of about three weeks, covered some 4,000 miles and included most of the industrial centres and outlying developments in the eastern part of the country. During this time we visited some 49 plants and annexes.

The first point to be noted by way of background is the fact that Australia has always been predominantly a producer of primary materials. Before the war she had practically no mass production in heavy industry. She had not even built a complete motor car. Even the great Australian steel industry is a creation of recent years. Her munitions industry at the outbreak of the war was very small and was housed in four munitions factories which have since grown to 49 factories, working or authorized, and 170 munitions annexes. A further point of background to be noted is the fact that it was not until Japanese entry into the war that production of war material in Australia, with and by Australian resources, became a pressing and strategic necessity. This country is now producing a full range of war material in very substantial quantities in modern up-to-date plants which compare in all respects, except perhaps size, with any other plants in the world.

### Conversion of Industry

Apart from the magnitude of the task which has been accomplished in a very short time, the range and ingenuity of the conversion which has taken place in such Australian industry as did exist before the war was particularly striking. For instance, one plant which had previously made wrist watch bands, compacts and cigarette cases, had been entirely converted, under an energetic and dynamic manager, to the manufacture of a wide range of optical instruments, including a particularly difficult type of dial sight, sighting telescope for field guns, AA identification telescopes, range finders, surveying instruments and a number of specialized aircraft instruments. This plant was grinding its own lenses and working successfully to tolerances laid down by the most exacting international specifications. It was incredible to see the work which a plant with such a background was doing and to find them working, in some cases, to one millionth of an inch and producing in quantities adequate to take care of Australia's needs.

Another good example of conversion was noted in a factory which a few short months ago was making sporting goods. This factory is now turning out the rifle furniture for Australian small arms production; it is making gas mask components; it is making wooden barges and fast plywood petrol motor boats. This same plant is also considering the possibility of going into the construction of gliders.

A large structural steel shop had extended its range in both directions so that, on the one hand, it was producing steel factory window sash, and on the other, triple expansion steam engines for the Australian merchant shipbuilding programme.

We found the body building and assembly plants of the Australian motor companies converted into the manufacture of universal carriers, armoured cars, mobile units of all kinds and landing barges. In some cases, they were actually making machine tools and, in other instances, had turned to ordnance manufacture.

### Wide Range of Production

Not only was it the extent to which conversion has taken place that surprised us, but also the wide range which a country with little industrial manufacturing background had seen fit to attempt. Several examples were particularly noticeable. Australia had never made optical glass, the manufacture of which has always been regarded as one of the closed secrets of a few firms of worldwide repute. At the beginning of the war, Australia foresaw the difficulty of obtaining optical glass for her munitions programme but at that time it was not even known whether the necessary materials existed in Australia. A special committee of scientists was called together and a new industry was launched which is now producing optical glass in quantities in excess of the country's requirements, so that substantial contracts have recently been placed in fulfillment of the requirements of some of her Allies.

In a large ordnance factory we came to a section set off by itself where they were making anti-aircraft gun predictors. This highly intricate instrument which requires some 8,000 pieces including small gears, instruments and electrical equipment, was being produced on a time schedule comparing very favourably with that of English manufacture of the same instrument. The most surprising part of this job, in common with many others, was that it was being accomplished by about 90 per cent diluted labour. From precise optical instruments, on the one hand, we found that Australian production runs through small arms, ammunition of all types, field, anti-aircraft and naval guns, tanks, airplanes and merchant and naval ships of all types including Tribal class destroyers powered with Australian built turbines and boilers.

The extent of the conversion and the rapidity with which production has been stepped up has inevitably resulted in certain anomalies which are now being ironed out. A pressing need at the moment is for rationalization of mushroom industries. In one particular ordnance plant, we discovered that three different types of anti-aircraft guns, two types of field guns and one type of naval gun were being produced; thirty different types of shot and shell, aircraft bombs in large quantities and the anti-aircraft predictor above referred to were also being made.

### Machine Tools

In developing from small beginnings the present extensive war production programme, one of the problems which originally faced Australian authorities was the procurement of the necessary machine tools. Over the course of the last several years a large number of tools have been obtained from outside the country. This was inevitable in view of the fact that Australia did not have a machine tool industry of any proportion before the war, nor is the market large enough to support such an industry in face of American and English competition. At the beginning of the war, realizing her isolation and the time and danger involved in transportation and the extreme shortage that was bound to ensue in the over-all machine tool supply position, Australia started making machine tools. At first, there were only five factories in a position to make machine tools, whereas at present machine tools are being produced in some seventy-five various establishments. Machine tools are being built by firms which, before the war, would never have been regarded as potential tool manufacturers. We saw many excellent examples, both large and small, of machine tools which would compare favourably with those manufactured in any other part of the world, bearing such unexpected names as Ford, American Iron and Steel, Broken Hill Pty. and so on. Many Australian tools are of a very intricate nature and they are turning out splendid work. A 48-in. gun lathe weighing fifty tons, 72 ft. long and 50 ft. between centers; a horizontal boring mill with a 7½ in. spindle and a 15-ft. vertical travel; complicated gun rifling lathes; a 2,000-ton hydraulic press and a wide range of lathes, milling machines, grinders were amongst the items which were constantly coming to our attention.

### Basic Industries

As has been pointed out, there was very little manufacturing of any sort in Australia and hardly any war industry at the beginning of the war of 1914. The experience in the last war pointed to the necessity of the establishment of a steel industry. The steel mills of the Broken Hill Pty. were first opened in 1915 and, in a short period of twenty-five years, "B.H.P." has expanded many times to a point where Australia is now practically self-sufficient in steel. Her production on a per capita basis, roughly equal to that of Great Britain, is more than double that of Soviet Russia and five times that of Japan. The various B.H.P. enterprises are also active in the non-ferrous as well as the ferrous sphere. The large magnesium plant which is now turning out all of Australia's magnesium requirements was most impressive. B.H.P. plants are also making their own ferro alloys and, in certain of the important alloy steels, Australia is moving towards self-sufficiency. Not only is she self-sufficient as to carbon and many of the alloy steels, but the steel industry has developed a number of special armour plate steels and various other special steels required for war purposes. Stainless steel is also being produced. In all the various plants, in the three main steel centers in Australia, we were impressed by the modern and efficient operation of the industry and the vision and foresight which was quite obviously behind the conduct of the affairs of this company which is able to sell steel as cheaply as any other company in the world. Australia is thus very fortunate in having readily at hand adequate quantities of high quality steel at a minimum cost. For these things she must be thankful to the very high grade ores of South Australia and the large coal deposits of the East Coast and equally thankful for the superb organization of the B.H.P. Company which has been built up under the guiding genius of Mr. Essington Lewis, who was recently appointed Director General of the Ministry of Munitions.

### Aircraft Production

One of Australia's most important strategic requirements is air protection. Here again she has received valuable assistance from outside but has not been content to rely entirely upon others for her own defence. In the early days of the war it was considered somewhat precocious to embark upon a programme of aircraft production. But Australia was not to be deterred by lack of precedent or "know how" with the result that the aircraft industry was a revelation to us and a monument to the judgment and self-confidence of Australian engineers. We saw coming off that assembly lines the valuable *Beaufort* bomber, several fighters and dive bomber types and several trainer planes. A now famous wooden light bomber will also very shortly be in production. A further fast fighter aircraft is now in the prototype stage and the project is being tooled up. Several types of propellers are also being made, together with their intricate hub mechanisms. Australia, who previously had never even made an automobile engine, is now producing three types of aircraft engines including the famous Pratt & Whitney twin-row Wasp. In addition to their own programme most aircraft plants are making available large proportions of their capacity for the repair of U.S. equipment at present in operation in the Pacific theatre. For instance, in one large propeller factory they were repairing and servicing more propellers than they were actually producing even though they had reached full production and had been forced to build further annexes for their repair work. In an engine plant, two extra bays had been added to a three-bay factory for the exclusive use of repair facilities.

### Ordnance Production

In ordnance requirements, Australia is filling her own and part of the needs of others, in small arms, Bren guns, Austins and several Australian adaptations of other famous makers. We visited the plant which is making the now well-known Owen sub-machine gun at a cost of less than $30 apiece. The simplicity of the operation of this gun is almost startling and we were very interested to meet the quiet spoken, retiring young man who invented this gun in the pursuance of a private hobby and who volunteered as a private in the A.I.F. He was eventually discovered and induced to assist in the production of his own invention. Three famous anti-aircraft guns, four types of tank and anti-tank guns, eleven types of field guns, including the famous 25 pounders, three types of mortars and a number of types of naval guns and coastal defence guns are also being produced. Most of the ammunition for all this ordnance is being made in Australia and in some instances production is now in excess of Australian requirements. Pistols, rifles, respirators, grenades, parachutes and all forms of pyrotechnics are also being manufactured locally.

### Tank Production

The decision to manufacture a tank of Australian design is further evidence of enterprise and courage. The tank includes many novel features and conforms closely to special Australian requirements. One of the most interesting features of the design was the hull casting which includes the whole body of the tank and, unlike most other designs, includes the skirt plates. This casting is made to a special armour plate formula developed by the Australian steel industry and subjected to a very exacting heat treatment. The design of the latest model and the armament which will be mounted, together with special features and the properties of the armour plate, place the tank in a category which compares favourably with any other medium tank in the field. It was a very interesting experience to ride in one of the tanks around an extremely tough test course. The tanks are powered with engines supplied from the United States, and certain other components such as bearings and transmissions have also been supplied. While the engines will probably continue to be imported, it is expected that Australia will eventually become self-sufficient in respect to most of the other components. In addition to tanks, of course, the Directorate of Armoured Fighting Vehicles is also responsible for the production of armoured cars, universal carriers, anti-tank gun mounts and so on.

### Shipbuilding and Repair

The shipbuilding programme falls into four main categories—small ships—merchant ships—naval ships—and ship repairs. A very impressive job has been done in small ship construction. Fairmiles, minesweepers, patrol boats, landing craft, and barges and a number of other types are all being built in substantial numbers. The merchant ship programme, which is concentrating on a 10,000 ton freighter, has been cut back in favour of the Australian ship repair programme. Several merchantmen have been launched and others are on the ways, but it will be some time before this programme is fully reinstated. The naval programme has also been affected by the need for repairs. However, Australia already has a Tribal class destroyer, built in Australian ways and powered with Australian boilers and turbines, in combat service. Several others are in course of construction. Australia has also been building corvettes and has recently switched to the larger frigate type. The ship repair work, however, is perhaps the most impressive part of her contribution from the point of view of the difficulty and complication of the tasks undertaken and from the point of view of the actual shipping tonnage which is being put back into service. Major repairs are being made to both merchant and naval shipping. It was incredible to see the extent to which a ship could be damaged and still make port for repairs. The authorities had many interesting stories to tell of the extent to which some of the naval ships had undergone repairs, and there were several quite startling examples which came under our notice.

### Allied Works Council

Another really big job is being carried out by the Allied Works Council under the very energetic direction of Mr. Theodore, the Director General. Even the people in Australia cannot be told fully of the tremendous job which has been done in the construction of bases, roads, airports, temporary landing fields, military cantonements and the like. The task of the Allied Works Council has been made both necessary and more difficult by virtue of Australia's size and geography. It has been necessary to mount a defence, now being turned into an offence, on the northern shores of the continent—shores which have hitherto been sparsely populated and little explored. The Council has undertaken the construction of over 5,000 miles of strategically located roads of which the great North-South road connecting Darwin with the southern railhead is the most outstanding. As a matter of fact, this particular piece of rush construction is perhaps one of the most outstanding pieces of work brought forth by the war. Built through tropical terrain, the road was completed within a matter of months at a cost of just under $5,000,000 and using a labour force of some 4,000 men. Another example of the Council's work is the $10,000,000 air field and repair and assembly depot covering 20 square miles which was virgin scrub just over a year ago. The Council to date has placed under construction, works valued at almost a quarter of a billion dollars and a considerable portion of this is, of course, being carried out for the use of American Services in the southwest Pacific. When the story of the Allied Works Council can be fully told, it will be one of absorbing interest to engineers and may well open new horizons as to the engineering possibilities which can result from a wide organization set up from the point of view of continental requirements.

### Conclusion

One of the things which impressed me was the high regard in which the Canadian war effort is held, and the extent to which Canada's help and co-operation has been extended. Many of the Australian officials had visited both the United States and Canada. In many instances the Canadian ventures in their particular fields were on about the same scale as was contemplated in Australia and they were usually at a stage of development sufficiently far advanced beyond Australia to be of particular use in making available to technicians the results of their experience in construction and their difficulties in the early production stages. Not only has Canada been extremely helpful in the technical sphere, but most visitors returned with the warmest praise for the general controls and wartime organizations which had been set up in Canada. The Australian wartime industry is about a year or so behind Canada for strategic reasons, as stated earlier in this article. Even taking this lag into account, of course, the over-all production in Australia cannot compare in magnitude with that of Canada. Australia has a very much smaller population; she was very much less industrialized than Canada at the beginning of the war; in the early part of the war her main contribution was made by her fighting forces in the Near East and it was not until Japan entered the war that the possibility of Australian isolation demanded an immediate quickening of Australian war production. Then too, Australia did not have the advantage which accrued to Canada by virtue of being a continental partner of the most powerful industrial country in the world. Nevertheless, in the range of her war production, in the ingenuity of her industrial conversions, and in the courage with which her engineers have embarked upon new and difficult programme, Australia is to be greatly admired. There are some who question the wisdom of the resultant industrialization and there are some who wonder where this industrialization is going to lead in the post-war world. But Australia, interested only in the job in hand, has been indifferent to both these questions. She has decided to make major contributions both on the field and in war production. In the field she has maintained the splendid tradition which her fighting men built up in the last war, and on the production front she has matched this record with similar initiative and imagination.

---

## SUBSTITUTE MATERIALS

A new process, which increases the original resistance of glass to fracture and thermal shock from three to seven times, is promoting its use in such products as searchlight lenses, vending and tabulating machines, machine guards, fire screens, oven doors, signs, dance floors, stair rails, shingles, and others.

Corning Glass Company has produced coiled glass springs, glass piping, glass centrifugal pumps, chemical glassware, etc., of unusual resistance.

Fiberglas is being used for low-temperature insulation, wire insulation, storage battery retainer mats, air filters, and fireproof fabrics, thus substituting for cardboard, rubber, asbestos, silk, rayon, cotton, rock wool, and wire screening. In many cases, a new use of glass results in an improvement in the quality of the product.—*Business Week*, March 21, 1942.

★ ★ ★

The new Army "tap" sole is made of black carbon, a small amount of crude rubber, and more reclaimed rubber. Tests indicate it may wear five times as long as standard leather under the same conditions. In addition, it is more flexible, gives fine traction on wet or dry ground, and will not slip on metal. It has been called the greatest improvement in service shoes in Army history.—*Printer's Ink*, April 3, 1942.

Experts claim that a new insulating board, known as AE Board, made of pure glass fibers, possesses all of the insulating properties of cork, and is superior in some qualifications. The material, produced by Owens-Corning Fiberglas Corp., is designed for low-temperature and roof-insulation applications. The development will tend to release the United States from dependence upon cork in meeting the tremendous war-created demand for cold-storage refrigeration of perishable food supplies and industrial materials.

The heat conductivity coefficient of the new board is 0.265, compared with 0.27 for cork. The insulation has high resiliency, and shows almost complete recovery in five minutes after loading to 1,728 lbs. per square foot—a load far above the normal encountered in refrigerated spaces or roof-deck service.—*Scientific American*, May, 1942.

★ ★ ★

The War Department announces that plastic fuses for trench mortars instead of the standard aluminum fuses will be used in the future. By making this change, tons of aluminum will be freed for other military uses and the machine tools previously used in this production are freed for other work.—*Journal of Commerce*, April 1, 1942.

# THE C.N.R. TERMINAL DEVELOPMENT PROJECT IN MONTREAL

The work that has been done to date on the construction of a new C.N.R. central passenger terminal in Montreal is the result of three primary considerations—the need for a new modern passenger station, the elimination of highway-railway grade crossings in the heart of the city and the necessity for enlarging and modernizing the company's freight facilities in Montreal.

To anyone acquainted with Montreal it is not necessary to say much to justify the provision of a new passenger station. The question of the elimination of grade crossings on the G.T.R. between Bonaventure and Turcot and Pointe St. Charles has been raised many times, the earliest being in 1886 when the Montreal Board of Trade made recommendations in this connection.

In May 1927, the Board of Railway Commissioners instructed the C.N.R. to show cause why it should not separate the railway-highway grades between Bonaventure and St. Henri and Pointe St. Charles and also east from Moreau Street station in Maisonneuve. Hearings were held and the chief engineer of the Board was ordered to examine and report on the whole situation. As a result of a long series of studies which the C.N.R. had made they were in a position to outline to the Board's chief engineer a comprehensive plan for grade separation combined with terminal integration.

The plans prepared by the C.N.R. were later submitted in detail to the Federal Government who, because of the magnitude and importance of the works involved, felt it necessary to secure the advice of an independent expert. In 1928, the government invited Sir Frederick Palmer, eminent British engineer, to study the entire project and report on it. Sir Frederick spent some months studying the proposal submitted by the C.N.R. and also proposals made by various other parties. In January, 1929, he submitted his report approving all of the C.N.R. proposals.

In June, 1929, parliament passed an act authorizing and providing the money for the entire project, which consisted essentially of the following primary pieces of construction—

1. The construction in the area bounded by Cathcart, University, St. Antoine and Mansfield streets of a new passenger station. This has now been constructed although the dimensions have been somewhat curtailed and many of the facilities originally planned have been omitted.

2. The construction in the station area noted above of a modern office building to house all of the C.N.R. office facilities in Montreal. This has not been constructed. Some office space has been provided in two floors over the station as now built, but this space is sufficient only to take care of the district and station operating staffs.

3. The construction of an elevated railway between the new passenger station referred to above and the end of Victoria Bridge. This has been completed and more details are given later in this article.

4. The construction of Mountain and Guy Street bridges across the tracks in the Bonaventure Station area and the closing of various other streets in the same area that crossed the tracks at grade. The removal of passenger traffic from the Bonaventure area will reduce the railway traffic between St. Henri and Bonaventure to such an extent that construction of grade separation at the balance of the railway-highway grade crossings will become unnecessary. Mountain and Guy Street bridges have been completed and in operation for some years.

5. The construction of grade separations to eliminate railway-highway grade crossings between Turcot and Pointe St. Charles. This work has been largely completed, subways have been constructed at St. Remi, Ste. Marguerite, Notre-Dame, D'Argenson, Hibernia and Charlevoix streets. Several other streets have been closed to traffic. There are still two streets left with grade crossings—one of which has become of negligible consequence since adjacent subways have been constructed and put into operation.

6. The construction of a double track railway between Val Royal and Pointe-Claire to enable passenger trains from the west to operate into the new station from the north, through the existing double track tunnel through Mount Royal. This project involved the construction of an engine terminal near the town of St. Laurent and also the construction of several new, and the reconstruction of various existing, grade separations between the north portal of the tunnel through the mountain and Val Royal. None of this work has yet been done.

7. The construction of a double track railway between Eastern Junction (on the line between the tunnel and Val Royal) and Bout de L'Isle and connection to Longue-Pointe or Montreal East. This project was for the purpose of allowing for the operation of passenger trains from the east, now using Moreau Street station in Maisonneuve, into the new central station by way of the tunnel through the mountain. It was also for the purpose of providing a badly needed C.N.R. freight connection between the east and west ends of the city of Montreal. Work was started on this project in 1930 but has not progressed very far.

8. The construction of a double-track railway from a point near Atwater avenue, in Pointe St. Charles, along the route of the old St. Pierre river and thence along the river front to the end of Victoria bridge. This project also involved the construction of a freight yard on the river front and a railway connection to Montreal harbour. The construction of this work, with the exception of the connection to Montreal harbour, is now in progress and should be completed before the end of the year.

Soon after the act of parliament, in June, 1929, authorizing the above work the acquisition of the necessary properties was undertaken and construction was started on several grade separations and on the excavation of the station site during the year.

The work was suspended in 1931 due to the depression and except for the completion of some few grade separations which had to be finished, the work was suspended for seven years.

In 1938, various studies were made to determine the minimum expenditure necessary to construct and put a new station into operation; the outcome of these studies was the adoption of a "modified" plan and the re-starting of construction in 1939 as an unemployment relief measure.

As noted above, a great many of the facilities included

**Fig. 1.—The terminal seen from the Bell Telephone Building, showing East Street, the plazas, Dorchester and Lagauchetière Streets.**

in the original scheme have not been constructed, under the so-called "modified" plan, but the works that have been provided are so constructed that they provide a workable terminal to which there can at any future time be added any one or more or all of the balance of the originally contemplated facilities.

In brief, the facilities as now constructed consist of the following:

1. A new passenger station in the Dorchester Street area.
2. A new elevated track construction between the new station and the end of Victoria bridge.
3. Construction of grade separations at all but two streets between Turcot and Victoria bridge.
4. Construction of Guy and Mountain Street bridges and the closing of various streets that formerly crossed the tracks at grade in the Bonaventure area.
5. Construction of a new coach yard, together with ancillary buildings and other facilities on the river front.
6. Electrification of all passenger tracks between the new station and Victoria bridge and Turcot.
7. Installation of a complete interlocking and signalling system over all tracks between the new station, Southwark and Turcot.
8. Acquisition of electric locomotives and the construction of a mercury-arc rectifier sub-station to provide direct current for traction power.

### Station Building

A modern railway passenger station involves the provision of a large number of different facilities; the initial problem is to arrange all of these facilities in the best possible manner for the operation of the station as a unit of the railway and the convenience of the public. Referring to Fig. 2 it will be seen that there are six different levels with accommodation grouped as follows:—

Elevation 36—Mechanical room and pipe ducts to provide services to station, tracks and future buildings overlying the entire area.

Elevation 53—Inbound and outbound express sheds, baggage room, post office, garage and various storerooms for railway news, sleeping and dining car department, etc.

Elevations 69 and 73—Tracks and station platforms.

Elevation 90—Station concourse, waiting rooms, lavatories, ticket offices, baggage checking, parcel checking, restaurant, dining room, drug store, news stand, entrance and departure plazas and all other facilities ordinarily used by the general public.

Elevation 130—Railway offices.

Elevation 143—Railway offices.

Of the above there are three levels that concern the public—the concourse, track and baggage-express floors. Wide, enclosed and heated stairways are provided between the concourse and the points over the mid-length of each platform with escalators also between the concourse and the platforms that will handle all but suburban trains. Ramps or elevators are provided over both ends of all platforms for the handling of express, baggage and mails to and from trains. Freight elevators are provided between the baggage checking rooms at concourse level and the baggage room in the sub-track and there is also a passenger elevator from the concourse direct to the baggage room for the convenience of patrons who have to visit the baggage room personally for customs information or other purposes.

Access for vehicles and pedestrians to the concourse level has been made extremely easy. Vehicular access can be had from McGill College Ave., at Cathcart Street by way of a ramp road on a very easy grade direct to the north plaza which occupies the entire area between the station building and Dorchester Street. Vehicular access can also be had from Lagauchetière Street where the south plaza, which is at the same elevation as the concourse, extends from the station building to Lagauchetière street. Pedestrian access direct to the concourse can be had from several points—from McGill College Avenue by way of the north ramp road; by stairway and escalator at the east end of Dorchester Street bridge, by stairway and escalator at the west end of Dorchester Street bridge, from the new East Street and from Lagauchetière Street.

Parking facilities for several hundred private automobiles are provided, on the north plaza. The bulk of this space is for outdoor parking but limited provision is also made for indoor heated parking. Parking facilities for taxi cabs and busses are provided on the south plaza.

### Station Facilities

The station concourse has been designed so that all the facilities which the public uses may be readily found and reached, and everything has been made as easy as possible for passengers and for their friends who care to greet them or see them off. It is 350 ft. long, 104 ft. wide and has a ceiling height of 33 ft. It is spanned by rigid frames at 25 ft. centres. The vertical legs of these rigid frames have been used as one of the main architectural features of the room, being encased in soft blue terazzo and rising from floor to ceiling from only slight projections at the floor level to a wide support for a band of blue connecting them along the length of the ceiling. Between these bands the ceiling is acoustic tile in variegated buff colours.

The floor is of marble terazzo, predominantly reddish in colour. Along the centre of the concourse the stairways and escalators leading to the underlying train platforms are located at 50 ft. intervals. There are seven stairways. Escalators are located adjacent to each of four of these stairways and there is a fifth escalator at the side of the concourse. The escalators are reversible and can be operated to suit the direction of flow of traffic. These five escalators are now being installed but will not be in operation till some little time after the station is opened on July 15th.

The concourse lies almost due east and west. At the west end are located, on the north side, the wickets for purchase of train and sleeping car tickets, travel bureau, information counter, telegraph office and travelling passenger agent's office; on the south side the parcel checking and hand baggage checking facilities, transfer office, newstand and public telephone room. A restaurant is placed across the width of the concourse at the extreme west end. At the

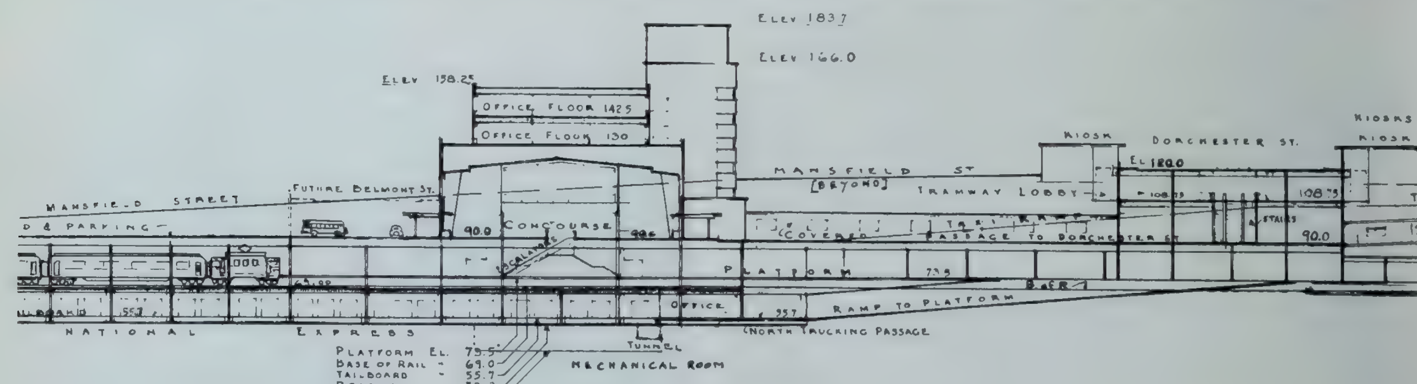



**Fig. 2.—North and south section through station building showing track and street levels.**

east end of the concourse are the general waiting room, women's waiting room and lavatories, traveller's aid, army and navy information bureau, R.C.A.F. staff headquarters, service men's room, men's lavatories, barber shop, drug store and immigration rooms.

All rooms throughout are equipped with acoustic ceilings, centrally operated clocks and public address systems.

The women's waiting and retiring rooms are located immediately to the north of the general waiting room. Special features of the women's quarters are a quiet room for women who require rest and a nursery *en suite* with a first aid room where a trained nurse is in attendance.

The men's rooms, located immediately to the south of the general waiting room are in line with the most modern principles of sanitation. A feature of the men's quarters is the large number of private rooms equipped with showers and baths. The barber shop is located between the men's bathroom and the general waiting room and can be entered from either.

The main restaurant is of the low horseshoe counter type with the addition of a number of individual tables providing, in all, seating accommodation for about 100 people. Immediately north of the restaurant there are three private dining rooms, each 33 ft. by 22 ft., supplied from a service kitchen. These three rooms are separated by folding partitions which can be rolled back to allow the three rooms to be used as two or as one room as may be desired. This space will accommodate about 165 people at a sitting. The restaurant and the dining room are to be operated by the C.N.R. dining car department.

### Train Platforms

The seven train platforms, serving fourteen tracks, are reached by stairs and escalators from the concourse. All platforms are at car floor level. In operation the greater length of the platforms will be reserved for passengers, as all baggage, mail and express is moved to and from the platforms by way of ramps and elevators located at or near the ends of each platform.

In addition to the fourteen regular passenger train tracks there are three others. One of these is reserved for the handling of mail, express, etc., and the other two will be used for storage of equipment, parking of special cars, handling of express, etc.

### Sub-Track Area

Below the tracks and platforms there is located the "behind the scenes" operating staff of the station. In this area, the principal facilities are the C.N. express warehouses, the railway express agency warehouse, the post office, the baggage room, the transformer room for the supplying of electric power for lighting and train operation and a service garage for the C.N. Express Company's fleet of trucks. There are two vehicular entrances to this sub-track level, one from St. Antoine Street, just west of Ste. Genevieve, the other from Lagauchetière Street, just west of the old Tunnel Station. These roadways enter the sub-track area through power operated doors that open and shut automatically when vehicles pass over magnetic controls built into the roadways.

The track structure, over the sub-track area, is of reinforced concrete construction. Foundations are on solid rock about six feet below floor level. Columns are round and concrete was poured inside of thin steel casings which are designed to act as mechanical surface protection for the columns. The track slab is of beam and slab construction, the only variation from conventional practice being that, in order to get a flat ceiling with the maximum headroom in the subtrack space, the slab was poured first and the beams that carry the slab loads to the columns were poured after and overlying the slabs. These beams are located under platforms and between tracks and offer no obstruction on the upper sides of the slabs. The only special precaution with this type of construction was the necessity to provide additional reinforcing steel between the beams and the

**Fig. 3.—Main concourse.**

slabs to transfer the vertical reactions from the slabs to the beams and also to take longitudinal shear at the cleavage planes between beams and slabs.

### Elevated Track Structure Approach

Between the new station and Victoria bridge the tracks are carried on an elevated track structure. The elevation of the tracks at the Montreal end of Victoria bridge is nearly the same as the south portal of the tunnel through Mount Royal and the new tracks between these two points are substantially level at this elevation. The greater length of this elevated track structure is on fill, with a number of structures carrying the tracks over streets, the Lachine canal and low level tracks.

The elevation of the tracks on the elevated track structure, as determined by the track elevation at the Montreal end of the tunnel and of Victoria bridge is about 25 ft. above the elevation of the city streets crossed by these new tracks and this greatly facilitated the construction of grade separations across these streets. The elevated tracks are carried by a reinforced concrete viaduct between St. Antoine and Ottawa streets, a distance of about 2,000 ft. In addition to carrying the tracks, this viaduct is in reality a two-storey enclosed building with city streets cutting through the ground floor at five places. There is approximately 350,000 sq. ft. of floor space in this structure, all of which is in use for offices, garages and warehouses. The portions in use for offices are fully air-conditioned and supplied with the latest type fluorescent lighting. This viaduct structure was built, and except for two small sections, was completed ready for occupation, in 1931. Since that time it has been used for housing railway offices that previously occupied rented space. The financial saving to the railway during the last 12 years has already amounted to a figure nearly sufficient to cover the entire cost of the viaduct structure.

South of the viaduct, this elevated track structure crosses Smith, Wellington, Ann and Brennan streets on a reinforced concrete structure some 500 ft. long which in itself constitutes a rather important engineering accomplishment. Its design and construction involved many difficulties. The foundations were very soft, the streets crossed over are like a jig-saw puzzle, the spans are very long for concrete and the skews are exceedingly sharp, the tracks are on a very sharp curve and the structure tapers from six to four tracks wide in its length.

South of this structure again the tracks are carried across the Lachine canal on a double track two-span vertical lift bridge and between this point and Victoria bridge there are various steel and concrete structures, all of which are of more or less conventional type.

The new 500-car electrified coach yard is located on the river front just upstream from Victoria bridge on ground made by filling in part of the river with material excavated


**Fig. 4.—Plan showing rail connections with tunnel, Victoria bridge, and points west.**

from the Dorchester Street site. This coach yard is modern in every detail with all buildings and facilities for cleaning, servicing and repairing passenger cars.

All main line tracks for the operation of both passenger and freight trains between Turcot and Southwark and into the new passenger station have been equipped with a centrally controlled interlocking and signal system with power operated switches.

When the new station goes into operation on July 15th, trains coming into Montreal from the west will change from steam to electric traction at Turcot and those coming into Montreal from the south will change to electric traction at the Montreal end of Victoria bridge. The tracks coming into the new station from the north, through the tunnel, were previously electrified as far as St. Eustache and no change has been necessary in this electrified traction installation.

Figure 4 shows the layout of tracks leading to the new station. It will be noted that, until the new line between Pointe-Claire and Val-Royal is built, all trains going to the west leave the new station to the south, cross the Lachine canal twice and go west through Turcot the same as at present.

For the duration of the war, Bonaventure station will continue to be used as a passenger station to handle the lakeshore suburban trains and a few other short run trains. There are various reasons for this, the chief being the wartime restriction on the purchase of additional electrical equipment and locomotives.

### Future Construction at Station Site

At the new station site there still remains some construction work to be done by the C.N.R. This consists mostly of the building of city streets through the station site, for instance the extension of Inspector Street from Lagauchetière up to McGill College Ave. and the extension of Belmont St. westerly to Mansfield Street.

In addition to the construction already completed and yet to be done at the station site by the C.N.R. there is a vision of a great building development arising in the area bounded by Cathcart, University, St. Antoine and Mansfield Streets, similar to that which has developed around the Grand Central Station in New York City. In all of the construction done by the C.N.R. at this site, provision has been left for columns for overhead buildings to be located at about 25 ft. centres in both directions and no changes or alterations of any consequence are necessary in any present construction to allow for these columns to be so located anywhere in the area.

The columns that support the new station building are completely isolated and insulated from all parts of any structure carrying train or street loads in order to prevent train or street vibrations from entering these structures. In the present construction, care has been taken that columns of all future overhead buildings will likewise be isolated and insulated against vibration from trains and street traffic. This has somewhat complicated the construction but the basic principle has been the complete separation of building construction from track and street construction by air spaces where possible and otherwise by the effective use of insulation materials.

---

The information on which the above article is based has kindly been furnished by the C.N.R. Engineering Department, through C. B. Brown, M.E.I.C., its consulting engineer, to whom our thanks are due for his kind assistance.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## BRITAIN FAVOURS SHORTER FLUTE DRILLS

Eric N. Simon

There has been little development in twist drill design over the last ten or twenty years. However, the quality of high-speed steel employed is better; the hardening treatment has improved; and there have been certain refinements in finish. Moreover, in Britain at all events, most twist drills are being made to-day by butt-welding a high-speed steel cutting portion to an oil toughtened steel shank, thus producing a drill "right at both ends," since the oil-toughened steel is better suited to resist the twisting stresses encountered in drilling than is the much more brittle high-speed cutting steel. The result has been a marked diminution in drill breakages in Britain's engineering shops.

This refers solely to the "general purpose" drill, working on the normal materials of daily shop practice. Certain special drills have, of course, been invented during the period mentioned, particularly the special drill for manganese steel (11-14 per cent manganese).

### Orthodox Design Out of Date

Britain's engineers are now coming to the conclusion that orthodox twist drill design is hampering progress, both in regard to penetration per revolution and revolutions per minute, in view of the possibilities afforded by the latest high-speed steels. They feel that the present design detracts from the ability of drills made from the highest classes of high-speed steel to withstand heavier feeds and faster peripheral speeds.

Drilling machine makers annually increase the power and strength of their products. It is always easier, for example, to instal a larger motor than to manufacture a steel that will stand up at the working end. In consequence, the twist drill rapidly becomes the weak link in the chain.

For a given design of drill, there is little, if any, difference between the feed per revolution than can be employed with a carbon steel twist drill and that possible with a high-speed steel drill. Logically, therefore, the twist drill made from the best high-speed steel can only justify its extra cost by either lasting longer between grinds, or by effecting a greater penetration per minute by increased peripheral speeds. In the attempt to achieve increased speeds, conditions sooner or later cause failure by breakage.

### Causes Cost to Rise

A small percentage of such failures, combined with the high first cost of super-high-speed steel drills, causes the cost per hole to rise rapidly, and the user is driven back to the ordinary run of lower quality high speed steel drills. In Britain, drills made from steel of super-high-speed type, i.e. those containing more than 18 per cent tungsten or substitute steels of corresponding types, are not popular for general purpose drilling, because of the failures experienced.

To be successful for general purpose drilling, a twist drill must possess a measure of elasticity, which is lacking in the super-high-speed steels. If drills of these high quality steels are to be employed, design must be changed to minimize this need for elasticity. In general, this need decreases as the sturdiness of the drill form increases.

Now that the butt-welding of twist drills is accepted, designs become feasible that would have been wasteful a few years previously. Britain's drill makers consider that maximum efficiency is attained by using what may be termed the "single purpose" drill, not for general jobbing work, but for quantity production on normal materials.

### Swing-Over to 18 Per Cent Tungsten

The higher qualities of super-high-speed steel are not suited to the general run of jobbing drills, and those of 14 per cent tungsten steel or its substitutes are still being used extensively in their manufacture, though in British shops there has recently been a marked swing over to 18 per cent tungsten steel or its substitutes.

Many operations call for drills with a specially tough temper to prevent an unduly high percentage of breakages. The super-high-speed drill is useless for such jobs, as some of the cutting efficiency of even a 14 per cent tungsten steel has to be sacrificed under the prevailing conditions to give the added toughness required.

Hardness figures taken recently on a large number of high quality 18 per cent tungsten high-speed steel twist drills showed that in only one instance was the hardness of the drill equivalent to what would be expected from an 18 per cent tungsten high-speed steel lathe tool. In most instances, the diamond Brinell number was much below normal.

This means that in each instance the manufacturers had made the drills as hard as they dared, consistently with the necessary toughness required to meet the prevailing conditions in engineering shops. Thus, the cutting efficiency of which even a medium quality high-speed steel is capable had been partly sacrificed.

### Maximum Cutting Efficiency Necessary

Obviously, therefore, the harder super-high-speed steels cannot be successfully used unless means can be found of using them fully hardened so as to give their maximum cutting efficiency. This means that design must be modified.

Between the drilling of boiler or ships' plates and that of manganese steel lies a vast field, beginning with a demand for specially tough (softer) drills, and ending with a demand for the hardest and best. But the graduation from one extreme towards the other entails a change of design as important as the change in quality and hardness. The altered design consists of an increase in the rigidity and strength of the drill, incorporating at the same time the best helix angles, web-thickness, flute width, and so on for the nature of the work.

Standard twist drills in Britain are invariably made to the British Engineering Standards Association Specification No. 328/1928, but when a user requires to penetrate an unusual thickness of material he does not hesitate to order a drill specially long on the flutes to suit his requirements. It was seldom that the user thought of specifying drills *shorter* on flutes than standard. There was, and in some directions still is, a definite prejudice against shortening drills, although in many difficult drilling operations they are now known to overcome the greater part of the difficulty.

### Quicker and Better Drilling

The sole object of shortening the drill flute length is to enable it to drill quicker and better, and to do more work. Two instances may be given where standard length and ordinary quality high-speed steel twist drills were altered and achieved satisfactory results.

In one shop, thousands of 9 mm. holes had to be drilled in austenitic chromium nickel stainless steel plates. These plates were exceptionally large, so that the job had to be carried out under a line of plate-drilling machines, with the finest feed, one hundred cuts per inch penetration. New drills of orthodox design were used, but trouble quickly followed. A cure was effected by simply shortening the flutes.

Before this modification, the margin of strength and safety was small, resulting in chatter of breakage following the loss of the keen cutting edge. This resulted in a high percentage of broken drills, and a large number of blind holes needing special attention.

### Safety Enormously Increased

The average performance was about twelve holes per grind. When the drill flute length was shortened, the margin of safety was enormously increased, and actually resulted in eliminating all broken drills and blind holes, the average number of holes being raised to over one hundred per grind. Thus, the cost of the job was greatly reduced and production improved.

In another instance, far more than the normal amount of breakages occurred in drilling 5/32 in. holes in castings for the attachment of machine nameplates. A shortened drill was supplied 5/32 in. dia. by 1 in. long on flutes, 2⅜ in. overall, with a web thickness much greater than standard, thus making the drills considerably more robust. This performed the work without any breakages whatsoever.

Similar examples could be multiplied indefinitely, but only one more will be given. Oil holes were drilled in rustless steel bars, the holes being about 6 in. deep by 5/16 in. diameter. Ordinary 14 per cent tungsten high-speed steel twist drills were used, but failure through breakages was continually experienced.

The problem was again solved by using a drill with a flute length of 2½ in., the remainder being plain cylindrical material. Frequent withdrawal of the drill to clear the chips was carried out, and a super-high-speed steel drill employed, of a special design. The drill was successfully used in drilling high carbon steel samples, and measured 1 in. dia. by 4½ in. flute length, by 9⅛ in. overall.

The most difficult of all materials to drill, manganese steel, has surrendered to commercial drilling by specially designed twist drills of super-high-speed steel, but only because the drills were designed for the job. Hence, British practice in not only to shorten standard drill flute lengths to meet the requirements of difficult jobs, but is concentrating more and more on special designs of twist drills for specific jobs and materials.

## SYNTHETIC TIRES

Being Tested, But None Yet for Public

From *Scientific American*, February, 1943

Tires whose rubber content is 99.84 per cent synthetic rubber are now being tested on the highways in various parts of the country, according to Dr. Howard E. Fritz, director of research of the B. F. Goodrich Company. In discussing the present relative positions of natural and synthetic rubber from the standpoint of their usefulness in tires, Dr. Fritz emphasized that this testing of high-percentage synthetic rubber casings should not be considered as indicating any early public availability of such tires—that it does not affect the nation's tire supply situation at all.

"Experimental development work done with samples of butadiene-type synthetic rubber—the type which makes up the great bulk of the government synthetics programme—has already shown up much that is good and several things that are still unsatisfactory about this new rubber," he said.

"Passenger tires and small-size truck tires give excellent service. When we come to large-size truck and bus tires, several difficult problems arise due to the fact that synthetic rubber while running generates more heat than natural rubber, and may fail from that cause in spite of its higher heat resistance. However, we are now hard at work on this problem and are confident it can be solved as we gain more experience in the field."

## GAS TURBINES

Possibilities for Ship Propulsion

From *Trade and Engineering*, (London, Eng.), March, 1943

Considerable progress has been made recently in the development of the internal-combustion gas turbine, and its adoption for ship propulsion appears to present great possibilities in the future. The simplest form of installation comprises a compressor driven by an exhaust gas turbine and delivering air to a combustion chamber into which the fuel is injected. The gaseous products of combustion provide the working medium for the turbine that drives the compressor, and the surplus output is available for useful work. The handicap of the gas turbine in the past has been the relatively large amount of negative work that has to be expended on the combustion air to enable it to perform its useful work. Improvements in the design of axial compressors result in efficiency ratios of about 85 per cent, giving an overall efficiency in association with the gas turbine of about 70 to 75 per cent. On this basis the thermal efficiency of a simple installation with inlet gas temperature of about 1,000 deg. F. is about 18 per cent. There is a wide scope for advance on this standard by improvements in design, since each 1 per cent increase in turbine or compressor efficiency will yield a gain of about 4 per cent in the cycle efficiency.

#### RECENT ADVANCES

The most recent line of development favours the use of two-stage compression and combustion, with preheating of the combustion air by the exhaust gases of the turbine. The recuperation of the heat of the exhaust gases in an exchanger of moderate dimensions brings about an improvement of nearly 25 per cent. The extent to which the latter expedient can be utilized is limited only by the materials available for withstanding the increased combustion temperature. The developments that have taken place upon these lines enable units to be constructed with a thermal efficiency of about 23 to 25 per cent, which should permit effective competition with the most modern arrangements of steam turbine or oil engine machinery.

An apparent limitation to the use of gas turbines for ship propulsion has been the falling off in efficiency at reduced loads, but this can be circumvented, with particular advantage for marine installations, by the use of separate turbines for driving the compressor and providing the propelling power, because the compressor turbine can be operated at the most suitable speed independently of the propulsion turbine. In marine applications, the residual heat of the exhaust gases can be utilized in waste heat boilers to generate steam for driving the auxiliaries or supplementing the propelling power through an auxiliary turbine drive. A further economy, amounting to about 10 per cent, can accrue in this way. The output of the waste heat boiler can be supplemented by independent oil firing, which would also serve as a source of auxiliary power when the main machinery is shut down. Control is simple, since the output is largely governed by the amount of fuel injected into the combustion chamber. Starting from cold can be effected in about 10 minutes by a small turbine taking steam from the boiler using direct oil firing, or by an electric motor taking power from a small oil engine driven generator which would be available for general purposes on board when the main source of power is shut down. Any bunker oil capable of being burnt under boilers can be employed in the combustion chamber, and with suitable provisions it seems probable that future developments will permit the use of pulverized coal.

#### SAVING IN WEIGHT

To parity in thermal efficiency with turbine machinery the gas turbine offers the advantages of saving of weight. The specific weight of the lightest forms of steam turbine machinery yet adopted for merchant ship propulsion is about 85 lb. per s.h.p., whereas the corresponding weight for gas turbine machinery is only about 35 lb. The fuel consumption rate in the present state of development, in comparison with orthodox oil engines, is about 50 per cent greater, but this is almost entirely compensated for by the price differential between the different grades of fuel that will be used. The weight difference between gas turbines and the most compact designs of oil engine is such that the total machinery and fuel weights of the two types will be the same for a radius of action of about 20,000 miles.

Experience already acquired with gas turbines at sea in driving superchargers for four-stroke oil engines and with a variety of instal.ations ashore has shown that increasing confidence can be placed in the mechanical reliability of such plant working with gas temperatures up to 1,000 deg. F. at the turbine inlet, and further experience may be expected to lead to improvements in both compressor and turbine machinery. The specific output and thermal efficiency of such equipment would be substantially increased if higher gas temperatures could be employed, and there is good reason to hope that with developments in the manufacture of materials this will become possible.

## MACHINE TOOLS FOR WAR

B.B.C. Tells Story of Vital Part Played by British Tool Makers and Designers

"Tools for the Job" was the title of a British Broadcasting Corporation feature programme broadcast on the overseas short wave service telling in dramatic form the story of a vital part in the war effort played by Britain's machine tool makers and designers. It was written and produced by Leonard Cottrell. Valuable help was received from Machine Tool Control and individual manufacturers in Britain and great care was taken to see that every fact was true, every figure correct. In preparing his script, Cottrell concentrated on the human drama behind the drive for machine tools and small tools.

Starting with James Watt, who, when he was developing the steam engine overcame the difficult problem of boring the cylinders with the aid of the first machine tool constructed for the purpose by Henry Wilkinson, the story came down to the present day and the situation in the industry as it existed in September 1939. The narrator said:

> . . . When Britain entered the War, the Navy went to its battle stations, the Army mobilised, the R.A.F. stood by, but there were no dramatic headlines about Britain's engineers. You did not read "Machine Tool Industry mobilises" or "Engineers at Action Stations" . . . These men looked over their breakfast coffee at the newspaper pictures of Hitler, and shook their heads. They read the glib political speeches promising a mighty flood of armaments, and a huge expansion of the Services, with an intimate, exact, personal knowledge of the work involved in making those arms and equipping those Services.

Many difficulties had to be overcome and various speakers described the setting-up of Machine Tool Control by the Government; how the shortage of skilled labour was overcome; the fall of France and the consequent heavy loss of equipment; the diversion to Britain in mid-Atlantic of ships laden with machine tools intended for France and then:

> . . . Many valuable cargoes of machine tools were snatched from under the noses of the Germans. The wooden crates painted with the names of their French consignees were unloaded at British ports with the German bullets still embedded in them. And before long those American machines, lathes, millers, grinders, shapers, were at work in British factories.

Illustrating the way in which urgent problems were overcome by the cooperation of designers, makers and Government experts was the story of how a sudden call for a portable range-finder was met, at a time when invasion seemed imminent. Voices were heard in conference, and so:

> . . . Round that table, on that Sunday afternoon, with an old gramophone motor between them, those engineers worked out the design of the new range-finder. All pooled their ideas, there were criticisms and suggestions, ideas were taken up and rejected, but, in under a fortnight, a substantial number of the new machines were in the hands of our gunners on the coast. And that is only one typical incident.

Another speaker described the intensified industrial drive made necessary not only for replacing lost equipment but to supply the great armies of liberation on an ever-increasing scale. There was a shortage of small tools which caused a serious hold-up in production at the time of the Battle of Britain. Makers of small tools were swamped with orders and could not promise delivery under ten months. How the bottlenecks in production were freed was described in a scene in which engineers got together and organized a gigantic comb-out of the industry, unearthing thousands of small tools lying idle all over the country and putting them to use. Sixty travellers from machine tool firms were sent to find out about these bottlenecks and to ask firms if they would be willing to lend tools if others would reciprocate. The narrator told what happened:

> . . . Every one of the firms visited agreed to this proposal. At the first meeting, which was christened the Committee of Mutual Aid—the C.M.A.,—80 per cent of the problems were solved, then and there, on the spot, by practical engineers dealing with practical engineers, without fuss, without form-filling and without red tape . . . Since then, Mutual Aid Committees have been established all over Great Britain.

Then came the blitz and the broadcast told of the havoc wrought in the big industrial towns. Undamaged machines in bombed works were sprayed with rust-preventative and then temporary roofs were put on.

> . . . Engineers helped each other through their own organization, specially set up for the purpose—the Emergency Services Organization, a body for which no praise is too high from those whose job it was to keep our factories working during concentrated aerial attack. It was a pool, to which all contributed their share of practical help.

The narrator continued:

> . . . A bomb makes a loud noise and sounds impressive. Its effect is, well, dramatic, and no doubt the eager Nazis in their night bombers thought they were obliterating Britain's industrial centres. They did grievous damage and they did cause hold-ups, but they failed in their main objective and one of the reasons for their failure was that undramatic figure, that quiet, peace loving, practical man, fond of his golf and his gardening, who looked at the shattered walls of his factory and said: "Well, they've made a nice mess, but, it's not as bad as it looks. Ted! get some men clearing this glass up to start with! Then we can see what we're doing."

Dispersal became essential with the vast increase in output and to minimise the bombing menace. The old hands rose magnificently to the occasion. Two men with long experience, George Dowell and Henry Barber, told their story. The former said:

> . . . I started as a fitter fifty-two years ago, and I've seen some wonderful changes since that time. The first thing I learned was how to use a file and a hammer and chisel. We also used the scraper. There is very little scraping done to-day. Machines have taken the place of all that. I made tools in the Boer war, and in the last war. I remember when the first milling machine was made in my factory, in fact I put it together. Then there was the automatic lathe. We all thought that was wonderful

when it came out in 1906. Nowadays you see them in every factory.

No women worked in machine tool factories before the war—the work was considered too highly skilled—but thousands are now doing valuable work and a woman fitter, Mrs. Hughes, described how she is doing her bit:

. . . I came into the factory after my husband joined the army. Before I got married I was a silk worker, and I thought when I came here first that some of the men would resent women coming into the machine tool trade, but I was wrong. Everybody has been very kind and it didn't take me long to pick up my job. It seemed strange at first, but I got used to it and now I'd rather do this than be at home. Home doesn't mean much when your husband's abroad, I feel like a lot of women working in factories to-day. We like to think we're helping to get the war over so that we can have our husbands back again.

. . . To-day, said the narrator, the British machine tool and small tool industries are producing eight times their output at the outbreak of war. The industry was never a large one. After the last war it went through hard and difficult times and many of its skilled workers knew long periods of unemployment. Yet that small body of men, executives, planners, designers and skilled workers have taken their skill and experience into hundreds of other factories which never previously made tools.

Textile manufacturers, brewery workers, watch and clock makers are among those who are playing their part in this key industry. "These too are now feeding a never ceasing supply of the tools needed by Britain's great arms factories —the machine tools without which nothing would be made and the small tool without which those machines would be useless. The tools which are fashioning the weapons of victory—the tools to finish the job."

## MATERIALS FOR ESSENTIAL INDUSTRIES

From *Trade and Engineering* (London), Sept., 1942

The high cost of war, which already has been brought home to Canadians in some measure by greatly increased taxation, by rationing of sugar and petrol, and by shortages in civilian supplies of certain other commodities, is beginning to be experienced in other ways as well. Mr. C. D. Howe, Minister of Munititions and Supply, has uttered a warning that hundreds of Canadian manufacturers will be unable to get sufficient supplies of raw materials, processed parts, machinery and repair parts to keep their plants operating and that "only those civilian industries which are essential to the economy of a nation at war will be given any preference." Canada's price ceilings system has been maintained surprisingly well up to the present, but recently has been under attack by agricultural interests. It has yet to meet its greatest test, when decreased turnover in many industries making goods for the civilian trade will increase manufacturing costs and intensify the "squeeze."

Meanwhile, war production in the Dominion continues to expand in all branches. "Canada's cotton textile industry is eleven times ahead of its war production records of 1914-18" is the statement made by the largest textile manufacturing company in this country. The industry is delivering annually about 215,000,000 yards of aircraft fabric, besides ammunition pouches, anti-gas cloth, camouflage netting, gun covers, parachute webbing, powder bags, uniform cloth, web equipment and other essential materials. The company's employees are earning 28 per cent more hourly than in 1939 and it is paying 5.4 times more in taxes than the total paid in dividends to its several thousand shareholders. So great has been the demand for war materials that shortages have developed in various lines of civilian cotton goods. Oil refineries throughout the Dominion have been increasing substantially their output of aviation spirit and other war materials at the expense of their regular products for civilian use.

## REME'S CONTRIBUTION TO AFRICAN VICTORY

John L. Young

Into the dust of battle lumbers a heavy British tank spitting fire and churning up the sand as a battleship churns up the waters of the ocean. A shot from the enemy and the tank may be put out of action, unable to move, presenting a sitting target. Signals are flashed to a Light Aid Detachment of Britain's Army's Royal Electrical and Mechanical Engineers—the technicians and craftsmen of the military machine—who have been cruising around in the battle area waiting for just such a call.

In their armoured mobile workshop the engineers dash up to the tank, dismount and hastily examine the damage with skilled precision. Within a few minutes, if the damage is comparatively slight, they are able to repair or replace the broken parts. The tank lumbers back, fully effective once more, into the onsweeping battle, and the Light Aid Detachment retires to cruise around again, ready for another such call for first aid.

Repair on the battlefield, though much more difficult, has reached to-day the same efficiency as repair in the stationary workshop in Birmingham or in Detroit. So far, this has largely been proved in the victorious African campaign. In many instances indeed, it was the men from Birmingham or Detroit who worked as engineers on these battlefields, just as in peace time they worked at the bench or on the lathe at home. This war has often been called a citizens' war, and battlefield repair calls upon many men to follow amid the dust of conflict the vocations they once followed in the factory and workshop.

### Light Aid Detachments Work Fast

The organization of repair and recovery in the field is largely a development of the present war. Even since those first early days of the Battle of France the technique of this vital work has been improved and developed step by step with the ever-increasing demands of this mechanized war. To-day, the lightning repair for that damaged tank on the battlefield itself is an instance of these developments. During the 63 days of the chase from El Alamein to Tripoli, more than 1,000 damaged tanks were so repaired and sent back into the battle, once more effective units of destruction.

Despite the need for maintaining every possible machine in action as a fighting unit, no time is wasted, no fruitless efforts expended, by these men of the Royal Electrical and Mechanical Engineers. These Light Aid Detachments are organised for first aid only. Rapid inspection of a damaged tank or armoured car may reveal the impossibility of carrying out the necessary repairs within an effective time. Machines which cannot be repaired quickly on the spot are towed or carried on recovery transporters to mobile workshops which follow the advancing army close behind the lines. Here, within gunshot of the enemy, these workshops are equipped to accomplish more drastic repairs. For example the engine may be damaged beyond repair; the men in these behind-the-line Brigade Workshops of the Royal Electrical and Mechanical Engineers can remove it and bolt a new one in place within forty minutes or so. If the engineers of the Brigade Workshop decide that adequate repairs will need days of work, they arrange for the machine to be transported back to the base.

Occasionally the Light Aid Detachment on the battlefield may find that a damaged tank is completely beyond repair, in which case they may blow it to pieces on the spot, if likely to fall into the hands of the enemy or to impede the progress of the battle, and signal for a replacement—but the watchwords of the R.E.M.E. are "Repair, Re-condition, Re-habilitate"; renovation and recovery have largely replaced evacuation or demolition. The battle must go on; the tank must if possible keep up with the rhythm of advance; the enemy must be harried remorselessly, relentlessly, continuously. The servicing squads of the R.E.M.E. must follow the battle closely, sending forward their advanced aid units, the Light Aid Detachments, into the heart of the conflict. There's no rest for the R.E.M.E.

### Jacks Of All Trades

Every regiment of the Royal Armoured Corps, and the Royal Artillery, every Brigade of Infantry, has its own servicing detachment of the R.E.M.E. which is prepared

**Tank recovery during battle. This tank was transported safely to the REME's workshop and was soon back in action for Britain's victorious African campaign.**

to perform every function from dragging a tank out of a ditch, to repairing the radio apparatus, from restoring a gun to firing efficiency to replacing a smashed engine or a broken caterpillar tracks.

These men from Birmingham and other centres of industry are jacks of all trades and masters of all. You cannot stand in the midst of a battle to consult trade union or workshop regulations in order to decide whose job is whose. Within a few months one Light Aid Detachment in Greece assisted Royal Engineers to re-start a power station, mended or replaced the radiators of armoured cars shot up by German dive-bombers, hauled vehicles across streams and towed badly damaged tanks out of the battle. On paper, three out of those four jobs were someone else's—but the same squad of Engineers performed them all.

They work in constant danger, these Engineers who have turned their peacetime abilities and skill to the service of war. The Germans are not going to stand peacefully by while they are repairing a damaged tank or towing it back to Brigade Workshop; they aim at interrupting the work of recovery, and killing the Engineers. One day a recovery detachment in Libya was transporting a damaged tank to Brigade Workshop, when a column of lorried German infantry swept along; and thinking they had an easy prize, opened fire at the mobile workshop and the disabled tank. Hastily the R.E.M.E. soldiers restarted the power, swung the turret gun into action, drove off the Germans and went on with their work of recovery.

## HIGH-GRADE IRON ORE FROM STEEP ROCK

From *Trade and Engineering* (London), June, 1943

Details have now been announced of the arrangements for bringing into production the vast, high-grade iron deposits at Steep Rock Lake, in northwestern Ontario, with the direct co-operation of the governments of the United States, Canada and the Province of Ontario and no fewer than 18 government departments, bureaux and agencies.

The Reconstruction Finance Corporation of the United States Government is advancing $5,000,000 on a first mortgage; the Federal Treasury at Ottawa will furnish funds to the Canadian National Railways for constructing a spur line and docks at Port Arthur, and, in addition, will provide a subsidy of 20 cents a ton on the first 5,000,000 tons of ore handled, and the Hydro-Electric Power Commission of Ontario will build a power line from Port Arthur to Steep Rock, a distance of 125 miles, at an estimated cost of $1,600,000. All necessary priorities for materials and supplies have been arranged and work will be pushed aggressively, with the expectation of bringing the property to the producing stage within 17 months with an initial output of 2,000,000 tons annually. The plans entail the diversion of the Seine River and draining of Steep Rock Lake, work which will take about 11 months. This development will make available for Canadian requirements and export an immense supply of high-grade iron ore of a quality equalled only by the famous Swedish deposits. Control of the enterprise will remain with Canadian shareholders.

## ARMY TO USE WAR PRISONERS FOR NON-MILITARY PROJECTS

From *Engineering News-Record* (New York), June 10, 1943

A large number of the prisoners of war now being brought to this country are expected to be made available for construction operations that do not promote the war effort. There are 36,000 war prisoners in this country at the present time, but it is reported in Washington that this number may be increased to 200,000.

Major emphasis at present is being placed on agriculture, partly because it is expected that the prison camps will be located chiefly in farming areas, but also because agriculture is not considered as connected with the war effort and lends itself well to the making of adequate provision for security of the prisoners.

Projects on which the use of prisoners of war is considered feasible by the government, next to agriculture, are grading operations on roads and dams. The general plan, for which more details will be available within the next week or two, is to delegate to the commanding general of each service command throughout this country authority to make arrangements for the use of the prisoners of war in his area, general policies only being laid down by the War Department.

### War Prisoners on Construction

It is expected that this labour will be made available to private employers as well as to governmental agencies. On construction operations, prisoners of war will not be used alongside normal labour, nor will the prisoners be used as skilled tradesmen. The prisoners will be used as common labour in large groups, which can be guarded easily. They have already been so used at Denison Dam by the Corps of Engineers for clearing the reservoir area on the Oklahoma side. Several groups also were used on levee repair during the recent Mid-west floods, one group of about 200 being used near Weingarten, Mo.

As a peace offering to organized labour—and this affects chiefly the construction trades because of the rapid decline in construction jobs—war-prisoner labour will be made available only in areas where there is an insufficient supply of native labour, as determined by the War Manpower Commission, and then only at prevailing rates of pay.

Under the Geneva convention, prisoners of war can be put to work only on jobs not directly related to the war effort, and only on tasks that are not hazardous or unhealthful. Prisoners who do not work are paid only 10 cents a day, but those who work are paid 80 cents a day. Under the set-up as proposed in this country, the difference between the prevailing rate that is paid by the employer and the 80 cents that the prisoner gets goes chiefly to the government, the employer being permitted to deduct any expenses that would not be incurred with the use of free labour. Social security costs will be paid by the government.

## HAWKER TYPHOON

From *Trade and Engineering* (London), June, 1943

For many months Britain's formidable new fighter, the Hawker Typhoon, has remained on the secret list. It is now permissible to disclose limited details regarding it. The Typhoon is a single-seat, low-wing monoplane of all metal construction, powered by the Napier Sabre sleeve-valve engine of 24 cylinders, which are in four banks of six cylinders arranged in "H" formation. The Sabre, concerning which no details have yet been disclosed, is the engine which has been described as developing more horse-power than the Royal Scot. There are two versions of the Typhoon now in service, the 1A and the 1B. The only difference is in the armament. The former has twelve 0.303 Browning machine-guns, six fixed in each wing, and the 1B has four Hispano 20-mm. canon, two in each wing. Main dimensions are as follows:—Wing span, 41 ft. 7 in.; length, 31 ft. 11 in.; height (tail up), 14 ft. 7 in.; height (tail down), 15 ft. 3½ in.

The lines of the Typhoon immediately proclaim it as coming from the Hawker "stable," and it has many similarities with the Hurricane, which is quite natural in view of the fact that they were designed by the same man, Mr. Sydney Camm. Although bigger and heavier than the Focke-Wulf 190, which is the enemy's main weapon for "tip-and run" raids on our coastal districts, the Typhoon has shown that it is the faster and more manoeuvrable machine by the number of times it has shot down the raiders. More than 40 have been destroyed by Typhoons this year, 20 of them by a single squadron. In one period of 11 days, two Typhoon squadrons shot down 11 F.W. 190's and damaged others. The power of its armament speaks for itself. The new fighter has been equally successful in an offensive role, having proved a deadly weapon for low-flying attacks on railway targets and against ships. One squadron equipped with Typhoons has destroyed 100 enemy locomotives in three months. Other units have gone out for bigger "game," attacking such sea targets as E-boats, armed trawlers, and minesweepers.

## TIMBER CONSTRUCTION RECORDS BROKEN IN 1943

From *Engineering News-Record* (New York), June 10, 1943

Three all-time world records for timber construction were established during the first half of 1943 as vast Army and Navy plants, designed and engineered in timber, have been completed.

The largest amount of wood ever used in a building—27,000,000 ft.—went into a giant cargo-plane assembly plant built by the Austin Company of Chicago, under the supervision of Army engineers.

The largest clear span timber arches ever erected roof the Navy's mammoth new timber blimp hangar. They rise 153 ft. from the floor and span an area 237 ft. wide and 1,000 ft. long—237,000 sq. ft. of floor space unobstructed by columns or supports of any kind.

Records for speed of construction fell when the Navy completed in seven months its new $50,000,000 naval training station in New York State. Although not built entirely of wood, the project used 41,000,000 ft. of lumber in its 400 buildings.

Lumber production in the United States for the first quarter of 1943 is estimated at 7,141,109,000 bd. ft., and is not far under the estimated first quarter goal needed to meet total military and essential civilian requirements of 32 billions bd. ft. for 1943, the War Production Boards Lumber and Lumber Products Division has announced.

Monthly production has risen steadily during the first quarter period, with 2,199,240,000 bd. ft. in January; 2,307,448,000 bd. ft. in February, and 2,634,421,000 bd. ft. in March.

It is not possible to forecast whether or not the rate of production established during the first quarter can be maintained for the entire year, Lumber Division officials stated, since the log supply is dependent on numerous factors; labour and equipment, the most important ones, are already curtailed in comparison with peacetime standards and additional shortages are to be expected.

## ATLANTIC SEADROMES

From *Trade and Engineering* (London.) June, 1943

The Pennsylvania Central Air Lines and associated organizations recently filed a formal application with the United States Civil Aeronautics Board for permission to establish "seadromes" across the Atlantic between the United States and Great Britain in order to provide America with bases at convenient distances apart and thus provide for air travel along the shortest, fastest and most economical air route between the two countries.

The plan is to establish a seadrome every 800 miles. The landing surface will be 70 ft. above the ocean, and the seadromes will have a draught of 180 ft. and weigh approximately 64,000 tons. It is claimed that this construction will make the seadromes as steady as a land base, uninfluenced by waves or rollers because of their enormous draught. Somewhat similar schemes put forward in this country proposed to have the landing platform at the top of a number of huge vertical cylinders, the principle being that waves running up and down the cylinders would not affect the structure as a whole.

When the application was filed to the C.A.B., officials of the Pennsylvania Central Air Lines stated that construction would begin as soon as the steel was available, which presumably means after the war. They claimed that the American Bureau of Shipping had expressed approval of their seadrome, which was designed and developed in Philadelphia. Mr. Bevell Munro, president of the air lines company, stated that the company sought no monopoly and that the seadrome route would be made available to air lines of any other nation. An important point, he added, was that these seadromes would make it possible for landplanes such as those now in use to fly the Atlantic easily and economically. To operate air transport services between America and Europe with any semblance of economic sanity the flight distance without refuelling could not exceed the definite limits which applied to overland flying and, without bases permitting refuelling within those limits over ocean airways, air transport could not hope to attain a fraction of the value to commerce and industry that an economically sound, self-supporting air service could render. Each seadrome would provide complete airport and hotel facilities, so that passengers could spend a holiday on them.

There is nothing new in the idea of having seadromes anchored at convenient distances apart across the Atlantic. From time to time similar proposals have been put forward, and but for the war one scheme would very probably have been carried out. Responsible authorities regard the proposal as thoroughly practicable. If the seadromes could be provided within a short period of the cessation of hostilities no doubt British air lines would welcome the facilities for they would enable air transport services to be run to and from the United States with such types of aircraft as would be immediately available.

## POWDER METALLURGY

From *Engineering* (London, Eng.), March 26, 1943

### Refractory Metals

Further examples of circumstances in which it is more convenient or better, to use the powder-metallurgy technique than casting are afforded by refractory metals such as tungsten, molybdenum, tantalum, platinum, etc. All these materials can be cast, but it is an expensive and difficult technique in view of the high melting points, and in many cases the cast product is certainly not so satisfactory as that made from powders. It is particularly interesting to note that platinum has been worked up by powder metallurgy from the very earliest days and the details of the process were described by Wollaston in 1829.

Tungsten metallurgy is a typical example of powder metallurgy applied to the refractory metals. The tungsten powder, having very carefully controlled chemical and physical qualities, is reduced from the oxide by heating in hydrogen. The powder is pressed under hydraulic presses into bars from 8 to 24 in. in length and normally 1 cm. square in cross section. Additions of paraffin to the powder may be made to assist the pressing operation and improve the green strength of the compact. Next, the bar is pre-sintered in hydrogen at 900 deg. to 1,100 deg. C., for half an hour. This treatment is given purely to increase the strength sufficiently to permit of manual handling for the next stage, which is the final sintering operation. This operation is conducted by mounting the bar between water-cooled contacts in an atmosphere of hydrogen, and alternating current is passed through it sufficient in intensity to raise the temperature nearly to the melting point. A normal bar requires a current of some 2,100 amperes at 10 to 15 volts for a period of about 30 minutes. The temperature is controlled by regulation of the wattage employed. During sintering, shrinkage to the extent to about 17 per cent occurs. After sintering, the bar is strong, but very brittle, and cannot be deformed at room temperature without fracture. It can, however, be manipulated in the neighbourhood of 1,300 deg. C., and is, in fact, subsequently brought down to the dimensions of a wire by hot swaging at these temperatures. Other complicated mechanical and thermal processes follow to produce the remarkable single crystal "coiled-coil" electric-lamp filament which is so familiar.

General experience gained with powder metallurgy, and in particular with refractory metals, has shown that it is a technique which is particularly suitable for the working up and consolidating of metals in mass (as distinct from the manufacture of articles). Over the normal processes of smelting and casting, powder metallurgy shows several advantages; in particular it is possible to control compositions with precision, it frequently permits of the production of purer metals, it obviates casting defects such as blow-holes, inclusions, etc., it allows control over grain size and shape which cannot be approached by casting, and last, but not least, frequently introduces a considerable saving in power and labour expenditure. These advantages are familiar to the workers in refractory metal, but are only just beginning to be appreciated by the metallurgist handling the everyday metals, iron, nickel, copper, etc. It is interesting to speculate whether the metallurgy of the commoner metals will become powder metallurgy. There are indications that this is taking place and one recent example is the coalescence process for copper, which is powder metallurgy pure and simple, and inasmuch as the product appears to have improved qualities with respect to electrical conductivity, ability to absorb cold, and freedom from casting defects, it is a technique which is likely to develop and extend in the future.

### Iron Parts

Consideration will next be given to the field of powder metallurgy in which, apart from other reasons and advantages, it is actually a cheaper technique than most methods. This field is best illustrated by the manufacture of a number of various small iron parts which is being undertaken on a considerable scale in America. Saving in manufacturing costs by using powder metallurgy is mainly achieved at the present time in cases in which the die and the metal-powder costs can be more than offset by the production of large numbers of parts in which, normally, a considerable amount of skilled machining is required. The iron parts referred to are more or less non-porous, or have a low porosity, and are not to be considered as bearing materials, although they are frequently given self-lubricating properties by oil impregnation or the addition of graphite. Typical of such parts are a tappet from a washing machine, a part from a push-button radio tuner, a part in a dictating machine, a "non-squeaking" part from a motor-car window winder, and a motor-car oil-pump gear wheel. This last item is a remarkable achievement and has received considerable publicity. It is a small gear used to circulate the oil in a General Motors car. The gear teeth must be true involute curves and accurately formed to avoid noisy operation or binding. In the past it has been machined from a cast blank at considerable expense. The powder-metallurgy product is in every way superior and cheaper. A large number of advantages have been cited in its favour, but it will suffice to mention the facts that machining is dispensed with and waste of raw material avoided, moreover, the gear has a more accurate contour and better surface finish and is therefore more silent in operation.

Iron parts of this type are manufactured much on the lines used for the porous bronze bearings. Similar presses can be used, but the pressures are higher, namely, from 30 tons to 40 tons per sq. in. Sintering furnaces are similar, and the sintering temperature is in the region of 1,100 deg. C. Furnaces fitted with roller hearths, or wire-mesh conveyor belts, are employed. The sintering time is from 20 minutes to 40 minutes in an atmosphere of dried, partially-combusted hydrocarbon gas. There is, generally, a slight shrinkage during sintering amounting to ½ to 3 per cent. In most cases the pieces are sized after sintering; generally cold, but in some cases hot, at 400 to 500 deg. C. Iron parts made in this manner have been produced experimentally with tensile strengths exceeding 50 tons per sq. in., but the qualities of iron powder at present commercially available, and bearing in mind that wear on the dies increases with pressing pressure, it is not customary to exceed a tensile strength of 9 to 15 tons. These parts can, therefore, be regarded as having properties very similar to those of ordinary cast-iron. As commercial experience is gained it will become possible to make use of the results of laboratory investigations in which higher pressures and alloy-steel powders have been employed.

### Hot Pressing

Finally, something must be said about hot pressing as a powder-metallurgy technique. In this method, pressure is applied to the powder while it is cold, and the cold-compressed compact is heated up and then pressed again while it is hot. The method can be worked out in several ways, and techniques involving hot forging or hot extrusion can be adopted. So far, however, the method has received little industrial attention. I have examined a wide variety of alloys prepared from powders by this technique, and find that it not only combines all the advantages usually associated with powder metallurgy, but, in addition is capable of giving compacts having excellent mechanical properties; in some cases these are superior to those of the cast article. These results have been published in detail, and it will be sufficient to state here that with an ordinary cast-iron, tensile strengths of 36 tons per sq. in., and with bronzes, tensile strengths in excess of 23 tons per sq. in., combined with an elongation in excess of 75 per cent, have been secured.

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

### THE PRESIDENT VISITS QUEBEC BRANCHES

The second chapter of the story of President Cameron's tour of the branches was written in the province of Quebec during the month of June. This time the branches of Quebec, Saguenay and St. Maurice Valley were visited, in addition to which a regional meeting of Council was held in Quebec.

There were several features not always found in a president's tour. Chief among these was the boat trip from Quebec to the Saguenay and return. This was a very pleasing experience, combining a vacation atmosphere with a practical method of overcoming the transportation and hotel congestion associated with Arvida. On this trip, the president and Mrs. Cameron were accompanied by Past Vice-president Eric Muntz and Miss Peggy Muntz, Past President A. R. Décary, Vice-president Hector Cimon, the general secretary and the assistant general secretary.

On Saturday the 19th, a Council meeting was held at the Château Frontenac, followed by a luncheon meeting with the branch over which Branch Chairman René Dupuis presided. Later in the afternoon, the president examined the building and equipment for the Faculty of Science of Laval University, under the guidance of René Dupuis, director of the department of electrical engineering, and chairman of the branch.

Early Sunday morning the party left by boat for Bagotville, and on Monday morning, again early, motored to Arvida.

Using the delightful Saguenay Inn as a base, the party visited many parts of the city. The afternoon was devoted to an examination of the power development at Shipshaw, an enterprise so huge in conception, and so far flung in execution, that the mind has difficulty in grasping it.

In the evening a dinner meeting was held with the branch. Although there was no head table, the meeting was "chaired" by R. H. Rimmer, chairman of the branch. The members of the president's party were set one at each of the other tables—an excellent idea. About eighty were in attendance.

The party returned late that night to Bagotville, and again boarded ship for the return trip to Quebec next day, arriving there in the early evening of Tuesday.

On Wednesday morning, the president and general secretary paid a visit to A. O. Dufresne, president of the Corporation of Professional Engineers of Quebec, at his office in the Parliament Buildings. With Mr. Dufresne was J. O. Martineau a councillor of the Corporation.

In the afternoon, officers of the Quebec Branch drove the party to Three Rivers for the meeting with the St. Maurice Valley Branch. En route a delightful diversion was afforded by a short visit to the summer home of Past President Décary at Batiscan, where the house still standing intact and in full use was built in 1660.

At Three Rivers in the late afternoon, the plant of the Canada Iron Foundries was visited by all those attending the branch meeting. This plant is engaged largely in manufacturing marine engines for medium sized freighters. It was interesting to see so much of the work done in one shop, including the massive castings for the base. The shop afforded an excellent demonstration of the ingenuity of man in the adaptation of old machines to new purposes.

After the inspection, the group of almost ninety gathered at the St. Maurice Hotel for dinner, under the chairmanship of J. H. Frégeau. Besides the president, the speakers programme included Past President Décary, Past Vice-president H. O. Keay and the general secretary.

It was a real pleasure for everyone to see F. X.T. Berlinguet, one of the oldest—if not the oldest—member of the Institute who is now in his 89th year. He joined the Institute in 1887 as an Associate Member. He is in splendid health and still practising his profession as a consulting engineer, and surveyor.

On Thursday 24th, the party returned by train to Montreal and Ottawa. In the large attendances at these meetings and the cordiality in evidence everywhere, can be seen the accumulated effects of the long series of visits of successive presidents. It is to be hoped that nothing will ever interfere with these tours, because they do so much to bind together the branches, and to stimulate activities everywhere.

### TENTATIVE PROGRAMME FOR JOINT ASME-EIC MEETING

As we go to press, some of the details of the programme for the joint meeting with The American Society of Mechanical Engineers have just been worked out and it is now possible to give the topics which will be discussed during the professional sessions in Toronto.

Instead of breaking down the programme into several concurrent technical meetings, it was thought advisable to hold six main sessions dealing with the principal problems of mechanical engineering as related to the war. For this reason it was found necessary to extend the meeting at least another half day, so that the dates are now September 30th, October 1st and 2nd.

The meeting will open on Thursday morning with a session on STEAM POWER. Discussion will bear on the changes in steam generation principles—particularly in marine equipment—brought about by the war and their resultant effect on power generation in the future. Mr. E. G. Bailey, vice-president of Babcock & Wilcox, New York, will be the speaker from the American Society.

At luncheon on that day the speaker will be Brigadier-General John K. Christmas, deputy chief, Tank Automotive Centre, Detroit Ordnance Department, United States Army.

The afternoon session will be devoted to the discussion of TRANSPORTATION problems. It is expected that the Canadian speaker will give a broad economic treatment of the Canadian railway problem, whereas the speakers from the United States will deal with railroad and air transportation equipment developed during wartime and the effect of such developments on peace-time transportation.

Instead of planning any social function for Thursday evening, it was thought advisable to hold another professional session at 8 p.m., at which time there will be a discussion on POST-WAR PLANNING, thus giving an opportunity to those members who could not attend during the day, to participate in the discussion of this important subject. It is intended to describe the necessary components of post-war planning by government and industry, and the need for co-ordination between these components as well as the limits of their respective fields. The presentation of the American point of view will be made by Ralph E. Flanders, past-president of The American Society of Mechanical Engineers; chairman, Committee on Economic Development; and president of Jones & Lamson Machine Company, Springfield, Vt.

The morning session on Friday will be given over to a discussion on CONSERVATION OF MATERIALS. A description will be given of the steps taken to achieve conservation through modification of design and substitution of less critical materials and a discussion will take place on the relative merits of different methods of fabrication, e.g., forging versus casting, versus welding. Mr. H. Coonley, chairman, Conservation Division, War Production Board, Washington, D.C., has already agreed to take part in this symposium.

It is expected that the luncheon speaker on that day will be a Canadian engineer prominent in the organization of war production. The Friday afternoon session will be devoted to a discussion of MANPOWER UTILIZATION, with particular reference to the steps taken by industry and government in establishing policies in training, upgrading and substitution. The American speaker will be Lawrence A. Appley, deputy director, War Manpower Commission, Washington, D.C.

As mentioned elsewhere, the dinner speaker on Friday night will be William L. Batt.

On Saturday morning, October 2nd, there will be a technical session devoted to PRODUCTION ENGINEERING. Prominent speakers from both the United States and Canada will give summaries of outstanding contributions of production engineering, particularly in ordnance and aircraft manufacturing.

## W. L. BATT TO BE GUEST SPEAKER

As a feature of the joint meeting to be held in Toronto on Thursday, September 30th and Friday, October 1st, between The American Society of Mechanical Engineers and The Engineering Institute of Canada, Dr. W. L. Batt, vice-chairman of the War Production Board and past-president of The American Society of Mechanical Engineers will be the speaker at the dinner on the Friday night. Mr. Batt is one of the outstanding engineers in North America, and almost since the outbreak of the war has been doing special work for the government of the United States at Washington. He is president of the S.K.F. Industries Inc.

## RECRUITING BY CIVILIANS

In the early days of the war the Institute received frequent requests for assistance in recruiting personnel for the active services. Sometimes these requests were for one person; other times for a substantial number. Since the creation and recognition of the Wartime Bureau of Technical Personnel such inquiries have gone there, as was natural.

Doubtless during the same period other organizations received similar requests. It would be interesting to know if any of them were asked to aid in recruiting below the professional level. It seems that in the United States there has been a greater effort to utilize the service of those groups which employed or supervised the technical and artisan groups. It has been disclosed that through civilian organizations many thousands of individuals have been "steered" into the service units where their special training could be used to advantage.

The following account which has been taken from the *Engineering News-Record* of June 10th, indicates the splendid support which engineers and contractors are giving the army. Such co-operation between the military and the civilian should do much towards solving each other's related problems, by uncovering for the army the types of men it requires, and yet preserving for the industry those persons who are reasonably essential to it.

### NEW YORK CONTRACTING ORGANIZATIONS SPONSOR ARMY RECRUITING DINNER

Large dinner held in New York to aid Army engineers in recruiting men from the construction industry for construction regiments

Over fifteen hundred contractors and engineers from the New York Metropolitan district gathered for dinner in the ball room of the Commodore Hotel in New York on June 3 to honour Major General Eugene Reybold, chief of engineers, U.S. Army. The dinner had been arranged to assist the Army engineers in their campaign to recruit 100,000 men from the construction industry of this country for the general service and special service regiments that the army now is raising for service abroad. John P. H. Perry, vice-president, Turner Construction Co., acted as toastmaster. James W. Escher, president, Metropolitan Builders Association, in outlining the purpose of the dinner, said that he hoped it would be but the first of many such dinners to be held across the country under sponsorship of the A.G.C. and like organizations.

#### Recruiting Well Started

Brig. Gen. B. C. Dunn, division engineer of the North Atlantic Division, stated that 2,200 men already had been recruited in that division and that the high caliber of the men received had been the subject of comment from the units to which they were assigned.

The units now being organized by the army are for construction overseas. Men between the ages of 18 and 50 who are physically fit for overseas duty are accepted. Men skilled in construction trades are desired, but young men lacking these skills will be given training at Camp Claiborne, La., and elsewhere.

Most of the enlisted men in general service regiments have ratings above that of the private, there being less than 200 privates among the 1,200 men in a general service regiment. Officers are drawn in large part from the construction industry.

#### Construction Moves Abroad

Construction for the Army, said General Reybold, has shifted from this country, where it could be done by civilian contractors, to foreign fields, where it must be done by men trained and equipped to defend themselves in case of attack if that becomes necessary. During the period of intensive construction in this country, many men of draft age on construction jobs were given deferment. Now they are being released and it is hoped that the skills that they have developed can be made of most use by getting them into the construction regiments that are being organized. To that end, a plan has been worked out whereby, through voluntary induction, men between 18 and 38 can be assured of assignment to such regiments. Men desiring such assignment, General Reybold said, should apply to local division or district offices of the Corps of Engineers where they will be interviewed and given letters to their local draft boards asking their assignment to engineer units if they apply for induction before their numbers come up. Men up to 50 with construction skills may enlist through regular recruiting channels.

General Reybold said that it would be a tragic mistake to let these men get into army units where their construction skill could not be used to best advantage when men with such skills are badly needed in prosecution of the war. He observed also that both the men themselves and the construction industry generally would gain by a plan that would keep these men in shape for the construction jobs that lie ahead in the post-war period.

## NEXT ANNUAL MEETING IN QUEBEC

At the regional meeting of the Council held in Quebec city, on June 19, an invitation from the Quebec Branch to hold the next annual meeting of the Institute in that city was accepted.

The last time the annual meeting was held in Quebec was in 1927, when Dr. A. R. Décary was president of the Institute. Memories of the brilliant functions which marked the occasion are still vivid in the minds of those who were present.

Under present conditions the social features of the next meeting will necessarily be reduced to the minimum and attention will be directed to the discussion of the problems connected with the war.

It is hoped that many members of the Institute will be able to get away from their work for a few days in order to meet and discuss their common problems with their confrères, at the same time enjoying the charm of the ancient city and the traditional "hospitalité québecoise".

The dates are February 10th and 11th, 1944, and the headquarters for the meeting will be the Château Frontenac.

## THE ENGINEERING INSTITUTE OF CANADA PRIZE AWARDS 1943

Twelve prizes known as "The Engineering Institute of Canada Prizes" are offered annually for competition among the registered students in the year prior to the graduating year in the engineering schools and applied science faculties of universities giving a degree course throughout Canada.

Each prize consists of twenty-five dollars in cash, and having in view that one of the objects of the Institute is to facilitate the acquirement and interchange of professional knowledge among its members, it has been the desire of the Institute that the method of award should be determined by the appropriate authority in each school or university so that the prize may be given to the student who, in the year prior to his graduating year, in any department of engineering has proved himself most deserving as disclosed by the examination results of the year in combination with his activities in the students' engineering organization, or in the local branch of a recognized engineering society.

The following are the prize awards for 1943:

| | |
|---|---|
| Nova Scotia Technical College | Robert Bernard Wilcox |
| University of New Brunswick | Sydney Eugene Acker, S.E.I.C. |
| McGill University | Donald Robertson Brown, S.E.I.C. |
| Ecole Polytechnique | Jacques Miron, S.E.I.C. |
| Queen's University | Jack Willsie Kirk |
| University of Toronto | Robert Harvey Aspinall |
| University of Manitoba | Douglas J. Roy |
| University of Saskatchewan | James Anthony Wheat |
| University of Alberta | No award |
| University of British Columbia | Stanley James Beaton |
| Laval University | Lionel Boulet, S.E.I.C. |
| Royal Military College of Canada | No award—regular course discontinued during the war. |

## RECENT GRADUATES IN ENGINEERING

Congratulations are in order to the following Junior and Students of the Institute who have completed their courses at the various Universities:

### McGILL UNIVERSITY

#### HONOURS, MEDALS AND PRIZE AWARDS

Anderson, James Douglas, Lunenburg, N.S., B.Eng. (Mech.); University Scholar; British Association Medal; Honours in Mechanical Engineering; The Jenkins Brothers Limited Scholarship, June, 1942.
Bernstein, Saul, Montreal, Que., B.Eng. (Mech.), University Scholar; Honours in Mechanical Engineering.
Freeman, Paul Ora, Toronto, Ont., B.Eng. (Ci.); The Engineering Undergraduates' Society's Second Prize for Summer Essay.
Hobson, William, Montreal, Que., B.Eng. (Elec.); Honours in Electrical Engineering; Montreal Light, Heat and Power Consolidated, Second prize.
Killam, Robert Bradbury, Yarmouth, N.S., B.Eng. (Mech.); Honours in Mechanical Engineering.

#### DEGREE OF BACHELOR OF ENGINEERING

Allen, James Lawrence, McConnell, Man. (Mech.).
Backer, George Ernest, Grand'Mère, Que. (Mech.).
Baker, Donald Blair, Summerside, P.E.I. (Mech.).
Baker, Maxwell Clifford, Botwood, Nfld. (Ci.).
Berry, Arthur Herbert, St. Lambert, Que. (Mech.).
Blakely, Nelson Wesley, Winnipeg, Man. (Mech.).
Bloom, Charles Abie, Montreal, Que. (Mech.).
Burgess, Basil Arthur, Montreal, Que. (Mech.).
Charton, Herman, Verdun, Que. (Chem.).
Cohen, Peter Zelig, Outremont, Que. (Mech.).
Covo Stramba, Pedro Victor, Montreal, Que. (Mech.).
Cyr, William Henry, Grande Ligne, Que. (Mech.).
Freeman, John Edward, Iroquois Falls, Ont. (Mech.).
Garceau, Gilles, Shawinigan Falls, Que. (Mech.).
Gareau, Léo Eugène Arthur, Outremont, Que. (Elec.).
Gold, Manuel Theodore, Outremont, Que. (Mech.).
Howe, Lloyd George, Calgary, Alta. (Mech.).
Kennedy, Lowell Keith, Southport, P.E.I. (Mech.).
Klein, Max, Montreal, Que. (Chem.).
Leonards, Gerald Allen, Montreal, Que. (Ci.).
Matthews, Clair Robert, Danville, Que. (Mech.).
Miller, Zavie, Outremont, Que. (Mech.).
Norton, Harold Arthur, Montreal, Que. (Chem.).
Ritchie, Ross Alfred, Chateauguay Heights, Que. (Mech.).
Roche, Maurice John, Flin Flon, Man. (Chem.).
Sheinberg, Sydney, Montreal, Que. (Mech.).
Stewart, James Johnston, Montreal, Que. (Ci.)
Tétrault, Robert, Montreal, Que. (Elec.).
Wein, Harry Garrick, Outremont, Que. (Ci.).
Woods, Jack Myer, Montreal, Que. (Chem.).

### ECOLE POLYTECHNIQUE

#### DISTINCTIONS ET PRIX

Gaudreau, Marcel, Montréal, Qué., B.Sc.A. (mécanique-électricité), I.C., avec grande distinction. Médaille de Son Exc. le Lieutenant-Gouverneur de la Province. Médaille d'or de l'Association des Diplômés de Polytechnique.
Labrosse, Fernand, Montréal, Qué., B.Sc.A. (mécanique-électricité), I.C., avec distinction.
Auger, Roland, Outremont, Qué., B.Sc.A. (mécanique-électricité), I.C., avec distinction.
Salvas, Paul-Emile, Montréal, Qué., B.Sc.A. (mécanique-électricité), I.C., avec distinction. Médaille d'Argent de l'Association des Diplômés de Polytechnique.
Leroux, Florian, Outremont, Qué., B.Sc.A. (mécanique-électricité), I.C., avec distinction. Médaille de Bronze de l'Association des Diplômés de Polytechnique.
Audet, Henri, Outremont, Qué., B.Sc.A. (mécanique-électricité), I.C., avec distinction.
Baribeau, Benoit, Pointe-Gatineau, Qué., B.Sc.A. (chimie industrielle), I.C., avec distinction.
Brunette, Charles-Edouard, Montréal, Qué., B.Sc.A. (chimie industrielle), I.C., avec distinction.
Joubert, Maxime, St-Lambert, Qué., B.Sc.A. (mécanique-électricité), I.C. Médaille de Bronze de l'Association des Diplômés de Polytechnique.
Quintal, Robert, Montréal, Qué., B.Sc.A. (travaux publics—bâtiments), I.C. Prix Ernest Cormier.
Douville, Paul-Emile, Montréal, Qué., B.Sc.A. (chimie-industrielle), I.C. Prix de la Cinquantième Promotion de l'Ecole Polytechnique.

#### DEGRÉ DE BACHELIER ÈS SCIENCES APPLIQUÉES ET DIPLÔME D'INGÉNIEUR CIVIL

Boyd, Robert, Montréal, Qué. (mécanique-électricité).
Grondines, J. Léon, Montréal, Qué. (mécanique-électricité).
Trudeau, Jean, Montréal, Qué. (mécanique-électricité).
Le Brun, Hubert, Montréal, Qué. (mécanique-électricité).
Magnan, Maurice, Montréal, Qué. (mécanique-électricité).
Pageau, Marcel, Ville La Salle, Qué. (mécanique-électricité).
Laroche, Jean-Luc, Montréal, Qué. (mécanique-électricité).
Ménard, Jean, Montréal, Qué. (mécanique-électricité).
Madore, Paul-René, Montréal, Qué. (mécanique-électricité).
Cadieux, Jean, Montréal, Qué. (mécanique-électricité).
Lavallée, Jean-Charles, Montréal, Qué. (mécanique-électricité).
Thibault, Bernard, Montréal, Qué. (mécanique-électricité).
Turgeon, Maurice, Montréal, Qué. (mécanique-électricité).
Laverdure, Conrad, Montréal, Qué. (mécanique-électricité.)
Lebel, Marcel, Montréal, Qué. (travaux publics—bâtiments.)
Mousseau, François, Montréal, Qué. (travaux publics—bâtiments).
Thauvette, Laurent, Vaudreuil, Qué.*(travaux publics—bâtiments).
Sansfaçon, Jacques, Montréal, Qué. (travaux publics—bâtiments).
Shooner, Jacques, Montréal, Qué. (travaux publics—bâtiments).
Vaillancourt, Rosaire, Montréal, Qué. (travaux-publics—bâtiments).
Pépin, Maurice, Longueuil, Qué. (travaux publics—bâtiments).
Chadillon, François, Montréal, Qué. (chimie industrielle).

### UNIVERSITY OF ALBERTA

#### HONOURS AND PRIZE AWARDS

Campbell, Donald Kilgour, Edmonton, Alta., B.Sc. (Ci.), The Webb Memorial Student Paper Competition (Second).
Hiller, Walter Andrew, Edmonton, Alta., B.Sc. (Ci.); First Class General Standing in Applied Science; The H.R. Webb Memorial Prize offered by the Association of Professional Engineers of Alberta in Civil Engineering.

#### DEGREE OF BACHELOR OF SCIENCE

Casault, Joseph McGill, Edmonton, Alta. (Ci.).
Fish, Arthur William, Peace River, Alta. (Ci.).
Hannah, Merwin Russell, Halifax, N.S. (Elec.).
Hargrave, Arthur Ralph Carlton, Red Cliff, Alta. (Ci.).
Hislop, Richard H., Edmonton, Alta. (Ci.).
McPherson, John Donald Perrin, Edmonton, Alta. (Ci.)
Morrison, Lloyd Fletcher, Cowley, Alta. (Ci.).
Poole, George Ernest, Edmonton, Alta. (Ci.).
Samuel, Albert Benjamin, Banff, Alta. (Ci.).
Simpson, Jack Lloyd, Edmonton, Alta. (Ci.).
Smith, Leroy Elsworth, Edmonton, Alta. (Ci.).
Wilkins, Ernest Bertram, Lethbridge, Alta. (Ci.).
Willson, Bruce Franklin, Edmonton, Alta. (Ci.).

### UNIVERSITY OF TORONTO

#### HONOURS

Archibald, Huestis Everett, Toronto, Ont., B.A.Sc. (Ci.); Honours in Civil Engineering
Maclean, Donald Gordon, Toronto, Ont., B.A.Sc. (Ci.); Honours in Civil Engineering.
Muller, Richard Alfred, Toronto, Ont., B.A.Sc. (Engrg. Physics); Honours in Engineering Physics.

Scott, Ronald Edwin, Toronto, Ont., B.A.Sc. (Engrg. Physics); Honours in Engineering Physics.
Telford, Robert Brown, Toronto, Ont., B.A.Sc. (Ci.); Honours in Civil Engineering.

#### DEGREE OF BACHELOR OF APPLIED SCIENCE

Allin, Arthur Daniel, Toronto, Ont. (Ci.).
Ashton, Hugh Williams, Toronto, Ont. (Chem.).
Bessant, William Edward, Toronto, Ont. (Chem.).
Curzon, David Macklem, Guelph, Ont. (Ci.).
Dyke, John Morley, Toronto, Ont. (Mech.).
Hamlin, Donald Latham Blacker, Toronto, Ont. (Ci.).
Hibbard, David Ernest, Toronto, Ont. (Ci.).
Love, John Gordon, Toronto, Ont. (Ci.).
Mackenzie, Arthur Drury, Toronto, Ont. (Ci.).
MacVannel, Duncan Pyne, Toronto, Ont. (Mech.).
Near, Frank Manning, Toronto, Ont. (Ci.).
Oldreive, Donald Drake, Toronto, Ont. (Ci.).
Onasick, Peter, Toronto, Ont. (Ci.).
Smith, Claude Harry Mortimer, Oshawa, Ont. (Ci.).
Smith, Peter Douglas, Toronto, Ont. (Elec.).
Tod, James Alexander, Newmarket, Ont. (Ci.).
Weller, Robert Charles, Toronto, Ont. (Ci.).
Zimmerman, George Douglas, Toronto, Ont. (Chem.).

#### DEGREE OF MASTER OF APPLIED SCIENCE

Beaupré, Bernard, Montreal, Que., B.Sc.A.

#### DEGREE OF METALLURGICAL ENGINEER

Beard, George Francis, B.A.Sc., Toronto, Ont.

### QUEEN'S UNIVERSITY

#### DEGREE OF BACHELOR OF SCIENCE

Blackett, Robert Leslie, Moncton, N.B. (Chem.).

### NOVA SCOTIA TECHNICAL COLLEGE

#### HONOURS, MEDALS AND PRIZE

Bowes, William Henry, Halifax, N.S., B.Eng. (Mech.); Governor-General's Medal; Association of Professional Engineers of Nova Scotia, Prize.
Eisenhauer, Martin Albert, Lunenburg, N.S., B.Eng. (Mech.); Honours in Mechanical Engineering; Alumni Medal.
Vail, Gilbert Frank, Sydney, N.S., B.Eng. (Elec.); Honours in Electrical Engineering.

#### DEGREE OF BACHELOR OF ENGINEERING

Clark, Frederick Hubert, St. John's, Nfld. (Mech.).
Edwards, George Robert, Halifax, N.S. (Elec.).
Foley, Maurice Aloysius, Halifax, N.S. (Mech.).
Foster, John Stanton, Halifax, N.S. (Mech.).
Haliburton, George MacDonald, Halifax, N.S. (Mech.).
Janigan, George Gregory, Halifax, N.S. (Mech.).
Langille, Lorimore Leon, Lunenburg, N.S. (Mech.).
MacDougall, Lorne Wells, Ellerslie, P.E.I. (Ci.)
Marshall, Herbert Ansley, Dartmouth, N.S. (Mech.).
Tulk, Egbert Gordon, Halifax, N.S. (Elec.).

### UNIVERSITY OF SASKATCHEWAN

#### DEGREE OF BACHELOR OF SCIENCE

Bing-Wo, Reginald, Regina, Sask. (Ci.).
Kennedy, Thomas Vernon, Unity, Sask. (Ci.).
Leeper, Robert Patrick, Vancouver, B.C. (Mech.).
Mikkelborg, Gordon Hodgson, Zealandia, Sask. (Mech.).
McLeod, George Carroll, Plato, Sask. (Ci.).
Thompson, Charles Mervin, Regina, Sask. (Ci.).

### UNIVERSITY OF NEW BRUNSWICK

#### SCHOLARSHIP AND MEDAL

Loane, George Herbert, Campbellton, N.B., B.Sc. (Elec.); The Brydone-Jack Memorial Scholarship for the highest standing in fourth year Electrical Engineering.
McFarlane, Howard William, Fredericton, N.B., B.Sc. (Ci.); The Ketchum Silver Medal for the highest standing in fourth year Civil Engineering.

#### DEGREE OF BACHELOR OF SCIENCE

Cole, Robert Arnold, Ottawa, Ont. (Elec.).
Downman, Bernard Hugh, Westmount, Que. (Elec.).
Gerrard, James Herbert, Fredericton, N.B. (Ci.).
Heinze, Laurence Sherwood, Fredericton, N.B. (Ci.).
Hubbard, Frederick Wilmot, Fredericton, N.B. (Elec.).
Long, Ludovic Andrew, Albertine, N.B. (Elec.).
Marr, Ralph Burton, Fairville, N.B. (Elec.).
Morehouse, Rupert Henry, Fredericton, N.B. (Ci.).
Mundee, Lawrence Sterling, West Saint John, N.B. (Elec.).
Macdougall, Douglas Keith, Fredericton, N.B. (Ci.).
MacMillan, John Daniel, Campbellton, N.B. (Ci.).
Macnab, Edward Nelson, Montreal, Que. (Elec.).
McDermott, Arthur Gregory Paul, Saint John, N.B. (Elec.).
McElwain, Donald Melvin, Fredericton, N.B. (Ci.).
McLaughlin, Robert Hugh Benson, Fredericton, N.B. (Ci.).
Rogers, John Douglas, St. Stephen, N.B. (Elec.).
Ross, Gordon William, Peterborough, Ont. (Elec.).
Smith, Robert Rudolph, Fredericton, N.B. (Ci.).
Watt, John Simmons, Ottawa, Ont. (Ci.).

### UNIVERSITY OF MANITOBA

#### MEDALS

Chambers, Joseph Byng, Killarney, Man., B.Sc. (Elec.); University Gold Medal.
Hink, Anthony Albert, Winnipeg, Man., B.Sc. (Ci.); University Gold Medal.

#### DEGREE OF BACHELOR OF SCIENCE

Bolton, Gerald Henry, Winnipeg, Man. (Ci.).
Cosman, Ernest, Winnipeg, Man. (Ci.).
Dahl, Henry Lewis, Winnipeg, Man. (Elec.).
Farish, Frank John, Winnipeg, Man. (Ci.).
Francis, James Scott, Winnipeg, Man. (Elec.).
Glenn, Clayton Holly, Winnipeg, Man. (Elec.).
Jeske, Robert August, Winnipeg, Man. (Elec.).
Keay, William Logan, Winnipeg, Man. (Ci.).
Lindsay, Colin, Winnipeg, Man. (Elec.).
Morison, George Alfred, Winnipeg, Man. (Ci.).
Morris, Walter Victor, Winnipeg, Man. (Ci.).
Muirhead, Charles Randolph, Winnipeg, Man. (Elec.).
Orloff, Irving, Winnipeg, Man. (Ci.).
Sawyer, John Edward Benjamin, Winnipeg, Man. (Ci.).
Shane, Walter Roulston, Winnipeg, Man. (Elec.).
Swarek, Martin, Winnipeg, Man. (Elec.).
Termuende, John Edward, Montreal, Que. (Elec.).
Tivy, Robert Harrison, Winnipeg, Man. (Elec.).
Waldron, John Ross, Winnipeg, Man. (Elec.).
Whaley, Claire Edward, Winnipeg, Man. (Elec.).

## CORRESPONDENCE

### Alaska Highway

To the Editor,
Engineering Journal, April 27th, 1943.
Dear Sir,

Relative to General Sturdevant's address on the Alaska Highway which is printed in the March issue of *The Engineering Journal*, it is of interest that about 1930 the late Colonel William Mitchell of the U. S. Army discussed with the writer his idea of a chain of airfields and a highway to Alaska from Edmonton, which was based on information he obtained from Klondyke miners which came in by that route while he was with the Signal Corps of the U. S. Army in Alaska. The existing airfield at Peace River was to be the first of the chain, and the highway was to start from the railhead of the Central Canada Branch of the Northern Alberta Railways which was *north* of the Peace River.

The Alaska Highway as built follows Colonel Mitchell's plan substantially, except that it starts from Dawson Creek the railhead of the Northern Alberta Railways on the *south* side of the river instead of from Hines Creek the railhead on the *north* side of the river as planned by Mitchell. This starting from Dawson Creek makes it necessary to cross the Peace River at Fort St. John, and this crossing is one of the major difficulties of the Alaska Highway. The Peace River at this point is wide and it is subject to ice troubles and to floods which may reach 300,000 cu. ft. per sec. Mr. MacDonald, U. S. Commissioner of Highways, has stated that the crossing will be by an 1,800 ft. suspension bridge. But this will require much time and critical material, and furthermore the plateaux on which the highway is located are 800 to 900 ft. above the river at this point; and experience in northern Alberta is that such approach grades and cut bank locations usually require extensive maintenance. It might be well to consider building a highway from the railhead on the *north* side of the river, as planned by Mitchell, to connect with the highway already built north from Fort St. John. A pack trail has been operated over this route for many years.

W. L. Waters, M.E.I.C.,
*Consulting Engineer*,
New York, N.Y.

## REGIONAL MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Château Frontenac, Quebec, on Saturday, June 19th, 1943, at nine forty-five a.m.

*Present*—President K. M. Cameron (Ottawa) in the chair; Vice-President Hector Cimon (Quebec); Councillors E. V. Gage (Montreal), E. D. Gray-Donald (Quebec), R. E. Heartz (Montreal), H. J. Ward (Shawinigan Falls), General Secretary L. Austin Wright and Assistant General Secretary Louis Trudel.

There were also present by invitation—Past-Presidents A. R. Décary (Quebec) and O. O. Lefebvre (Montreal); Past Vice-Presidents E. P. Muntz and Fred Newell of Montreal; Past-Councillor Bruno Grandmont (Rimouski); R. S. Eadie, chairman, Montreal Branch; and the following members of the Quebec Branch: René Dupuis, chairman, L. C. Dupuis, past-chairman, Paul Vincent, secretary-treasurer, Stanislas Picard, Gustave St. Jacques and Y. R. Tassé, members of the executive, and Dr. Paul E. Gagnon.

In welcoming the councillors and guests, President Cameron expressed his pleasure in presiding at a Council meeting in Quebec city. Before proceeding with the business of the meeting, he asked each person present to rise, give his name, place of residence and Institute affiliation.

On behalf of the members of the Quebec Branch, Vice-President Cimon extended a cordial welcome to the president and the officers accompanying him, and stated that such visits were much appreciated by the branch.

*Committee on the Engineer in the Civil Service*—Referring to the report which the Institute's committee, under the chairmanship of Councillor MacRostie, had presented to the "Advisory Committee to the Treasury Board on Administration of Personnel," the general secretary reported that after receiving the report of its Advisory Committee, the Treasury Board had presented its report and recommendations to Parliament. As far as the Institute's representations were concerned, the report of the Treasury Board included none of them, although it was generally understood that in its recommendations to the Treasury Board, the Advisory Committee had made favourable recommendations. A group representing the Civil Service had appealed the Treasury Board's report, and the Institute's committee wondered if Council would support it in making further representations. Following discussion, it was unanimously agreed that the Institute's committee be asked to make such further representations as it considered advisable.

*Committee on Professional Interests—Affiliated with Sister Societies*—In view of the far-reaching nature of the recommendations made by the Committee on Professional Interests in a report first presented to the regional meeting of Council held in Saint John on April 17th, it had been suggested that this report should be discussed at the regional meetings held throughout the year across Canada. Accordingly, the general secretary read again the first section of the report dealing particularly with the Institute's relations with sister societies.

Since that time, informal discussions had been held with officers of some of the sister societies in the United States, and the general secretary read a letter which had been received from the secretary of the American Society of Mechanical Engineers outlining several items which might be discussed by representatives of the societies with a view to closer co-operation.

Dr. Lefebvre read to the meeting extracts from a letter addressed to Dr. Challies, as chairman of the Committee on Professional Interests, from W. J. Gilson, vice-president of the American Institute of Electrical Engineers in Canada. It outlined some of the difficulties in working out such an affiliation, and emphasized the fact that the A.I.E.E. was a technical and not a professional group. Following considerable discussion, it was unanimously resolved that the letter from the secretary of the A.S.M.E. should be referred to the Committee on Professional Interests.

*Collective Bargaining Legislation*—Following the last meeting of Council, the brief approved at that meeting, urging that professional men be not included in any compulsory collective bargaining legislation, had been presented to the National War Labour Board by a delegation representing the architects, chemists and engineers. The results were not yet determined, but the general secretary reported that in similar legislation which was being drafted in certain of the States the professional groups were being included, although the American Society of Civil Engineers was putting up a strong fight to have them excluded from such legislation.

*St. Lawrence Waterway*—The president stated that he had nothing further to report on the proposal of Mr. J. G. G. Kerry that the St. Lawrence Waterway be kept open all the year round. He was hoping to have an early opportunity to discuss the matter with members of the Institute who had been in close touch with this development. Dr. Lefebvre stated that he had had considerable correspondence with Mr. Kerry on this subject and would be glad to discuss the matter with the president at his convenience.

*Toronto Branch Junior Section*—A request had been received from the chairman of the Toronto Branch for a contribution of $100.00 towards the funds of the Junior Section of that branch. Although anxious to do everything possible to aid Junior Sections the Finance Committee felt that it should have a financial statement from the branch before making a decision. In view of the fact that there is a Junior Section in the Montreal Branch and that others may be formed, the committee felt that it should have full details before recommending the allocation of special funds for this purpose. The general secretary was instructed to secure the necessary information for the Finance Committee.

*Purchase of Victory Bonds*—A letter had been received from President Cameron in which he had recommended that, in future purchases of war bonds, some allocation should be made whereby some of the smaller branches might get credit in their own districts. The bonds would be delivered to Headquarters as usual, but the branches would get some credit locally for the purchase. The Finance Committee had looked with favour on this recommendation and it had been agreed that the next purchase of bonds would be handled in this way.

*Building Maintenance*—The House Committee had reported that prices were being obtained for certain work which should be done on the Headquarters building. In order that the work might be proceeded with during the summer months the Finance Committee had agreed that when the figures were available they should be submitted to the members of the committee for approval and for authorization of the expenditure. This was noted and approved by Council.

*Journal Staff*—The general secretary outlined a possible expansion in the programme of the *Engineering Journal*, the idea being that if additional staff could be obtained a greatly improved Journal could be produced, and at the same time the advertising increased sufficiently to at least cover the increased costs. It was emphasized that every reasonable step should be taken to keep the Journal in the forefront of its field, and the Finance Committee submitted the suggestion to Council with the recommendation that the general secretary be authorized to investigate further and submit concrete proposals.

*Committee on Post-War Problems*—The general secretary read the following progress report from the chairman of the committee on Post-War Problems:

"Your Committee on Post-War Problems begs to report that the principal matter now before the committee deals with a reference to it by the president, that of considering what action the Institute may take towards co-operating with the established governmental agencies concerned with the rehabilitation of our own membership after war service. This matter has been referred to the whole personnel of the committee and the replies to date are not complete. They do, however, represent a variety of opinions, which we will transmit to Council when they are complete.

"I would like to pay tribute to the excellent work that is being done by one member of this committee Mr. Tennant. He is rather strategically located in Toronto where most organizations and associations with which we are co-operating hold their general meetings. Mr. Tennant has attended most of these meetings faithfully and reported on them in great detail. The entire committee is indebted to him for the load which he is carrying on our behalf."

The report was noted, and the general secretary was instructed to transmit to Mr. Tennant the thanks and appreciation of Council for the effective work he is doing on behalf of the Institute.

*Annual General Meeting*—On behalf of the Quebec Branch, Councillor Gray-Donald extended a cordial invitation to Council to hold the next annual general meeting in Quebec city. The invitation was enthusiastically received, and on the motion of Mr. Gray-Donald, seconded by Mr. Heartz, it was unanimously resolved that the invitation be accepted and that the next annual general meeting be held in Quebec City.

*Expulsion of Member*—It was reported to the meeting that a corporate member of the Institute had been tried and found guilty of a serious misdemeanor and was now serving a term of imprisonment.

After the evidence, in the form of a newspaper account and a copy of the court records, had been submitted to Council, it was moved, seconded, and unanimously agreed that the name of such member should be erased from the register of the Institute in accordance with Section 76(a) of the by-laws. The general secretary was instructed to notify the member of Council's action.

*President's Trip to the Western Branches*—Following a custom established by Dr. Lefebvre, President Cameron reported that he was planning his visit to the western branches during the month of October, and was also planning to visit the engineering schools at the same time. In recent years it has been customary to hold a regional meeting of Council in the west during the president's visit, and a suggestion had been received from the Winnipeg Branch that such a meeting should be held in that city during the president's visit. It was unanimously agreed that arrangements should be made for the holding of such a regional meeting in Winnipeg on the same basis as previous meetings at the time of the president's visit.

*Past-President C. R. Young*—Information to the effect that Past-President Young had been taken to the hospital was received with much concern, although no details were available. It was unanimously resolved that greetings and best wishes for a speedy recovery be sent to him from this Council meeting.

*Elections and Transfers*—A number of applications were considered and elections and transfers were effected as listed further below.

*Past-President A. R. Décary, M.B.E.*—Before adjourning the meeting, President Cameron felt that some reference should be made to the honour which had recently been conferred by His Majesty the King upon one of the outstanding members of the Quebec Branch. He referred to Dr. Décary who had been made a Member of the Order of the British Empire. The news had been received with great satisfaction by his fellow engineers, and the congratulations of Council were extended to Past-President Décary.

On behalf of Dean Pouliot, of Laval University, Mr. René Dupuis extended an invitation to the members of Council and guests to visit the new school of engineering at the University, where arrangements would be made for guides to conduct the party through the various buildings. The invitation was accepted with thanks and appreciation.

Regarding the committee's report, it was unanimously resolved that this Council meeting endorses the resolution of the Saint John meeting as follows:

"...that the first part of the report be accepted and approved and referred back to the Committee on Professional Interests for further action, and that the thanks of Council be extended to the committee for their efforts."

*Proposed New By-law*—With regard to the proposed new by-law with a view to implementing the suggestions made in the report of the Committee on Professional Interests, a preliminary draft has been circulated to all members of Council. Dr. Challies had emphasized the fact that the new by-law, as proposed, was very far-reaching and suggested that councillors should study it carefully and send in their opinions for the guidance of the committee in preparing its final recommendations.

*Legal Action by Architects against an Engineer*—The general secretary reported that the Committee on Professional Interests had named one of its members to consult with the other parties concerned in order to make a report to the committee. It was expected that within a short time the committee would have some recommendations to make to Council.

*Committee on Civil Defence*—A letter was read from Councillor Armstrong, chairman of the Committee on the Engineering Features of Civil Defence, expressing regret that his departure from Montreal on June 11th on a western trip would prevent him from being with the president on his visit to the Quebec branches and also from attending the regional meeting of Council.

His committee had nothing to report at this time, except that the report of Mr. Pitts' sub-committee dealing with the protection of buildings had been issued, although, unfortunately, it had not been possible to include the A.R.P. bulletins needed to complete the report.

The general secretary reported that he had endeavoured to secure the bulletins in question through the National Research Council but had been informed that they were confidential and not available for circulation. He had then cabled to Professor Webster, c/o the Ministry of Home Security, asking for permission to circulate the information through our committee, but no reply had yet been received. A rough estimate for a sufficient quantity reproduced in Canada indicated that the cost would be in the neighbourhood of $400.00. It was decided to take no action until a reply had been received from Professor Webster.

President Cameron reported that nothing further had developed in regard to the submission made by the committee to the Prime Minister last November suggesting an organization to cover an essential field in civil defence not now covered by A.R.P. or military organizations. Mr. Howe had taken the matter up and had referred it to the War Committee of the cabinet. On hearing of the bombing of dams in the Ruhr valley and the bombing of the island of Sicily, the president had reminded Mr. Howe that these were the things covered in the submission and which were not covered by any other organization. No action had yet been taken, but there seemed to be nothing further that the Institute could do at the present time.

*Committee on the Status of the Engineer in the Active Service*—The general secretary reviewed the previous activities of the committee and outlined some of the conditions which were making it difficult for the committee to bring in a final and satisfactory report. He stated that complaints of the treatment of engineers in the services were still being received, but that in spite of evidence that supported the committee in all of its contentions it had not been possible to get any persons who would permit their names to be used, due naturally to the need of protecting themselves in their positions.

Councillor Gray-Donald, a member of the committee, described certain anomalies that existed in the regulations and intimated that in his opinion recently proposed changes in the Ordnance Corps were only going half way.

The general secretary described a report which had been received from Colonel Grant who had been asked by the committee, while in England, to investigate the relative merits of the Imperial Army set-up for mechanical and electrical engineers (Royal Electrical and Mechanical Engineers) and the Canadian arrangement whereby this same group of engineers operate inside the Ordnance Corps. Colonel Grant's report indicated that he thought in view of the size of the Canadian army set-up as compared to the Imperial army a corps similar to the R.E.M.E. would be too small to justify the necessary overhead organization. This opinion was based on his own observations and the study made by the staff of the Canadian army overseas.

It was pointed out that the Royal Canadian Corps of Signals operates as an entirely separate section and is entirely free from the Ordnance Corps whereas the engineering work associated with mechanical maintenance is still done through the Ordnance Corps, which Corps, in its chief positions, is not staffed by technical men. Figures were read to show that of university students selecting the division of the army which they wished to join, almost none volunteered as ordnance mechanical engineers, but large numbers volunteered for engineers, signals, artillery and infantry positions. It was contended that the reason for so few volunteering for the ordnance mechanical engineers was that the progress for engineers in that corps was slower than in any other corps.

It was the opinion of the meeting that the committee should continue in its endeavour to gather facts and to make representations to the proper authorities at Ottawa.

## ELECTIONS AND TRANSFERS

At the meeting of Council held on June 19th, the following elections and transfers were effected.

*Members*

**Atkinson,** Alfred Lyford Courtenay, B.Sc., (Naval Arch.), (Univ. of Durham), B.Eng. (ad eundem) (Univ. of Sask.), constructor Lieut.-Commander, R.C.N.V.R., Ottawa, Ont.

**Beecroft,** George William, Col., R.C.O.C., B.A.Sc., (Univ. of Toronto), military adviser, Wartime Bureau of Technical Personnel, Ottawa, Ont.

**Beedham,** George Herbert, mech. engr., Loblaw Groceterias Co. Ltd., Toronto, Ont.

**Eaton,** Edwin Russell, Jr., B.A.Sc., (Toronto), supt. east mill, Canada Works, Steel Company of Canada, Hamilton, Ont.

**Harris,** Arthur David, chief engr., Ford Motor Co. of Canada, Ltd., Windsor, Ontario.

**Ley,** Albert George, B.Sc., (N.S. Tech. Coll.), engr., Montreal Engineering Co., Montreal, Que.

**Louden,** Thomas Newton, B.A.Sc., (Univ. of B.C.), general mgr. Hamilton Bridge Western Ltd., Vancouver, B.C.

**Lynde,** Carleton John, Jr., B.Sc., (elec.), (McGill Univ.), res. engr. for G. Lorne Wiggs, consltg. engr., Montreal, Que.

**McLean,** John Newell, B.Sc., (Univ. of Man.), asphalt engr., Imperial Oil Ltd., Winnipeg, Man.

**Monette,** Eddy, B.A.Sc., C.E., (Ecole Polytechnique), div. engr., Provincial Roads Dept., Ste. Thérèse, Que.

**Patrick,** Kenneth Ernest, B.A.Sc., (Univ. of B.C.), second asst. engr., Greater Vancouver Water District and Vancouver and District Joint Sewerage and Drainage Board, Vancouver, B.C.

**Peeling,** Herbert Oliver, B.Sc., (Univ. of Sask.), asst. to plant engr., Canadian Westinghouse Co. Ltd., Hamilton, Ont.

**Sweet,** Frederick Arthur, B.A.Sc., (Univ. of Toronto), asst. secty., Canadian Engineering Standards Assoc., Ottawa, Ont.

**Wilhjelm,** Fritz Eric, B.Sc., (Royal Tech. Coll., Copenhagen), instr'mn. Canadian National Railways, Moncton, N.B.

*Juniors*

**Barrick,** John Bruce, B.Sc., (Univ. of Man.), electl. dftsmn., Defence Industries Ltd., Montreal, Que.

**Pelletier,** Paul Lucien, B.A.Sc., C.E., (Ecole Polytechnique), service mgr., LaSalle Coke Company, Montreal, Que.

**Safran,** Nathan, B.Sc., M.Sc., (Univ. of Alta.), head of Science Dept., Provincial Institute of Technology, Calgary, Alta.

*Affiliate*

**Weightman,** Leonard, engineering dept., Steel Co. of Canada, Ltd., Montreal, Que.

*Transferred from the class of Junior to that of Member*

**Humphries,** George Edward, Lieut. R.C.E., (Overseas), 1554 Bathurst St., Toronto, Ont.

**Jarvis,** Gerald Walter, B.Sc., (Queen's Univ.), chief engr., McColl Frontenac Oil Co. Ltd., Montreal, Que.

**Rogers,** Hubert David, B.Sc., (Queen's Univ.), mtce. dept., Kingston Works, Aluminum Co. of Canada, Ltd., Box 23, Gananoque, Ont.

**Scroggie,** George Nelson, B.Sc., (Queen's Univ.), junior engr., Dept. of Public Works of Canada, London, Ont.

*Transferred from the Class of Student to that of Member*

**Lord,** Roger, B.A.Sc., C.E., (Ecole Polytechnique), asst. to res. engr., Power House, Beauharnois Light, Heat & Power Co., Beauharnois, Que.

*Transferred from the class of Student to that of Junior*

**Barkwell,** Stewart, B.Sc., (Univ. of Man.), junior engr., Canadian General Electric Co. Ltd., Peterborough, Ont.

**Bubbis,** Morris Israel, B.Eng., (McGill Univ.), asst. mech. engr., Directorate of Works & Construction, Dept. of National Defence, Ottawa, Ont.

**Chandler,** Ralph Wright, B.Sc., (Queen's Univ.), junior engr., Hydraulic Dept., Hydro Electric Power Commission of Ontario, Toronto, Ont.

**Fréchette,** Adolphe Gaston, B.A.Sc., C.E., (Ecole Polytechnique), dftsmn., Dominion Bridge Co., Lachine, Que.

**Jarry,** Aurel, Gaston, B.Eng., (McGill Univ.), F/Lt., R.C.A.F., Navigation Instructor, Ancienne-Lorette, Que.

**McDougall,** William Allan, B.Sc., (Univ. of N.B.), instr'mn., Dept. of Transport, Civil Aviation Branch, Moncton, N.B.

**Newby,** William Murray, B.Sc., (Queen's Univ.), engr., H. G. Acres & Co., Ltd., Niagara Falls, Ont.

**Ralph,** John Arthur, B.Sc., (Univ. of N.B.), plant engr., Marelco Ltd., Toronto, Ont.

**Rawland,** Arthur Gordon, B.Sc., (Univ. of N.B.), F/Lt., R.C.A.F., Senior Navigation officer, No. 6 I.T.S., Toronto, Ont.

*Students Admitted*

**Bourgault,** Laurent Alex, (McGill Univ.), 1405 Peel St., Montreal, Que.

**Brown,** Donald Robertson, (McGill Univ.), 3430 Beaconsfield Ave., Montreal, Que.

**Sawyer,** John Edward Benjamin, B.Sc. (Univ. of Man.), 748 Simcoe St., Winnipeg, Man.

**Simpson,** Leslie C., (Univ. of Man.), 43 Sherburn St., Winnipeg, Man.

By virtue of the co-operative agreement between the Institute and the Association of Professional Engineers of Saskatchewan, the following elections and transfer have become effective.

*Transferred from the class of Junior to that of Member*

**Wheten,** Waldo Alexander, F/O., R.C.A.F., B.Sc., (Univ. of Sask.), A.I.D. Insp. of Explosives, Dept. of National Defence, Eastern Air Command Headquarters, Halifax, N.S.

*Students*

**Loucks,** George Irvin, B.Sc., (Univ. of Sask.), Invermay, Sask.

**Swenson,** Orville, B.Sc., (Univ. of Sask.), Naicam, Sask.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

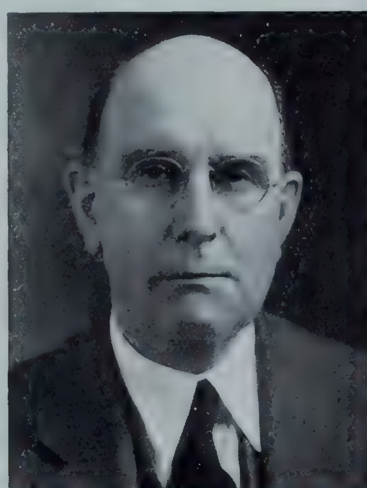
**Eric R. Jacobsen,** M.E.I.C., has recently been designated deputy director general in the Commonwealth of Australia War Supplies Procurement in Washington. His new functions will be the direction of the procurement and technical activities of this organization, which is the North American representative of all war and civilian supplies for Australia. Mr. Jacobsen was recently the leader of a two-man mission which flew to Australia and spent two months on the other side. Prior to his present position, he was personnal and technical assistant to the director general. He is an employee of the Dominion Bridge Company, Ltd., Montreal, and his services during the last year and a half have been on loan from that company to the Commonwealth Government.

**Hugh Beaver,** M.E.I.C., is now director-general of the Ministry of Works in England. He left the firm of Sir Alexander Gibb & Partners at the end of 1940 to become controller of building materials at the Ministry of Works, and at the beginning of 1942 resigned from the firm in order to become director-general of the Ministry.

**J. A. Heaman,** M.E.I.C., has recently retired from the position of office engineer of the Canadian National Railways at Montreal, after forty-two years of service. He is an honour graduate in civil engineering of McGill University, where he was the winner of the British Association Medal.

He started his engineering career with the Grand Trunk in 1901 as an instrumentman at St. Catharines, Ont., and was later stationed at Ottawa as resident engineer during the double tracking of the Montreal-Toronto-Chicago main line. Mr. Heaman became locating engineer on the National Transcontinental Railway in 1905. He filled important engineering positions in the Canadian west during the subsequent fifteen years and in 1924 was appointed chief engineer of the Grank Trunk Western region with headquarters at Detroit. In 1932 he transferred to system headquarters as office engineer, which position he held at the time of his retirement.

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



J. A. Heaman, M.E.I.C.

D. S. Ellis, M.E.I.C.

**H. L. Currie,** M.E.I.C., has been appointed office engineer of the Canadian National Railways at Montreal. He succeeds J. A. Heaman, M.E.I.C., who has retired. Born at Woodstock, N.B., Mr. Currie graduated from the University of New Brunswick in 1913 and entered the services of the Canadian Government Railways at Moncton the same years as draughtsman and leveller. He served overseas in the first great war as a member of the 9th Siege Battery of Halifax. Upon demobilization in 1919, he returned to the Canadian Government Railways and became engineer in charge of double track construction from Springhill Junction to Macaan, N.S.

Since then, he has worked in various capacities from Halifax to Fort William. Among the works of which he had charge were the engine yard facilities at Neebing, Ont., 1922-1923; the engine and car facilities at Toronto for the Toronto Terminals, 1926-1927; the construction of the locomotive erection shop, Montreal, 1928; and the construction of grade separations, track elevations and other work for the new Montreal Terminal, 1929-1933.

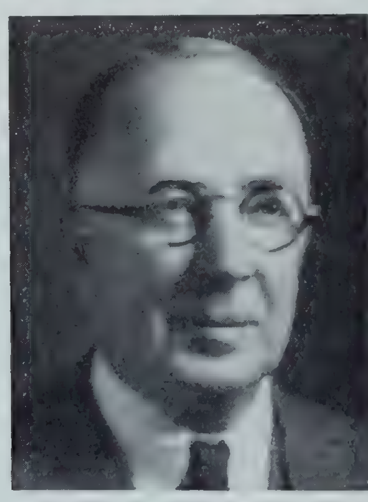
He was then assigned to headquarters engineering staff, Montreal, in charge of maintenance of buildings. With the resumption of work on the new terminal in 1939, he was placed in charge of construction of the new coach yard and other yard rearrangements, besides having a directive hand in the prosecution of various war emergency track requirements.

**D. S. Ellis,** M.E.I.C., has been made dean of the faculty of applied science at Queen's University, Kingston, succeeding Dean Arthur L. Clark, Hon.M.E.I.C. Born at Cobourg, Ont., Dean Ellis received his engineering education at Queen's where he was graduated in 1910. In 1911 he became employed with the International Waterways Commission. During 1913 and 1914 he was engineer for the Commission on the St. Lawrence ship channel. In the first World War, he served with the 6th Field Company, Royal Canadian Engineers. In 1918 he was lieutenant-colonel and chief instructor at the Canadian School of Military Engineering. Dean Ellis was appointed assistant professor of civil engineering at Queen's University in 1919, later becoming professor. In 1940 he was made head of the department of civil engineering.

**Dr. Ernest Brown,** M.E.I.C., has been appointed emeritus professor of mechanics and hydraulics at McGill University. Dr. Brown, who retired during the course of the last scholastic year as professor of applied mechanics and hydraulics, served as dean of the faculty of engineering at McGill from 1930 to 1942, retiring then to devote all his time to the teaching of the ever-increasing classes of students.

Dr. Brown has been a member of the McGill faculty since 1905, when he came to Canada from Liverpool. He has won widespread recognition for his pioneer work in the use of cement in structural work, and for research on design of water-turbines for hydro-electric installations. He is also the author of a number of reports, scientific papers and government reports.

**Arthur L. Clark,** Hon.M.E.I.C. has retired from the position of dean of the faculty of applied science at Queen's University. He was born at Worcester, Mass., U.S.A., and received his degree of bachelor of science from the Worcester Polytechnic Institute in the year 1894, and his degree of doctor of philosophy from Clark University in 1905. Following graduation from Worcester Polytechnic Institute, Dr. Clark was engaged for some time in charge of the construction of the plant and mains for the New Rochelle Gas and Fuel Company, New Rochelle, N.Y. He was professor of physics at Bates College, Maine, for five years before coming to Queen's as head of the department of physics, in 1906. He was appointed dean of the faculty of applied science in the same university, in 1920.



**Arthur L. Clark, Hon.M.E.I.C.**

During Dr. Clark's deanship, the faculty has grown from about 200 to 600 in enrollment. Besides carrying on his administrative functions, he made intensive studies in physics and particularly in thermodynamics. In 1919 he spent some time in Holland working on thermodynamics problems, at the University of Leyden. He is the author of several articles dealing with his studies in physics.

Dean Clark was made an Honorary Member of the Institute in 1922. He has maintained a constant interest in the activities of the Kingston branch. A fellow of the Royal Society of Canada, he has taken an active part in the scientific life of the Dominion and for some years has been a member of the National Research Council.

Dr. Clark will not sever his connections with the university but will carry on with some lectures and will be available for consultation on the administrative problems of the faculty.

**Elizabeth M. G. MacGill,** M.E.I.C., was recently married to Mr. E. J. Soulsby, manager of Victory Aircraft Limited, Malton, Ont., and now resides in Toronto. She was chairman of the Lakehead Branch of the Institute, having occupied for the last few years, the position of chief aeronautical engineer at the Canadian Car and Foundry Company's plant at Fort William, Ont.

**Major H. J. G. McLean,** M.C., E.D., M.E.I.C., is now district ordnance mechanical engineer for Military District No. 2 at Toronto. He resided previously in Montreal where he was engaged in private practice.

**E. C. Molke,** M.E.I.C., now holds the position of chief engineer of the Roberts and Schaefer Company, engineers and contractors, at Chicago, Ill. Before joining the company in 1937, Mr. Molke was employed with H. G. Acres and Company, Niagara Falls, Ont., where he was connected with the Outardes Falls hydro-electric development at Baie Comeau, Que. He was one of the co-recipients of the Gzowski Medal of the Institute for 1938.

**G. E. Blake Sinclair,** M.E.I.C., has been promoted to the position of general executive assistant, Lands, Parks and Forests Branch of the Department of Mines and Resources, Ottawa.

Mr. Sinclair was born in Morden, Manitoba, and educated in the local schools and the University of Manitoba, where he graduated in civil engineering in 1922. As chief of a geodetic survey party, he conducted field work in all provinces of the Dominion and was associated with developments in which the city engineering departments and hydro-electric power companies utilized the services of the Geodetic Survey. He assisted in the preparation of material for the Alberta and Saskatchewan Resources Commissions in 1933. In the reorganization of the department in 1936, he was promoted to an administrative post in the National

**G. E. Blake Sinclair, M.E.I.C.**

Parks Bureau and in 1939 again promoted to the position of inspector of National Parks and Historic Sites with supervision of the Field Operation and Development Division.

**T. R. Durley,** M.E.I.C., has joined the R.C.N.V.R. as a lieutenant in the electrical branch and, after a period of training in Montreal, has been posted to Halifax. He was previously superintendent of shell filling at the plant of Stormont Chemicals Limited, Cornwall, Ont.

**A. M. Thurston,** M.E.I.C., has taken a commission as a pilot officer with the R.C.A.F. in the Signals Branch. He was previously plant manager of Dominion Electric Protection Company Ltd., Montreal.

**J. Edouard Prévost,** M.E.I.C., has joined the staff of the National Research Council as an associate research engineer at Montreal. He is an honour graduate of Ecole Polytechnique in the class of 1921. For the past few years he had been employed with Defence Industries Limited at Montreal. He was resident engineer during the construction of the new buildings for the University of Montreal. In 1925 Mr. Prévost was news editor for the Montreal Branch of the Institute.

**Lieutenant S. N. Tremblay,** M.E.I.C., who had joined the Veterans' Guard of Canada last year has obtained a transfer to the active army and is now stationed at Valcartier, Que., with the 5th Company, Royal Canadian Engineers. Lieut. Tremblay served overseas in the last war and was demobilized as a major. Before joining up last year he was employed with the Quebec Streams Commission at Montreal.

**Capt. A. J. E. Smith,** M.E.I.C., is at present overseas with the Royal Canadian Engineers, First Canadian Corps Troops. Before joining up at the outbreak of war, Capt. Smith was employed with Canadian Allis-Chalmers Limited and was in charge of the Winnipeg office of the Company.

**Joseph V. McKenna,** Jr.E.I.C., is now employed with the John T. Hepburn Co. Ltd., Toronto. He was previously on the staff of General Motors of Canada at Oshawa, Ont. He graduated from the University of Toronto in 1942.

**H. J. Lemieux,** Jr.E.I.C., is now employed in the engineering department of the Aluminum Company of Canada Limited at Arvida, Que. He was previously employed with the Foundation Company of Canada Limited on construction of the Shipshaw development.

**J. H. Huggard,** Jr.E.I.C., is now employed with Aluminum Laboratories of Canada at Montreal. A graduate of the University of New Brunswick in the class of 1935, he had lately been employed with the H. G. Acres and Company on the Shipshaw power development.

**Flight-Lieut. André Aird,** Jr.E.I.C., is at present in charge of aircraft maintenance at No. 7 Service Flying Training School at MacLeod, Alta.

**Thomas B. Hilton,** S.E.I.C., is now in the U.S. Army Air Corps.

**W. J. Farago,** S.E.I.C., has left his position in the engineering department of the Kelsey Wheel Company Limited at Windsor, Ont., and has joined the R.C.O.C. as a second lieutenant. He is at present training at Trois-Rivières, Que

**Fernand Labrosse,** S.E.I.C., is in the employ of the Imperial Oil Company at Sarnia, Ont., as a junior engineer. He graduated this spring from Ecole Polytechnique, Montreal.

**Maurice Magnan,** S.E.I.C., a graduate of this year at Ecole Polytechnique, has joined the staff of the Imperial Oil Company and is at present training at Sarnia, Ont.

### VISITORS TO HEADQUARTERS

**J. W. McBride,** M.E.I.C, research assistant, Division of Industrial Co-operation, Massachusetts Institute of Technology, Cambridge, Mass., on June 12.

**Paul MacNeil,** Jr.E.I.C., Aluminum Company of Canada, Arvida, Que., on June 15.

**Sidney Hogg,** M.E.I.C., Saint John Drydock and Shipbuilding Company Limited, Saint John, N.B., on June 15.

**R. B. Brosseau,** M.E.I.C., superintendent, Saguenay Electric Company, Chicoutimi, Que., on June 16.

**Lieut. Colonel L. F. Grant,** M.E.I.C., vice-president of the Institute, Kingston, Ont., on June 16.

**A. E. Flynn,** M.E.I.C., Professor, Department of Mining Engineering, Nova Scotia Technical College, Halifax, on June 18.

**C. C. Cariss,** M.E.I.C., chief engineer, Waterous Limited, Brantford, Ont., on June 18.

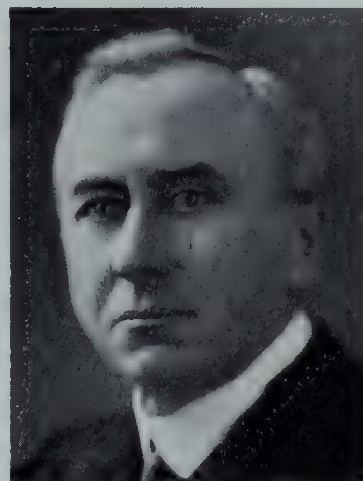
**W. M. Murray,** M.E.I.C., Massachusetts Institute of Technology, Cambridge, Mass., on June 18.

**L. J. Barron,** M.E.I.C., shipbuilding division, Foundation Maritime Limited, Pictou, N.S., on June 25.

# Obituaries

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

**Alexander Sutherland,** M.E.I.C., died suddenly at his home at Wolfville, N.S., on June 21st, 1943. He was born at Earltown, N.S., on January 18th, 1877, and received his education at Acadia University where he graduated as a bachelor of science in 1911.



Alexander Sutherland, M.E.I.C.

Upon graduation he joined the teaching staff at Acadia University and after teaching engineering for several years he became Dean of Applied Science. At the time of his death he was still professor emeritus of engineering. At one time, Dr. Sutherland was mayor of Wolfville.

He joined the Institute as an Associate Member in 1920 and became a Member in 1940.

**Edward Victor Polley,** S.E.I.C., a lieutenant with the Royal Canadian Engineers, was killed accidentally in England on March 3rd, 1943.

He was born in Belfast, Northern Ireland, on March 26th, 1920. He was the only son of Lieutenant R. V. Polley of the Royal Inniskilling Fusiliers who died from a war disability in February, 1921. He was educated at Methodist

Lieutenant E. V. Polley, S.E.I.C.

College, Belfast, and entered Queen's University, Belfast, in 1938, joining the University Officers' Training Corps. In the summer of 1939, he was in Canada with his mother, Mrs. Edith Polley, and upon the outbreak of war, they decided to stay in Toronto with relatives.

Victor Polley thereupon enrolled as a second year student in the Faculty of Applied Science and Engineering of the University of Toronto, again joining the C.O.T.C. of which he became an active member. In June, 1942, he graduated with honours in civil engineering, having achieved honour standing in each year of study. Immediately upon release from the University, he attended the officers' training centre at Brockville, passing all his test successfully. He was then posted for duty with the Royal Canadian Engineers at Petawawa, and proceeded overseas with his unit in December, 1942. He was killed in a motorcycle accident while on active duty as an umpire in manoeuvres somewhere in England.

Unusually well read, a brilliant student, a keen thinker and a good friend, Lieutenant Polley leaves behind him a lasting impression upon all who knew him. The engineering profession could ill afford to lose one of his calibre. To his mother goes deep sympathy.

Lieutenant Polley joined the Institute as a Student in 1942. The May number of the *Journal* carried an interesting letter which he had written to Headquarters in February, pointing out the value of military engineering experience.

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## BORDER CITIES BRANCH

W. R. Stickney, m.e.i.c. - *Secretary-Treasurer*
J. F. Blowey, m.e.i.c. - *Branch News Editor*

A joint meeting of the Border Cities Branch and Professional Engineers Association was held at the Prince Edward Hotel, Windsor, May 21, 1943, at 6.30 p.m. 39 members and guests were present.

In the absence of Mr. G. G. Henderson, the vice chairman, Mr. J. B. Dowler called on Mr. J. Clark Keith who introduced the speaker for the evening, Mr. M. J. Aykroyd of Toronto, vice-president of the Professional Engineers Association of Ontario, and Bell Telephone outside plant engineer.

With the aid of coloured motion pictures, Mr. Aykroyd told the story of the laying of underground telephone cables all the way from Ottawa to Montreal, Connected in one train, a tractor, rooter plow, cable laying plow and tractor trailers were shown going cross country across fields, through bush, up and down the hills.

Mr. Aykroyd told of how the front plow rooted through the earth with a three-and-a-quarter inch share loosening and breaking up the ground to a depth of from 30 to 50 inches, thus insuring uninterrupted passage of the following plow which deposited the cable in the ground.

"The 100-ton train, with its more than 400 horse-power, moves at a brisk walk under such conditions," he said. "Pauses are needed only to change reels or remove major obstructions. This is the procedure that was followed across prairie country in placing the trans-continental cable in the United States.

"In southern Ontario the farming subdivisions, sideroads, streams, wooded sections and other frequent obstacles, often make a modified operation desirable," continued Mr. Aykroyd. One crew with tractors and rooting equipment works about three to six miles ahead of the cable placing train. The job for this equipment is to open up the earth to a depth of 30 inches or more along the route of the buried cable, to remove boulders, tree roots and other obstacles, to grade steep banks at side roads or other places. The fences have to be so arranged as to facilitate the passage of the train."

After a most interesting discussion a vote of thanks to the speaker was moved by H. L. Johnston.

## MONCTON BRANCH

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

The annual meeting was held in the City Hall on May 31st. H. J. Crudge, chairman of the branch, presided. The annual report and financial statement were presented and, on motion, adopted. The scrutineers reported that as a result of the balloting in the branch elections the following will constitute the executive for 1943-44; Chairman, J. A. Godfrey; Vice-Chairman, A. S. Donald; Secretary-Treasurer, V. C. Blackett; Committeemen, E. R. Evans, A. Gordon, G. E. Smith, H. W. Hole, G. C. Torrens, Ex-officio, H. J. Crudge, G. L. Dickson. Brief remarks were made by the incoming Chairman Godfrey, A. Gordon and Past-Chairman Crudge.

Annual Report for the Year Ending May 31, 1943.

During the past year, Moncton Branch has had the unique privilege of welcoming two presidents of the Engineering Institute of Canada. On August 3rd, 1942, a dinner meeting was held at which President C. R. Young was the guest speaker, and on April 14th, 1943, a similar meeting was held in honour of President K. M. Cameron. At the latter meeting, 34 members and guests were present, a record attendance for a dinner meeting.

Because of wartime difficulties in obtaining speakers, technical films have been used as substitutes. On November 12th, through the courtesy of the General Electric Co., Halifax, N.S., a technicolor sound film entitled "The Inside of Arc Welding" was screened. The pictures showed in minute detail what constitutes a good weld and also why operators sometimes fail to get satisfactory results. This film was also screened under branch auspices, on November 11th at a meeting of the Engineering Society of Mount Allison University, Sackville. Through the efforts of Major A. S. Donald, the branch was able to secure the loan of an exceedingly interesting technicolor film, dealing with airport construction in Labrador, which was shown at a branch meeting on April 20th. These pictures were also screened at a meeting of the Engineering Society of Mount Allison on April 13th.

Other branch meetings during the year included a nomination meeting on April 27th, and the annual meeting which is to be held on May 31st. Six meetings of the Executive were held.

Membership

Our membership, at present, numbers sixty-five, as follows:

| | Resident | Non-Resident |
|---|---|---|
| Members | 31 | 12 |
| Juniors | 3 | 5 |
| Students | 4 | 6 |
| Branch Affiliates | 4 | 0 |
| | 42 | 23 |

It is with regret that we record the passing of two members of the branch. John George MacKinnon, m.e.i.c., died on October 19, 1942, and Fred Oxley Condon, m.e.i.c., on January 12th, 1943.

Financial Statement for the Year Ending May 31, 1943

Receipts

| | |
|---|---|
| Balance in bank, July 1, 1942 | $105.99 |
| Cash on hand, July 1, 1942 | 0.88 |
| Rebates on dues | 50.45 |
| Affiliate dues | 5.00 |
| Contribution from N.B. Professional Assoc. | 63.00 |
| Receipts from dinner meetings | 22.50 |
| Bank interest | 0.39 |
| Interest from War Bond | 1.50 |
| | $249.71 |

Expenditures

| | |
|---|---|
| Printing | $21.67 |
| General Meeting Expense | 12.00 |
| Special Meeting Expense | 62.18 |
| Honorarium to Secretary | 25.00 |
| Stenographic Services | 10.00 |
| Subscriptions to Journal | 8.15 |
| Miscellaneous | 29.38 |
| Balance in bank, May 31, 1943 | 81.05 |
| Cash on hand, May 31, 1943 | 0.28 |
| | $249.71 |

Assets

| | |
|---|---|
| Motion picture equipment | $ 85.00 |
| Balloptican lantern | 30.00 |
| Attache case | 5.00 |
| Unpaid Affiliate dues | 15.00 |
| War Bond | 100.00 |
| Balance in bank, May 31, 1943 | 81.05 |
| Cash on hand, May 31, 1943 | 0.28 |
| | $316.33 |

Liabilities

None.

Audited and found correct.

James Pollar, C. S. G. Rogers } Auditors.

Respectfully submitted,

V. G. Blackett, Secretary-Treas.
H. J. Crudge, Chairman.

## OTTAWA BRANCH

A. A. Swinnerton, m.e.i.c - *Secretary-Treasurer*
R. C. Purser, m.e.i.c. - *Branch News Editor*

The regular final meeting of the winter luncheon series of the Ottawa Branch was held at the Chateau Laurier Thursday noon, May 27. Lt. Col. R. G. Ervin, A.U.S., assistant military attaché for Air at the United States Legation, spoke upon the hazards of ice for air men, his address being accompanied by a two-reel sound film dealing with the subject. This film had been prepared by Walt Disney for use in the training of fliers in the United States Army and Navy.

"Ice formation on aircraft is still one of the major problems we have to battle in the air, whether for military or commercial purposes," stated the speaker. Much more research work would be necessary before the problem could be really solved.

W. H. Munro presided in the absence through illness of G. H. Ferguson, chairman of the Branch.

## PETERBOROUGH BRANCH

A. J. Girdwood, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, Jr.E.I.C. - *Branch News Editor*

The annual meeting of the Peterborough Branch was held in the Y.M.C.A. Building on May 20th. At a short business meeting, reports were made by the committee chairman. A brief account of the year's affairs was given by D. J. Emery retiring chairman; minutes for the last meeting were read by A. R. Jones, retiring secretary-treasurer. The new executive was elected and will be composed of Messrs. Ross Dobbin, A. J. Girdwood, A. R. Jones, A. L. Malby, C. R. Whittemore, and F. Pope.

The recreational activities which followed the business meeting consisted of volley ball, bowling and the use of other facilities at the Y.M.C.A. Mr. V. S. Foster's team carried off the War Saving Stamps for the volley ball and Messrs. Pope and McCrady's team took first and second prizes respectively in the bowling. The evening finished up with a buffet lunch.

At the first meeting of the new executive on June 3rd appointments were made as listed on page 389.

## SAULT STE. MARIE BRANCH

O. A. Evans, Jr.E.I.C. - *Secretary-Treasurer*

The fifth general meeting for the year 1943 was held in the Grill Room of the Windsor Hotel on Tuesday, June 1st at 6.45 p.m. when 15 members and guests sat down to dinner.

The chairman introduced the speaker of the evening, L. L. W. Ashcroft of the Canadian General Electric, who showed two of the most interesting sound films that have yet been presented to the Branch. They were "Power to Win," a film which depicts the part being played by the Canadian General Electric and its employees in the present war. This film showed the company making guns, searchlights, precision instruments, airplane parts, bulbs of all sorts for the war. There were also action pictures of these parts and machines in the present war.

Canadian General Electric can be justly proud of the part it is playing in the war effort and is to be complimented on its splendid film depicting its part.

The second picture was one on "Railroading" which was a colour sound film. It gave an excellent account of the railroads contribution to humanity and the war effort. It showed with what ease the railways of United States handle immense tonnages of ore, coal and freight of all kinds, also how the troops were moved to their destinations with the least friction. It also depicted how the fresh fruits and vegetables were moved from the South in winter to the northern markets, as fresh as when picked. Nothing was too small or too large to be moved with the minimum of risk and loss of time.

It also took the onlooker for a pleasant tour of the United States pleasure resorts.

## JUNE JOURNALS REQUIRED

**There has been an unusual demand for extra copies of the June, 1943, issue of *The Engineering Journal* and it would be appreciated if members who do not retain their copies would return them to Headquarters, at 2050 Mansfield Street, Montreal, Que.**

# Library Notes

## Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications

### BOOK REVIEWS

THEORETICAL SOIL MECHANICS

*By Dr. Ing. Karl Terzaghi*
*John Wiley & Sons, Inc., New York, 1943*
*510 pp., illus., diags., tables, 9 x 6 in., cloth, $5.00*
*Reviewed by I. F. Morrison, M.E.I.C.**

For some months past those teachers and engineers who are actively interested in Soil Mechanics have been looking forward to the appearance of this book. There has even been some speculation as to the character of it: such as, whether it would be suitable for undergraduate courses in engineering, whether it would be of value to the practising engineer who still has the urge to keep up with new developments in engineering, whether it would be too difficult to read by anyone not a specialist in the subject. It was, therefore, a welcome surprise to find that the treatment of the subject was of a sufficiently elementary character to enable anyone who has had the usual university courses in elementary engineering mathematics and mechanics to master the text without difficulty.

In this book, which has quite appropriately been entitled Theoretical Soil Mechanics, the author, already widely recognized as a most eminent authority on the subject, has gathered together his own theoretical researches, and those of a number of others, into a single volume of about 500 pages. It becomes the first treatise in the English language in which the theory of the mechanics of granular masses, as developed to its present state, is set forth in detail without consideration of the design aspect of engineering structures. It finds itself, therefore, in the same category as such excellent texts as Timoshenko's Strength of Materials. For the very purpose and nature of the book is to place the subject on a basis comparable with the mechanics of solid bodies which indeed forms the background for all structural design.

As is the case with the Strength of Materials, as compared with the Mathematical Theory of Elasticity, the treatment might be called quasi-rigorous for it is manifestly impossible to present a rigorous and at the same time elementary and useful exposition of the mechanics of granular materials on account of the mathematical difficulties involved. Such quasi-rigorous treatment is also precisely what is of necessity used in texts on the Strength of Materials which are addressed to engineers rather than mathematicians. No one recognizes better than the author himself the limitations placed on the theory which arise from the necessity of simplifying assumptions and that the ultimate justification of such assumptions lies in the degree of approximation to reality of the results devised from them. The author, therefore, keeps his reader fully aware of the limitations of the theory continually throughout the exposition of the subject and aptly points out that, although the development of some of the theory of the mechanics of granular masses was practically complete half a century ago, it is only until recently that a knowledge of the physical properties of real soils has been sufficiently accumulated to enable engineers to apply the theory with a full realization and proper understanding of its limitations.

The book deals, therefore, only with ideal soils of both the cohesive and non-cohesive types. The author promises, however, a companion volume on applied soil mechanics and such a work will indeed be a most valuable sequel to the present theoretical treatise. It is to be expected, perhaps, that it will contain a chapter or two on soil physics.

The book is divided into four main sections. The first section, A, sets forth the general principles of the theory and contains the first four chapters although just why the fifth chapter, which deals with the arching effect in ideal soils, was included in the following section rather than the first is not quite clear. In the opening chapter, the philosophy of the subject and the fundamental concepts are discussed briefly. This is followed by a chapter on the stress conditions for failure of soils based on Coulomb's empirical equation for shearing resistance and Mohr's theory of rupture. Chapters III and IV take up what the author chooses to call the "plastic equilibrium in a semi-infinite mass" and presents some simple applications of the general theory to practical problems including a brief discourse on rigorous and simplified methods. The elastic properties of soil is not taken into account in this theory.

Section B is given over to an abundant treatment of the conditions for shearing failure in ideal soils which is related to plastic flow. A detailed exposition of the theory of active and passive pressures on retaining walls forms the subject matter of Chapters VI and VII. These are followed by chapters on the bearing capacity of soils, the stability and failure of slopes, and earth pressures on temporary supports, in cuts, tunnels and shafts. The section closes with a chapter on anchored bulkheads. The material in this section consists of an application of that of the first section. Much of the exposition is analytical although Culmann's, and also Engesser's, graphical method of determining earth pressure is demonstrated. All of the topics are treated in an adequate manner and form perhaps the most comprehensive theoretical precis anywhere to be found in English.

The subject matter outlined above consumes about one-half of the entire volume and up to this point no account has been taken of the effect of water in the soil. To the preceding theory, therefore, the effect of the interaction between the solid particles and the water is introduced for detailed discussion in Section C. Of the four chapters in this section, the first,—chapter XII of the book,—deals with the effect of seepage on the equilibrium of a non-cohesive soil and use is made of the theory of flow-nets. The Theory of Consolidation, which occupies chapter XIII, is rather biefly treated without, perhaps, quite a much illustrative application as it should have. After a brief chapter on capillary forces, the section ends with one on the mechanics of soil drainage, which is of course closely allied to the problem of seepage given in the first chapter of the section and which, therefore, might well have been included in it.

Section D, on Elasticity Problems in Soil Mechanics, which is the final section of the book, returns to the subject of stress analysis but from a different angle. As the title indicates, the approach is altered and the soil is considered as an elastic material. After a brief discourse on the theory of subgrade reactions, the theory of stresses and strains in semi-infinite elastic solids, and in elastic layers of such solids, is given in a somewhat compendious arrangement. The final chapter is on vibration problems.

If, as has been suggested above, some of the topics have been rather concisely treated, it should be pointed out that the author has dealt with them in great detail elsewhere and that it has very likely been necessary to curtail the argument in order to keep the volume within reasonable bounds. In many instances, formulas are merely set down without derivation, giving the book a somewhat dogmatic quality. For example, Boussinesq's equations are given without development. To be sure, the theory by which Boussinesq arrived at them is quite beyond the range of the elementary mathematics of the book, nevertheless a subsequent derivation—based on simplifying assumptions—by Fröhlich is certainly not so and such a highly instructive demonstration might well have been included in order to make a method of analysis available to students for further study.

Throughout the book, the author states repeatedly the assumptions on which the immediately following theory is to be based, for he loses no opportunity to draw attention continually to the important fact that the validity of the theory from the point of view of practical application to real soil is primarily dependent on the validity of the assumptions on which it is based. This is an excellent feature of the book.

Unfortunately, probably on account of space requirements, there are but few illustrative examples worked out in detail and there are no problems included for solution. There is, however, an excellent collection of references and frequent reference is made to these sources throughout the text.

Three quite useful tables for the computation of vertical stresses in a semi-infinite elastic solid are contained in an appendix. Also a number of practically useful graphic charts are to be found in appropriate places in relation to the subject matter.

The book is well written and edited and the argument can, for the most part, be very readily followed. There is, perhaps, a bit too much repetition of statement here and there which is slightly irritating to those who would like to get on with logical development but, on the whole, the book is an excellent treatise on the theoretical aspect of the mechanics of granular masses. Every student and engineer who is seriously and actively interested in soil mechanics will derive considerable benefit from a careful reading of it. It will undoubtedly exert a considerable influence on the teaching of soil mechanics throughout the English speaking countries which, after all, is the author's main purpose. Everyone will look forward to the publication of the companion volume.

RECONSTRUCTION IN CANADA

*C. A. Ashley, Editor*
*The University of Toronto Press, 1943*
*148 pp., illus., map, 6 x 9 in., paper, $1.00*
*Reviewed by H. G. Cochrane, M.E.I.C.***

This is a series of eleven lectures given at the University of Toronto and dealing broadly with the various problems confronting Canada after victory.

The first lecture introduces the subject. Lecture number two deals with our economic problems, taking each of our main industries in turn and discussing production, markets, concluding with brief reviews of trade, employment, immigration, finance and demobilization. The third lecture discusses international economic collaboration, effects of the war, tariffs, international investments. The next deals

*Professor of Applied Mechanics, University of Alberta, Edmonton, Alta.

**Department of Munitions and Supply, Toronto, Ont.

with our present form of government, the trends towards changes in our constitution and the causes for such trends.

The next three lectures deal with various aspects of conservation. Soil, forest resources and water, point the way to constructive changes in the administration of our natural resources. Lecture number eight is entitled "Construction Projects," and is devoted to the possibilities for post-war employment through a vast public works programme. Lecture nine reviews our social services and envisages their extension and improvement. Housing and town planning are considered important enough to rate a short separate lecture, while the final chapter entitled "Recapitulation and Ideals," by Dr. H. J. Cody, is a recapitulation.

Here is a text book on post-war planning for the man-on-the-street, covering all the fundamental background, yet written like a series of magazine articles in language anyone can understand. There are a few gaps, such as the consideration of labour relations, and a more detailed discussion of our mineral resources, while the most immediate post-war problem of all, that of maintaining production and employment close to wartime levels and the future of education, might well have been the subjects for two more lectures. A brief résumé of current thought and planning in other countries would also have been pertinent.

This is something which should be supplied through the proper channels to our armed forces overseas. No engineer should fail to read it.

---

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**Simplified Design of Reinforced Concrete:**
*Harry Parker. N.Y., John Wiley and Sons, Inc., 1943. 5¼ x 8 in. $2.75.*

**Plumbing Practice and Design:**
*Volume 2. Svend Plum. N.Y., John Wiley and Sons, Inc., 1943. 6 x 9¼ in. $4.50.*

**Geodetic Control Surveys:**
*2nd ed. H. Oakley Sharp. N.Y., John Wiley and Sons, Inc., 1943. 8¾ x 11¼ in. $3.50.*

**Public Works Engineers' Yearbook 1943:**
*Including the Proceedings of the 1942 Public Works Congress. Chicago, American Public Works Association, 1943. 5½ x 8¾ in. $3.75.*

**Canadian Trade Index 1943:**
*Toronto, Canadian Manufacturers' Association, 1943. 6½ x 10¼ in. $6.00.*

### PROCEEDINGS, TRANSACTIONS

**Institutions of Water Engineers:**
*Transactions, vol. 47, 1942.*

**American Society for Testing Materials:**
*Proceedings of the forty-fifth annual meeting, vol. 42, 1942, Philadelphia, The Society, 1943.*

**American Institute of Consulting Engineers:**
*Proceedings of the annual meeting, January, 1943.*

### REPORTS

**Nova Scotia. Board of Commissioners of Public Utilities:**
*Report for the year ended December 31, 1942.*

**Canada. Department of Transport:**
*Report for the fiscal year from April, 1941 to March 31, 1942.*

**Manitoba. Department of Mines and Natural Resources. Mines Branch:**
*Fourteenth annual report on mines and minerals for year ending April 30, 1942.*

**Lethbridge Northern Irrigation District:**
*Twenty-second annual report and financial statement.*

**Harvard University—Graduate School of Engineering—Publications:**
*No. 364—The crushing strength of biological films on natural waters and the spread of larvicidal oils by Charles E. Renn.*

*No. 365—Analysis of longitudinal motions of trains by the electrical analog by Louis A. Pipes.*

*No. 366—A note on ionization by meteors by J. A. Pierce and Performance curves for M-derived filters by W. J. Cunningham.*

*No. 367—On the pickup of balanced four-wire lines by Charles W. Harrison, Jr., and A note on the characteristics of the two-antenna array.*

**Canada. National Research Council:**
*Phosphorescent paints by T. H. Glynn Michael. April 1943. Publication No. 1119.*

**U.S. Bureau of Standards—Building Materials and Structures Report:**
*BMS 95—Tests of cement-water paints and other waterproofings for unit-masonry walls. BMS 96—Properties of a porous concrete of cement and uniform-sized gravel.*

**U.S. Bureau of Mines:**
*Bulletin No. 451—Syllabus of clay testing, Part 1.—Technical paper No. 650—Carbonizing properties and petrographic composition of taggart-bed coal from mines 30 and 31, Lynch, Harlan County, Ky., and the effect of blending this coal with pocahontas No. 3 and No. 4—bed coals.*

**Iowa State College—Engineering Experiment Station Bulletin:**
*No. 158—Road tests of automobiles using alcohol-gasoline fuels.*

**Chinese Institute of Engineers—America Section:**
*Directory 1942-1943.*

**Edison Electric Institute:**
*A-C network operations 1938-1940. A report of the transmission and distribution committee. Publication No. K-4, April 1943.*

**Sixth Hoover Medalist—Gerard Swope:**
*N.Y., Hoover Medal Board of Award, 1942.*

**Electrochemical Society—Preprint:**
*No. 83-15—Some factors affecting automatic pH control.—83-16—The use of inhibitors for aluminium chemical equipment.—83-17—Gases evolved by the thermal decomposition of paper.*

**Bell Telephone System—Technical Publications—Monograph:**
*No. 1359—The relation of dielectric properties to structure of crystalline polymers: 1 and 2. 1360—Viscosity and cryoscopic data on polystyrene. 1364—Motion picture study of balata and hevea latices. 1365—On radiation from antennas.*

**International Union of Chemistry:**
*Sixth report of the Committee on atoms, 1941-1942.*

*Eleventh report of the Committee on atomic weights, 1941.*

### BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.**

**APPLIED MATHEMATICS FOR TECHNICAL STUDENTS**
**(Rochester Technical Series)**
*By M. S. Corrington. Harper & Brothers, New York and London, 1943. 226 pp., diagrs., tables, 9 x 5½ in., cloth, $2.20, without tables; $2.80, with tables; $0.75, tables alone.*

Arithmetic, algebra, logarithms and trigonometry are all included in this small volume, which is intended for trade schools, factory courses or pre-engineering study, and is also suitable for home study. Emphasis is on the practical applications. The text is based upon careful study of the mathematics essential in modern industry.

**CALCULUS MADE EASY**
*By S. P. Thompson. 2 ed. enl. The Macmillan Co., New York, 1914 (reprinted 1943). 301 pp., diagrs., charts, tables, 7 x 4½ in., cloth, $2.00.*

This little textbook, offered as "a very simplest introduction to those beautiful methods of reckoning which are generally called by the terrifying names of the differential calculus and the integral calculus" first appeared, anonymously, in 1910. In 1914 an enlarged edition appeared under the author's name, which is now reprinted. In vigorous, colloquial style it presents the fundamentals of the calculus for the benefit of students of engineering and science.

**(The) CHEMISTRY OF POWDER AND EXPLOSIVES, Vol. 2**
*By T. L. Davis. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 489 pp., illus., diagrs., tables, 9 x 5½ in., cloth, $3.00.*

This text provides a useful exposition of the modes of behavior of explosive substances and of the chemical and physical phenomena that they exhibit. The present volume, which completes the work, discusses the nitric esters, smokeless powder, dynamite and other high explosives, nitroamines, primary explosives, detonators and primers.

**ELECTROMAGNETIC WAVES**
*By S. A. Schelkunoff. D. Van Nostrand Co., New York, 1943. 530 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $7.50.*

This course in the theory of electromagnetic wave transmission is based on a course given at Brown University, and is the outgrowth of the author's work in Bell Telephone Laboratories. It aims to provide a course for students of communication engineering and microwave transmission and of radio engineering which will supply basic information on radiation, wave propagation, wave guides and resonators. It will also be useful as a reference work for research workers.

**ESSENTIALS OF DRAFTING**
*By C. L. Svensen. 3 ed. D. Van Nostrand Co., New York, 1943. 295 pp., illus., diagrs., charts, tables, 10 x 7 in., cloth, $2.35.*

The basic principles of drafting and their applications are covered in this text, without unnecessary ramifications. The result is a direct treatment suited to the needs of those who make drawings and those who are to read them. The new edition has been entirely rewritten and reset in a larger format.

**(The) FEEDING OF WAR WORKERS, A Selected, Annotated Bibliography. (Bibliographical Series No. 70)**
*Princeton University, Industrial Relations Section, Princeton, N.J., 1943. 15 pp., 9 x 6 in., paper, $0.25.*

This is a selected, annotated list of references on eating facilities for industrial employees and on efforts toward improved nutrition. It will be useful to factory managers and others faced with the problem of feeding workers.

**FUNDAMENTALS OF STRESS ANALYSIS, Vol.1**

*By A. Deyarmond and A. Arslan, prepared and edited by Associated Aeronautical Staff of Aero Publishers, Glendale, Calif., 1942. 256 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

The purpose of this book, the first of a two-volume textbook, is to describe fundamental methods of analyzing the stresses in the types of structures that are used in airplanes. The subject is presented in a simple, practical manner. Previous knowledge of simple mathematics, mechanics and strength of materials is assumed.

**GEOMORPHOLOGY, Systematic and Regional**

*By O. D. von Engeln. The Macmillan Co., New York, 1942. 655 pp., illus., diagrs., maps, 9½ x 6 in., cloth, $4.50.*

This volume is an important addition to the literature, which will be welcomed by all geologists interested in modern developments in geomorphology. The treatment is inclusive, and the text is abundantly illustrated with photographs and drawings. An extensive bibliography is appended and is supplemented by topical bibliographies in each chapter.

**GLOSSARY OF SHIPBUILDING AND OUTFITTING TERMS**

*By W. J. Eddington. Cornell Maritime Press, New York, 1943. 435 pp., illus., diagrs., tables, 7½ x 5 in., cloth, $3.50.*

This glossary contains a large number of terms used in the shipbuilding and shipping trades, with extensive definitions and descriptions. Various tables of use to shippers and lists of equipment for the deck, engine and steward's departments are appended. Those engaged in maritime work will find the book a valuable reference.

**GUN CARE AND REPAIR, a Manual of Gunsmithing**

*By C. E. Chapel. Coward-McCann, Inc., New York, 1943. 454 pp., illus., diagrs., tables, 8½ in., cloth, $3.75.*

This admirable book covers in precise detail the art of gunsmithing, from the layout and equipment of the shop to the methods of decorating guns. The needs of the home gun craftsman are especially considered, and the book provides all that the amateur needs to know in order to make, repair and alter rifles and other firearms. The Garand rifle, the Thompson submachine gun and the Army automatic pistol are described in detail.

**HIGH FREQUENCY THERMIONIC TUBES**

*By A. F. Harvey, with a foreword by E. B. Moullin. John Wiley & Sons, New York, 1943. 235 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $3.00.*

The increasing use of very high-frequency electrical energy in radio, television and other fields has called for accurate knowledge of the properties and behavior of vacuum tubes in high-frequency apparatus. The present book treats of these properties and their relation to those of the associated electrical circuits. Starting with an account of the properties of vacuum tubes at low frequencies, the changes that occur at very high frequencies are then considered. A chapter follows on retarding field generators. Two chapters are devoted to the magnetron. The final chapter describes the klystron and other special high-frequency tubes and their circuits.

**INDUSTRIAL ELECTRICITY AND WIRING**

*By J. A. Moyer and J. F. Wostrel. 3 ed. McGraw-Hill Book Co., New York and London, 1943. 541 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $2.75.*

The underlying principles of electricity are outlined, and the proper methods of wiring for light and power are presented fully and clearly, for use by students and electricians. The present edition has been based on the 1940 National Electrical Code. It has also been enlarged by a chapter on fluorescent lighting and one on the prevention of radio interference.

**MAGNETIC CIRCUITS AND TRANSFORMERS, a First Course for Power and Communication Engineers. (Principles of Electrical Engineering Series)**

*By Members of the Staff of the Department of Electrical Engineering, Massachusetts Institute of Technology; John Wiley & Sons, New York; Chapman & Hall, London, 1943. 718 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $6.50.*

This is the second volume of the series of texts on the principles of electrical engineering prepared by the Institute staff to provide a basic course for all students of that subject. Fundamental principles are stressed, and problems of both power and communication are considered. The book is in two sections. The first discusses the current theory of ferromagnetism, the computation of the behaviour of magnetic circuits and the theory and design of iron-core reactors. The second first discusses the general design of all electrical apparatus and then applies these general principles to transformers.

**MATERIALS HANDLING, Principles, Equipment and Methods**

*By H. E. Stocker. Prentice-Hall, New York, 1943. 309 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00 ($3.75, school edit.).*

The fundamental principles involved in the economical handling of those materials not handled in bulk, and the equipment and methods used, are described and explained in this text. A large amount of information about trucks, tractors, conveyors, cranes and other equipment is provided, with many illustrations.

**MATHEMATICS DICTIONARY**

*Compiled from the literature and edited by G. James, assisted by R. C. James. rev. ed. The Digest Press, Van Nuys, Calif., 1943. 273 pp. 46 pp. tables, diagrs., charts, 9½ x 6 in., fabrikoid, $3.00.*

This dictionary covers the vocabulary of mathematics from arithmetic through integral calculus. Both popular and technical definitions are frequently given, or else the definition is adapted to the mathematical maturity of the probable user. The needs of secondary schools and laymen have received special attention. The new edition has been enlarged and revised.

**MINERALS AND ROCKS, Their Nature, Occurrence and Uses**

*By R. D. George. D. Appleton-Century Co., New York and London, 1943. 595 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $6.00.*

This book provides a general survey of the earth materials that have become fundamental to the industries, suitable for use in courses in economic mineralogy especially, and in mineralogy and petrology generally. Part one discusses the metallic elements and minerals, describing the minerals in order of their importance. Part 2 describes the non-metallic elements and minerals, and Part 3 the rock-making minerals. Part 4 provides a short course in determinative mineralogy. Part 5 discusses the common rocks. Excellent illustrations are included.

**ORGANIC SYNTHESES**

*Collective Volume 2, a revised edition of Annual Volumes X-XIX, edited by A. H. Blatt. John Wiley & Sons, New York; Chapman and Hall, London, 1943. 654 pp., diagrs., tables, 9 x 6 in., cloth, $6.50.*

The annual volumes 10-19 of Organic Syntheses have been combined in this collective volume, with revisions, modifications and improvements of the methods and addition of eleven new ones. The book gives convenient laboratory methods for preparing a large number of organic chemical reagents in quantities of one-half pound to five pounds, especially those not readily procurable by purchase.

**PHYSICS AND PHILOSOPHY**

*By J. Jeans. The Macmillan Co., New York; The University Press, Cambridge, England, 1943. 222 pp., diagrs., 9 x 5½ in., cloth, $2.75.*

The revolution in physics which has taken place in recent years has not only changed our views of that science. It has also affected the scientific basis of philosophy and thereby our general view of the world we live in. In this interesting volume, the author traces the progress of philosophic thought through the ages and of physics since the time of Newton, and shows how modern theories of physics affect our thinking on religion, on free will and on the nature of man.

**REPORT ON SIGNIFICANCE OF TESTS OF CONCRETE AND CONCRETE AGGREGATES, 2 ed., sponsored by A.S.T.M. Committee C-9 on Concrete and Concrete Aggregates**

*American Society for Testing Materials, Phila., Pa., 1943. 171 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.50.*

The significance of the tests sponsored by the Society, their limitations and applicability are discussed by various experts. Tests for both concrete and aggregates are considered. In addition, the book includes a general discussion of the numbers of specimens or tests necessary for reasonable accuracy of the average.

**SHIP EFFICIENCY AND ECONOMY**

*By G. S. Baker. "The Journal of Commerce and Shipping Telegraph." Charles Birchall & Sons, Ltd., 17 James St., Liverpool, England, 1942. 145 pp., Index, pp. I-IX, diagrs., charts, tables, 10 x 7 in., fabrikoid, 42s.*

In this work the Superintendent of the William Froude Laboratory discusses the question, what is it that makes a satisfactory and seaworthy ship. On the basis of actual ship data and those obtained with ship models, he considers such matters as Roughness of surface and fouling, Wind resistance and hull shape, Rough water, rolling, pitching, Steering, Steering and stability of course in shoal water, Working conditions of propellers, Economical speed and margins of power. The treatment is non-mathematical.

**SHOP MATHEMATICS AND SHOP THEORY**

*By J. M. Amiss, G. K. Shurtleff and H. G. Moltzau. Harper & Brothers, New York and London, 1943. 360 pp., illus., diagrs., charts, tables, 8 x 5½ in., cloth, $1.60.*

The authors of this work are connected with the educational department of the Chrysler Corporation, and this book is based on long experience in teaching shop men. The course covers mathematics as used in the shop, including logarithms, mensuration, geometry and trigonometry. It also covers such topics as safety and fire protection, gages, cutting tools and their heat treatment, gearing, machine tools, superfinish and oilite bearings. Used in conjunction with a standard handbook, it provides material for a two-year course for apprentices.

**(The) STORY OF FLYING**

*By A. Black. rev. ed. McGraw-Hill Book Co., Whittlesey House Dept., New York, 1943. 272 pp., illus., 9½ x 6 in., cloth, $2.50.*

This popular narrative of human flight describes the outstanding steps from the earliest times to the present. All types of aircraft are considered, and attention is also given to engines, airports and various important instruments. The book offers non-technical readers a good overall view of aviation.

**STREAM FLOW, Measurements, Records and Their Uses**

*By N. C. Grover and A. W. Harrington. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 363 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

The collection, computation, publication and subsequent use of records of stream flow are discussed in this volume, whose authors have had long experience in this field. The reasons why records of the quantity and quality of the discharge of surface streams and of ground water are needed as a basis for their development are explained. The selection of sites for gaging stations, and the equipment and operation of such stations are described, together with the computing and publishing of the results.

**STRUCTURAL MEMBERS AND CONNECTIONS**

*Compiled by a staff of specialists; editors-in-chief, G. A. Hool and W. S. Kinne, revised by R. R. Zipprodt and F. N. Menefee. 2 ed., McGraw-Hill Book Co., New York and London, 1943. 639 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $6.00.*

Intended as a reference work for engineers and students, this book treats comprehensively the general theory and also the detailed design of structural members and their connections. Numerous worked-out examples are provided. Steel, wooden and reinforced concrete members are discussed. The new edition has been thoroughly revised.

**TEXTBOOK OF OFFICE MANAGEMENT**

*By W. H. Leffingwell and E. M. Robinson. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 469 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

The principles of scientific management are presented in clear language, and their application to office organization is discussed in detail and illustrated by numerous examples and practical problems. All phases of office work and equipment are considered. The book is an excellent text.

**THEORETICAL SOIL MECHANICS**

*By K. Terzaghi. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 510 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

In this volume the author confines himself to theoretical principles exclusively, limiting himself "to theories which have stood the test of experience and which are applicable, under certain conditions and restrictions, to the approximate solution of practical problems." The treatment covers the general principles involved in the theories of soil mechanics, the conditions for shear failure in ideal soils, and the mechanical interaction between solid and water in soils. There is an extensive bibliography of sources.

**THIS EXCITING AIR, the Experiences of a Test Pilot**

*By B. T. Guyton. McGraw-Hill Book Co. (Whittlesey House Div.), New York and London, 1943. 219 pp., illus., 8½ x 5½ in., cloth, $2.00.*

An experienced test pilot gives a vivid account of the work of test pilots, with illustrations from thrilling happenings in his own career and that of others.

**WORLD MINERALS AND WORLD PEACE**

*By C. K. Leith, J. W. Furness and C. Lewis. Brookings Institution, Washington, D.C., 1943. 253 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

One of the greatest obstacles to world peace is the fact that no nation can attain industrial power if wholly dependent upon its own mineral resources. Future peace will depend in large measure upon the international movement of minerals. The present book presents a factual study of the problem, analyzing the physical and commercial trends of world mineral production and the recent trends in political and economic control. Finally, it discusses the possibilities of controlling minerals to prevent preparation for war.

**CONCRETE MANUAL, 4th ed.**

*United States Department of the Interior, Bureau of Reclamation, Washington, D.C., 1942. 476 pp., illus., diagrs., charts, tables, 7½ x 4½ in., fabrikoid, $1.00 (lots of 40 copies or more subject to 25% discount).*

The new edition of this well-known manual differs little from the third, but errors have been corrected and the text altered to represent current practice. The book represents the practice of the Bureau of Reclamation. The subjects discussed include the properties of concrete and the factors that control them, the investigation and selection of concrete materials, concrete mixes, inspection and testing, concrete manufacturing, handling, placing and survey, and special types of concrete.

**DIE CASTING FOR ENGINEERS**

*New Jersey Zinc Co., New York, 1942. 148 pp., illus., diagrs., tables, 9½ x 6 in., cloth, $1.00.*

This is a brief, practical account of the method and its uses. The principles of the process, the alloys used, the design and construction of dies, finishes for castings, specifications, tests, etc., are discussed.

**THEORY AND PRACTICE OF JOB RATING**

*By M. F. Stigers and E. G. Reed. McGraw-Hill Book Co., New York and London, 1942. 154 pp., charts, tables, 8 x 5 in., cloth, $1.75.*

The method of job rating presented here claims to measure every element, including intangibles heretofore considered unmeasurable. The underlying philosophy is explained, a technique for actual evaluation is given, and questionnaires, rating scales, procedure for cross comparison and full instructions are given.

**THEORY OF FLIGHT AND AIRCRAFT ENGINES—Air Pilot Training**

*By B. A. Shields. 2 ed. McGraw-Hill Book Co., New York and London, 1942. 377 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.75.*

The present work is a revision and expansion of parts one and two of the author's "Air Pilot Training", and is designed to cover all the information on the theory of flight and on airplane engines called for by the examinations for certificates as a private or commercial pilot. The information is given in a simple, non-technical style which does not call for advanced education.

**TORQUE CONVERTERS OR TRANSMISSIONS**

*By P. M. Heldt. Publ. by P. M. Heldt, Nyack, New York, 1942. 406 pp., illus., diagrs., charts, tables, 8½ x 5 in., cloth, $4.00.*

The past ten or fifteen years have seen many developments in transmissions for use with internal combustion engines in vehicles. The present book brings together the wide variety of mechanisms which have been devised, in convenient form for use by designers and students. Much information on design is provided, especially for the types in common use.

**WAR GASES, Their Identification and Decontamination**

*By M. B. Jacobs. Interscience Publishers, New York, 1942. 180 pp., diagrs., tables, 9½ x 6 in., cloth, $3.00.*

The detection, sampling and identification of chemical agents of warfare and the decontamination of areas and materials polluted by them are presented in this work. The book is designed to aid civilian officials in dealing with gas attacks.

**WEATHER STUDY**

*By D. Brunt. Ronald Press Co., New York, 1942. 215 pp., diagrs., charts, maps, 8 x 5 in., cloth, $2.25.*

A simple textbook for readers with no previous knowledge of meteorology. The book is intended especially for candidates for the Air forces.

**YOUR CAREER IN TRANSPORATTION**

*By N. V. Carlisle. E. P. Dutton & Co., New York, 1942. 188 pp., illus., tables, 8½ x 5½ in., cloth, $2.00.*

Young men interested in vocational opportunities will find this book a sound guide to those available in the various transportation fields, rail, highway, water and air. The various positions are described, salaries are discussed and requirements explained.

**JIG AND FIXTURE DESIGN**

*Edited by F. D. Jones. 3 ed. Machinery (Industrial Press), New York, 1942. 382 pp., illus., diagrs., tables, 9½ x 6 in., fabrikoid, $3.00.*

The principles underlying the design of various classes of jigs and work-holding fixtures are dealt with, and many ingenious designs used in modern shops are illustrated.

**JORDANOFF'S ILLUSTRATED AVIATION DICTIONARY**

*By A. Jordanoff. Harper & Brothers, New York and London, 1942. 415 pp., illus., 10 x 7 in., cloth, $3.50.*

This dictionary gives clear definitions of some two thousand aeronautical terms and illustrates each by a simple drawing. Slang terms are included. Should prove a popular addition to any collection on aviation.

**LUBRICATION**

*By A. E. Norton, edited by J. R. Muenger. McGraw-Hill Book Co., New York and London, 1942. 244 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

This book is intended to meet the need for a basic text covering the fundamental principles that underlie the rational design of machine bearings and the methods of lubricating them. Starting with the simple concepts of viscosity and laminar flow, the major part of the book is devoted to developing the hydrodynamic theory of bearings. The types of friction of interest in lubrication are also discussed, and criteria for bearings are given. Lubricants are considered. Plain bearings are compared with roller contact bearings.

**MacRAE'S BLUE BOOK, America's Greatest Buying Guide, and Hendrick's Commercial Register, 50th Annual edition, 1942-43**

*MacRae's Blue Book Co., Chicago and New York, 1942. 3,728 pp., illus, 11½ x 8 in., cloth, $15.00.*

The latest edition of this well-known directory follows the pattern of the previous one, but has been thoroughly revised. An excellently classified subject directory is provided to manufactures of all kinds, accompanied by a directory of manufacturers and local distributors. There is also a large index of trade names.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

June 30th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the August meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

**FOR ADMISSION**

BUSH—ORVAL FERGUSON, of 4900 Côte des Neiges, Montreal, Que. Born at New Liskeard, Ont., Sept. 3rd, 1910; Educ.: B. Arch., Univ. of Toronto, 1938; 1929-32 (summers), govt. land surveys, gen. mach. shop works, road constrn.; 1933-36, gold mining, Dome Mines; 1938-40, design, gen. field work & supervn. of constrn., for H. B. Long, Architect, Kirkland Lake; 1940, asst. to res. engr., 1941 res. engr., 1942, mech. representative on installn. of mech. equipment in munition plant, and at present, res. engr. i/c of constrn. of extensive war plant, for T. Pringle & Son Ltd., Montreal, Que.

References: G. M. Wynn, A. L. Harkness, J. S. Hewson, E. V. Gage, F. T. Gnaedinger.

CADENHEAD—ARTHUR FORDYCE GRANT, of 156 Maple Ave., Shawinigan Falls, Que. Born at Camden East, Ont., Sept. 6th, 1885; Educ.: B.A. (Hon. Chem.), Queen's Univ., 1914. Member, C.I.M.M., Fellow, Can. Inst. Chemistry; 1907, installn. of acetylene gas lighting system, St. Ann's Bay, Jamaica; 1912-13, prospecting; 1912-15, house master, Pickering College, Newmarket, Ont.; 1918-29, lecturer in chemistry, Queen's Univ.; 1929 to date, director of plant research, Shawinigan Chemicals Limited, Shawinigan Falls, Que.

References: J. B. Challies, L. A. Wright, L. E. Westman, R. E. Heartz, M. Eaton.

CHRISTIE—ALEXANDER GRAHAM, of Baltimore, Maryland. Born at Manchester, Ont., November 19th, 1880; Educ.: Grad., S.P.S., 1901, M.E., 1913, Univ. of Toronto. D. Eng. (Hon.), Stevens Institute, 1939. D. Eng. (Hon.), Lehigh Univ., 1940. R.P.E. New York State and Maryland; 1901-04, erecting engr., etc., steam turbine dept., Westinghouse Machine Co., East Pittsburgh; 1904-05, instructor in mech. engrg., Cornell univ.; 1905-07, asst. district supt. and asst. supt. of constrn., Allis-Chalmers Co., Milwaukee; 1907-09, mech. engr., Western Canada Cement & Coal Co., Exshaw, Alta.; 1904-14, asst. & assoc. professor of steam & gas engrg., Univ. of Wisconsin, Madison; 1914 to date, associate and later professor of mech. engrg., The Johns Hopkins University, Baltimore, Maryland. Also consltg. engr. on numerous important projects, director of night courses in technology, chairman, Maryland State Board of Registration for Prof. Engrs. & Land Surveyors, Education Director, War Manpower Commission, State of Maryland.

References—G. A. Gaherty, J. B. Challies, T. H. Hogg, A. H. Hull, C. R. Young, R. W. Angus, L. A. Wright, C. A. Robb.

DUMONT—J. ALFRED, of Quebec, Que. Born at Levis, Que., Jan. 19th, 1909; Educ.: 1934-38, Quebec Technical School. 1938-42, summer courses in science at Laval University. At present taking I.C.S. course in civil engrg.; 1929-32, dfting. on constrn. for contractor in Quebec City; 1942 to date, chainman, rodman, dftsman., mtce. dept., C.N.R., Quebec, Que. (Applying for admission as Affiliate.).

References: L. C. Dupuis, P. Methé, S. J. H. Waller.

FEE—HOWARD RUSSEL, of Arvida, Que. Born at Killam, Alta., Nov. 1st, 1912; Educ.: B.Sc. (E.E.), Univ. of Alta., 1934; 1934-37, private contracting; 1937-41, electrician & elec. constrn. foreman, International Nickel Co.; 1941-42, test dept., plant engr., Saguenay Power Company; 1942 to date, system operating engr., Saguenay Transmission Co. Ltd., Arvida, Que.

References: J. R. Hango, W. E. Cooper, A. Robert, W. E. Cornish.

FLETT—FRANK PARKIN, of Toronto, Ont. Born at Chatham, N.B., Nov. 24th, 1892. Educ.: B.Sc., Univ. of N.B., 1914. 1919-20, special studies, Mass. Inst. Tech. R.P.E. of Ont.; 1914-15, Public Works, F. & G.L. Rly., N.B., I.C.R. & C.N.R.; 1915-18, overseas; 1919, district vocational officer; 1922-25, chief engr., Windsor, and 1925 to date, district manager, Toronto, for Truscon Steel Co. of Canada Ltd.

References: G. Stead, J. M. Oxley, H. E. T. Haultain, L. A. C. Lee.

GRAHAM—WALTER PETER, of 92 Highfield St., Moncton, N.B. Born at Belfast, Nor. Ireland, Dec. 6th, 1899; Educ.: 1913-18, Belfast College of Technology; 1927-30, 1931 (6 mos. periods), Kerr's Engrg. Academy; Board of Trade First Class Steam & Motor Certs. Member, Inst. of Marine Engrs. (England); 1915-20, engrg. ap'ticeship at Harland & Wolff, Belfast; 1921-23, junior engrg., Ulster Steamship Co., Belfast; 1923-34, Third & Second Engineer, Andrew Weir & Co., London, England; 1935-41, chief engineer, Quebec & Ontario Transportation Co., Montreal; At present, industrial sales engr., Moncton, N.B.

References: E. L. Baillie, F. L. Thompson, L. Sterns, C. G. Clark, S. Hogg, T. H. Dickson.

HAND—GEORGE WILLIAM, Lieut., R.C.N.V.R., of 346 Fifth Ave., Ottawa, Ont. Born at Montreal, April 29th, 1917; Educ.: B.A., Acadia Univ., Wolfville, N.S.; 1935-37, 1940-41, mtce. & administration of real estate, 1935-39, superintendence, quantity surveying & estimating, for Dr. W. T. Hand, Proprietor, Montreal; 1940-41, quantity surveyor, estimator, etc., for Cecil Carpenter & Co., Contractors, and Collet & Co., Engrs. & Contractors, Montreal, also contracting for self; Aug. 1940 to date, Lieut., R.C.N.V.R., one year with the Royal Navy; Nov. 1942, returned to Canada medically unfit to carry on sea duties, appointed to C.N.E.S. for duty with the Director, Works & Bldgs. At present, asst. office manager, D.W.B. (Naval). (Applying for admission as Affiliate.).

References: P. W. Walters, N. A. Thompson, A. M. Hudson, D. A. Chisholm, J. Dick.

MacKENZIE—HUGH, of 1049 West 29th Ave., Vancouver, B.C. Born at London, England, Feb. 27th, 1885; Educ.: 1901-06, extension lectures, Univ. of London; Extra 1st Class Board of Trade Cert., London, England; 1901-06, ap'ticeship, A. W. Robertson & Co., London, England; 1906-13, junior engineer on various ships; 1913-14, chief engr., Aberdeen Line; 1914-18, chief engr., H. M. Naval Transport; 1918-20, mgr., London Scaling Co. (Bristol Area branch); 1920-21, supt. engr., Brooks S.S. Corpn. of New York (U.S. Shipping Board); 1921-23, works mgr., cold storage constrn., Insulators Ltd.; 1923-25, engr. on various submarine, cable laying & repairing expeditions; 1925-31, gen. mgr., Hankow Lee Works, Hankow, China; 1931-36, distribution engr., 1936-41, supt., Hankow Light & Power Co. Ltd.; 1941 to date, with West Coast Shipbuilders Ltd., at present, engineer manager.

References: H. J. MacLeod, A. Peebles, H. N. Macpherson, P. B. Stroyan, W. N. Kelly.

McLAUGHLIN—ROLAND RUSK, of Toronto, Ont. Born at Toronto, March 16th, 1901; Educ.: M.A., M.A.Sc., B.A.Sc., 1922, Ph.D., 1926, Univ. of Toronto; 1923-24, established new factory for Canada Dry Ginger Ale Inc., at Hudson, N.Y.; 1926-29, chem. research at Univ. of Toronto under National Research Council; 1931-39, asst. professor, 1939-43, associate professor and Jan. 1st, 1943, to date, professor of chemical engrg., University of Toronto, Toronto, Ont.

References: C. R. Young, W. S. Wilson, R. W. Angus, E. A. Allcut, J. R. Cockburn, G. R. Lord, E. A. Smith.

RUSSELL—EDWARD BOON, of 2080 Haro St., Vancouver, B.C. Born at Adelaide, So. Australia, July 29th, 1917; Educ.: 1931-33, Thebarton Technical High School—Intermediate Tech. Cert. (equivalent of Senior Matric.). 1934-38, So. Australian School of Mines & Industries (evening classes), Mech. Dftsman's. Diploma, 1938; 1934-40, toolmaker ap'tice, General Motors, So. Australia; 1940-41, tool design dftsman., General Motors, Oshawa, and John Inglis Co., Toronto; 1941, mech. dftsman., and Oct. 1941 to date, tool design dftsman., ordnance plant, Dominion Bridge Co. Ltd., Vancouver, B.C.

References: W. B. Scoular, A. Dickson, A. S. Granger, P. B. Stroyan.

SHEETS—WILLIAM ELMER, of 1 Mallory Gardens, Toronto, Ont. Born at Canora, Sask., Aug. 18th, 1907; Educ.: B. Arch., 1932, M.Sc., 1933, Univ. of Man.; 1929-31 (summers), dfting. & estimating, Sask. Dept. of Highways; 1934-41, technical dftsman., Dept. of Mines & Natural Resources, Prov. of Man., Winnipeg; 1941 to date, designing dftsman., hydraulic dept., H.E.P.C. of Ontario, Toronto, Ont.

References: O. Holden, S. W. B. Black, B. S. Bjarnason, S. H. deJong, E. Gauer, D. M. Stephens.

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

SALES ENGINEER AND BRANCH MANAGER required for Ottawa office of firm specializing in sale of engineering supplies. Either French or English. Permanent employment, fine prospects. References required. Apply to Box No. 2635-V.

ASSISTANT PLANT SUPERINTENDENTS required by well-established firm engaged in the manufacture of building materials. One vacancy in Montreal plant and the other in a small town near Montreal. In the latter case, knowledge of French is essential. Apply giving record of education and experience to Box No. 2640-V.

MECHANICAL ENGINEER for the position of chief draughtsman, middle-aged person experienced in draughting office detail and capable of directing activities of 12 to 15 draughtsmen. Location Niagara Peninsula. Apply to Box No. 2644-V.

SALES ENGINEER experienced in building construction and possessing aptitude for sales work. Permanent position in Montreal, good opportunity. Bilingual preferred. Salary commensurate with ability. Apply to Box No. 2648-V.

### SITUATIONS WANTED

GRADUATE ENGINEER, University of Toronto, with seven years experience along lines of general mechanical draughting and design with accent on electric motors, instruments and small tools. Also considerable experience in electric instrument laboratory. Due to re-organization of his present company, services are not being fully utilized. Apply to Box No. 1486-W.

GRADUATE ELECTRICAL ENGINEER, University of Manitoba (1933), skilled in design and layout work of power and lighting distribution for industrial plants and commercial buildings. Presently employed but services available where better opportunity afforded. Apply to Box No. 2099-W.

GRADUATE ENGINEER of proven administrative and executive ability desires position entailing greater responsibility and scope for initiative. Presently supervising the production of precision tools. Experienced in personnel work and all phases of maintenance engineering work. Apply to Box No. 2450-W.

### FOR SALE

Thacher Calculating Rule in mahogany case, good condition. Apply to Box No. 49-S.

### CAMERA WANTED

A member of the Institute, who has to undertake an extensive reconnaissance survey, wishes to purchase a second-hand camera provided it is in first-class condition.

The minimum requirements are:

1. At least f4.5 Anastigmat lens or better.
2. Shutter speed to at least 1/150 of a second.
3. Positive sighting, or reflecting, type of finder.
4. Picture size 2¼ x 3¾″ or next larger.
5. Use of standard films.
6. Focusing scale easily read and set.

A No. 1-A Junior F 6.3 camera could be traded-in if desired. Reply giving specifications and price to Box No. 52-S.

### FOR SALE OR RENT

TRANSIT, W. & L. E. Gurley, complete with tripod, 5″ dia. horizontal circle. In excellent condition. Apply to Box No. 51-S.



TURNEY—ARTHUR JAMES, of 204 Weir St. North, Hamilton, Ont. Born at Oxford, England, June 10th, 1914; 1933-35, mach. shop & tool making experience, Gough Engrg. Works & Wright Tool Co.; With the Steel Company of Canada Ltd., as follows: 1938-40, mech. dftsman., 1940-41, chief dftsman., and 1941 to date, chief dftsman. i/c of mech engrg.

References: J. R. Dunbar, A. R. Hannaford, L. C. Sentance, W. A. T. Gilmour, W. E. Brown, T. S. Glover.

WEIGEL—MELVIN POWELL, of 372 Kitchener Ave., Westmount, Que. Born at St. Louis, Miss., Oct. 18th, 1902; Educ.: B.S. in Metallurgical Engrg., Missouri School of Mines & Metallurgy, 1923; (Accredited curriculum); 1923-26, junior engr., and 1927-35, engr., Aluminum Ore Co., East St. Louis, Ill.; 1926-27, engr., Anglo-Chilean Consol. Nitrate Corpn., Chile. With the Aluminum Co. of Canada Ltd. as follows: 1935-39, supt., aluminum plant, 1939-41, gen. supt., Arvida works, and 1941 to date, chief engr., Montreal, Que.

References: A. W. Whitaker, Jr., A. C. Johnston, R. H. Rimmer, M. G. Saunders M. E. Hornback, F. L. Lawton.

#### FOR TRANSFER FROM JUNIOR

ARCHIBALD—MANNING CLIFFORD, of 5450 Trans Island Ave., Montreal. Born at Bear River, N.S., Oct. 31, 1909; Educ.: B.Sc. (Elec.), N.S. Tech. Coll. 1933; Summers—1929, 1931, 1935, line work, switchboard mtce., Maritime Electric Co. Ltd., 1930, transformer loads, Maritime Tel. & Tel. Co. Ltd., Charlottetown; 1936-41, engr., Woodstock Public Utilities Commission, Woodstock, Ont.; 1941 to date, asst. purchasing agent, Montreal Engrg. Co. Ltd., Montreal. (St. 1931, Jr. 1939).

References: G. A. Gaherty, J. A. Vance, W. G. Ure, F. T. Julian, W. P. Copp, J. T. Farmer, F. H. Sexton.

HERSHFIELD—CHARLES, of 225 Maclaren St., Ottawa, Ont. Born at Winnipeg, Man., Dec. 24th, 1910; Educ.: B.Sc. (Civil), Univ. of Man., 1930. R.P.E. of Ont.; 1928-30 (summers), estimating, dfting. & designing, Dominion Bridge Co. Ltd., Winnipeg; 1930-32, designing & dfting., city engr's. office, Winnipeg; 1935-41, engr. i/c of design, detail, fabrication & erection of structl. steel, Standard Iron & Steel Works, Toronto; Also design of structural elements of various structures in a prof. capacity, and as consultant to various architects. At present, senior asst. engr., on structl. design, works & bldgs. branch, Dept. of National Defence (Naval Service), Ottawa, Ont. (Jr. 1935).

References: D. D. Whitson, S. W. S. Hall, J. N. Finlayson, A. E. Macdonald, S. D. Lash.

McKIBBIN—KENNETH HOLDSWORTH, Lieut.-Col., R.C.O.C., of Halifax, N.S. Born at Port Arthur, Ont., Dec. 11, 1915; Educ.: B.Sc., (Mech.), Queen's Univ., 1938; 1936-37 (summers), 1938—April 1939, and Sept. 1939 to Feb.1940, R.C.O.C. Workshops, Kingston and Petawawa; Apr.-Sept. 1939, Military College of Science, Woolwich, England; Feb. 1940—Dec. 1941, D.O.M.E., Military District No. 3; 1942, chief instr., R.C.O.C. Training Centre, Kingston; 1942—Mar. 1943, overseas, studying training methods; Apr. 1943 to date, D.O.M.E., Military district No. 6, Halifax, N.S. (St. 1935, Jr. 1941).

References: N. C. Sherman, D. S. Ellis, L. F. Grant, D. M. Jemmett, R. A. Low.

MacNEIL—DUNCAN PAUL, of Arvida, Que. Born at Glace Bay, N.S., Mar. 2, 1910; Educ.: B.Sc., (Mech.), N.S. Tech. Coll., 1936; 1926-29, reconstrn. work at mines of New England Fuel & Transportation Co., West Virginia, U.S.A.; 1934-35 (summers), highway work, N.S. Dept. of Highways; 1936-40, dftng. and general engrg., Dominion Steel & Coal Corp., Sydney, N.S.; 1940—Apr. 1942, dftng. and general engrg., Steel Company of Canada, Montreal; 1942—May, 1943, mtce. engr. for aluminum and fluoride plants, and at present asst. purchasing agent, Aluminum Co. of Canada, Arvida, Que. (Jr. 1938).

References: M. G. Saunders, A. C. Johnston, P. E. Poitras, A. T. Cairncross, E. C. Kirkpatrick.

MILLER—DONALD WATERS, of St. Lawrence, Nfld. Born at Winnipeg, Man., June 1, 1908; Educ.: B.Sc. (Civil), Univ. of Man., 1935; special student mining engrg., McGill Univ., 1940; 1935-37, various jobs, principally engrg. gold mines and prospects; 1937-39, engrg., 3 mos. Berens River Mines Ltd., 2 yrs. Island Mountain Gold Mines Co. Ltd.; 1940-42, mining engrg., Aluminum Co. of Canada, Ltd.; 1942 to date, asst. mgr., Newfoundland Fluorspar Limited, St. Lawrence, Nfld. (St. 1935, Jr. 1938).

References: R. F. Legget, A. E. Macdonald, C. V. Antenbring, H. A. Gray, F. L. Lawton.

#### FOR TRANSFER FROM STUDENT

CALLUM—JOHN PARK, of 250 Pim St., Sault Ste. Marie, Ont. Born at Sarnia Ont., Mar. 6, 1914; Educ.: B.Sc., Queen's Univ., 1938; 1938-40, junior fuel engr., 1940-42, master mechanic of blast furnaces, and at present asst. mech. supt., Algoma Steel Corporation, Sault Ste. Marie, Ont. (St. 1938)

References: C. Stenbol, W. S. Wilson, W. D. Adams, F. J. McDiarmid, A. H. Russell.

GIROUARD—LAURENT JEAN-BAPTISTE, of St. Lambert, Que. Born at St. Laurent, Que., March 11th, 1916; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1942; Summers—1938, surveying, Quebec Streams Commn., 1939, road constrn., Lakeshore Construction Ltd., 1940-41, Provincial Laboratory; 1942 to date, engr., Marine Industries Ltd., Sorel, Que. (St. 1940).

References: J. A. Lalonde, A. Gratton.

PAPOFF—WILLIAM NIKITOVITCH, of Rossland, B.C. Born at Blaine Lake, Sask., Mar. 25, 1913; Educ.: B.Sc. (Civil), Univ. of Sask., 1933; 1935-36, chainman, instr'man. & dftsman., mineral claims surveys, N.W.T.; 1937 to date, on the engrg. staff of the Cons. Mining & Smelting Co. Ltd., Trail, B.C., as instr'man., dftsman. and asst. to chief on various surveys, etc., in British Columbia, North West Territories and Saskatchewan. Also misc. surveys in connection with plant constrn. and mining properties development. (St. 1935).

References: S. C. Montgomery, A. C. Ridgers, H. A. Moore, G. H. Bancroft, A. S. Mansbridge.

SIMPSON—C. NORMAN, of Niagara Falls, Ont. Born at Port Arthur, Ont., Dec. 29, 1917; Educ.: B.Sc. (Civil), Queen's Univ., 1940; Summers—1936, recorder, Geodetic Survey, 1937, surveying and sampling, Kenricia Gold Mines, Kenora, 1938 sub party leader, Geological Survey, 1939, instr'mn. airport constrn., 1940, junior engr., Saguenay Power Co.; Apr. 1941 to date, asst. engr., H. G. Acres & Co., Niagara Falls, Ont. (St. 1939).

References: A. W. F. McQueen, D. S. Ellis, J. H. Inge, P. E. Doncaster, C. Miller, R. F. Legget, H. G. Acres, H. E. Barnett.

TANNER—WILLIAM JOHN, of Shawinigan Falls, Que. Born at Dundee, Que., Sept. 16, 1915; Educ.: B.Eng., McGill Univ., 1939; 1937 (summer) Noranda Mines, Ltd.; 1938 (summer), Southern Canada Power Co.; 1939-40, Canadian International Paper Co. Ltd., Gatineau Mill, Que.; Aug. 1940 to date, engr. in gas scrubbing plant, Aluminum Co. of Canada, Shawinigan Falls. (St. 1938).

References: A. R. Roberts, C. M. McKergow, R. E. Jamieson, E. Brown, W. M. Harvey.

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### COMMERCIAL STANDARD FOR MINERAL WOOL

The U. S. Department of Commerce, National Bureau of Standards, Washington, D.C., have issued bulletin CS-105-43, 21 pages, which promulgates a commercial standard for mineral wool in loose, granulated or felted form in low-temperature installations. It covers the minimum physical and chemical requirements of this material including thickness of insulation required for various operating temperatures, specifications for auxiliary materials, tests, installation requirements and method of guaranteeing compliance with the standard. Copies are obtainable direct from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., at five cents each.

### SYNTHETIC RUBBER PLANT

The first synthetic rubber manufacturing plant in the British Empire was placed in full scale operation on June 14th by Naugatuck Chemicals Limited, affiliate of Dominion Rubber Company Limited.

The new development will produce "Thiokol," one of the five commercial types of synthetic rubber, and the complete output of the plant has been placed at the disposal of the Dominion Government. "Thiokol" was first developed in the United States more th in ten years ago, and is widely used in the production of various types of mechanical rubber goods. For some specific purposes, "Thiokol" is superior to natural rubber, especially in its resistance to oil, grease, acid and sunlight, It is said to rank high in impermeability to gases and water.

The production in Canada of "Thiokol" synthetic rubber means that Canada can rely on an uninterrupted supply of essential rubber for the construction of vital oil and gasoline resisting hose for fuelling planes, ships, etc., and for other specific uses in war production. "Thiokol" is rated as being a synthetic rubber with scores of uses in the petroleum industry alone. It is claimed to be an outstanding product for lining chemical and acid tanks and pipes and hose for handling high octane rating fuels, and field gasoline storage tanks for fuel supply bases.

Like many important inventions, "Thiokol" was discovered accidentally, through experiments to produce anti-freeze. It is compounded from the products of sulphur and salt mines, and gas wells.

George Spence

### DRIVE CHAINS

Jeffrey Manufacturing Company, Ltd., Montreal, Que., have for distribution catalogue No. 725, 84 pages, covering a complete line of steel drive chains of both the steel thimble roller and finished roller types. Besides large scale illustrations of individual chains, sprockets, etc., the catalogue contains numerous illustrations of chains in actual service situations. Specification tables relating to chains and their component parts and tables of useful information make up the balance of the volume.

### ELECTRIC HEATERS AND HEATING DEVICES

Canadian General Electric Company, Ltd., Toronto, Ont., have for distribution catalogue No. CGED-650B, 48 pages, which is described as listing "everything needed for small heating jobs." In it are given construction features, installation and application data, and many tables, charts and diagrams providing a veritable text book on the subject of electric heaters and heating devices. Among the types of units illustrated and described are the company's Calrod, insertion, air and clamp-on, immersion, fin Calrod, cartridge, strip, oven and unit heaters. The company's lines of soldering irons, glue pots, metal-melting pots, cast-in immersion heaters for soft metals and control equipment are also featured. Tables of useful information to assist in selecting the heater or device best suited to the job are given, as are also photographs of installations and a glossary of industrial heating publications issued by the company.

### STEEL COMPANY CHANGES

The Steel Company of Canada Ltd. announces the appointment of D. B. McCoy as general sales manager, succeeding George Spence, who, after a long and distinguished career spent entirely in the steel business, is now retiring from the position of general sales manager which he has held since 1926.

Mr. Spence was born in Hamilton, Ont., and was educated in that city. He entered the business world in 1893 with the Canada Screw Company, later joining The Steel Company of Canada on its formation in 1910. Mr. Spence's experience in the industry has been a varied one, being successively stock clerk, head of invoicing, costing and accounting. Later he joined the sales department, eventually taking charge of the company's New York office in the interests of its export trade during the Great War. He has travelled extensively on trade missions to the Antipodes, the Orient, Africa, Europe and South America. In 1919 he was placed in charge of sales at Hamilton followed by his appointment in 1926 as general sales manager. After this service record of practically fifty years, he now retires carrying the good wishes of his many friends in the industry.

Mr. McCoy was born in Belleville, Ont., where he received his early education before joining the Toronto and Belleville Rolling Mills in 1907. This firm was later absorbed by the Canada Bolt & Nut Company, which in 1910 became a part of the newly formed "Steel Company of Canada Limited." Mr. McCoy successively became sales representative for Northern Ontario, then Eastern Ontario, manager of the Vancouver office; manager of the Toronto office and later assistant general sales manager. In 1941 Mr. McCoy was loaned to Wartime Merchant Shipping Limited, where he became assistant to the president, Mr. H. R. MacMillan. He now returns to The Steel Company of Canada Limited in the capacity of general sales manager with headquarters at Hamilton, Ont.

### INDUSTRIAL AND MARINE PACKINGS

Crane Packing Company, Ltd., Hamilton, Ont., have just issued catalogue No. 50 covering the complete line of "John Crane" metallic, fabric, plastic and shredded metallic packings, also plastic lead pipe-joint seal and packing lubricants. General industrial packings, marine packings, petroleum packings, chemical and refrigeration packings are fully illustrated and described. A recommendation chart furnishes a quick picture of styles that may be successfully applied to given operating conditions. Special emphasis is placed on "John Crane" metallic condenser packing rings. Comparative analysis of metallic rings, fibre, ferrule and corset lace methods are available in brief form.

### SAVING TRUCK TIRES

Dominion Rubber Company, Ltd., Montreal, Que., have prepared a manual under the caption "How To Save Truck Tires," and designed as a guide and ready reference for the fleet owner, average vehicle owner and operator. The manual contains information on lengthening the life of truck tires which is presented in easily understandable and concise terms. For instance, it tells how to match duals, break in new tires, etc., and deals authoritatively with recapping, tire storage and load and inflation capacities. Copiously illustrated with helpful diagrams and charts.

### INSULATED POWER CABLE JOINTS

Phillips Electrical Works Ltd., Brockville, Ont., have issued a 16-page bulletin, No. E.B. 41/1. Entitled "How to Make Joints for Insulated Power Cables" and giving step-by-step jointing procedures, this bulletin is devoted to presenting diagrammatically the recommended procedures in the splicing of the more usual types of insulated cables. Joint protecting boxes, split, cast iron and tubular type are similarly covered, as also are two typical examples showing how drawings, providing specific dimensions to be followed by cable splicers, which are enclosed in unit packages, are handled.

D. B. McCoy

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 — MONTREAL, AUGUST 1943 — NUMBER 8

"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."

★ ★ ★

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.



# CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

---

## STANDING COMMITTEES

### FINANCE
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

### LEGISLATION
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

### PAPERS
L. F. GRANT, *Chairman*

### LIBRARY AND HOUSE
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

### PUBLICATION
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

---

## SPECIAL COMMITTEES

### BOARD OF EXAMINERS AND EDUCATION
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

### GZOWSKI MEDAL
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

### DUGGAN MEDAL AND PRIZE
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

### PLUMMER MEDAL
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

### LEONARD MEDAL
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

### JULIAN C. SMITH MEDAL
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

### MEMBERSHIP
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

### PROFESSIONAL INTERESTS
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

### STUDENTS' AND JUNIORS' PRIZES
**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

### INTERNATIONAL RELATIONS
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

### THE YOUNG ENGINEER
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

### POST-WAR PROBLEMS
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

### WESTERN WATER PROBLEMS
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

### ENGINEERING FEATURES OF CIVIL DEFENCE
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

### INDUSTRIAL RELATIONS
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. P. BRIERLEY
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
R. DUPUIS
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

### DETERIORATION OF CONCRETE STRUCTURES
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville, Ont.

**CALGARY**
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE, H. R. HAYES, A. HIGGINS, W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS, G. P. F. BOESE, H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL, 803-17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN, J. W. JUDGE, E. D. ROBERTSON, J. D. A. MACDONALD, I. F. MORRISON, H. W. TYE
*(Ex-Officio),* D. HUTCHISON, E. NELSON
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE, S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON, R. J. G. SCHOFIELD, NORMAN EAGER, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, STANLEY SHUPE, A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN, 91 Barnesdale Blvd., Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN, J. R. CARTER, J. D. LEE
*(Ex-Officio),* T. A. McGINNIS, L. F. GRANT, A. JACKSON
*Sec. Treas.,* R. A. LOW, Dept. of Civil Engineering, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* R. B. CHANDLER
*Vice-Chair.,* S. T. McCAVOUR
*Executive,* S. E. FLOOK, O. J. KOREEN, E. L. GOODALL, J. I. CARMICHAEL, W. H. SMALL, A. D. NORTON, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* E. M. G. MacGILL (Mrs. E. J. Soulsby), E. J. DAVIES, H. G. O'LEARY
*Sec.-Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT, W. C. MILLER, F. T. TAYLOR, F. C. BALL, V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN, J. A. VANCE
*Sec. Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS, H. W. HOLE, A. GORDON, G. C. TORRENS, G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE, G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R. Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE, R. C. FLITTON, G. D. HULME, G. E. GELINAS, K. G. CAMERON, G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD, J. E. ARMSTRONG, R. E. HEARTZ, W. G. HUNT, J. A. LALONDE, G. MacL. PITTS, E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que

**NIAGARA PENINSULA**
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR, C. G. MOON, G. F. VOLLMER, H. E. BARNETT, J. W. BROOKS, G. MORRISON, D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 2135 Culp Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY, G. A. LINDSAY, R. YUILL, W. H. B. BEVAN, J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY, K. M. CAMERON, N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON, Dept. of Mines & Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN, A. L. MALBY, F. R. POPE, C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY, H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD, 308 Monaghan Road, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldgs., Quebec, Que.

**SAGUENAY**
*Chairman,* CHAS. MILLER
*Vice-Chair.,* G. B. MOXON
*Executive,* J. FRISCH, W. E. COOPER, F. T. BOUTILIER
*(Ex-Officio),* R. H. RIMMER, J. W. WARD, ALEX. T. CAIRNCROSS
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, P.O. Box 33, Arvida, Que.

**SAINT JOHN**
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN, C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH, J. P. MOONEY, D. R. SMITH, G. W. GRIFFIN
*Sec.-Treas.,* G. L. PHILLIPS, Saint John Dry Dock & Shipbldg. Co. Ltd., East Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vice-Chair.,* R. DORION
*Executive,* G. B. BAXTER, E. BUTLER, A. G. JACQUES, R. D. PACKARD, M. EATON, E. T. BUCHANAN, J. JOYAL, W. E. A. McLEISH, H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN, H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS, Shawinigan Water & Power Company, P.O. Box 190, Three Rivers, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN, E. K. PHILLIPS, J. I. STRONG, F. C. DEMPSEY, N. B. HUTCHEON, J. G. SCHAEFFER, R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG, P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK, C. R. MURDOCK, G. W. MacLEOD, K. G. ROSS, H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG, A. E. PICKERING, L. R. BROWN
*Sec. Treas.,* O. A. EVANS, 159 Upton Road, Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR, R. F. LEGGET, E. G. HEWSON, A. H. HULL, C. F. MORRISON, E. A. CROSS
*(Ex-Officio),* H. E. BRANDON, W. S. WILSON, T. H. HOGG, C. R. YOUNG, N. MacNICOL, J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD, R. E. POTTER, I. C. BARLTROP, E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT, C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD, A. N. ANDERSON, F. C. GREEN, J. H. BLAKE
*(Ex-Officio),* E. W. IZARD, A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING, 41 Gorge Road West, Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING, N. M. HALL, B. B. HOGARTH, R. H. ROBINSON, R. A. SARA
*(Ex-Officio),* W. P. BRERETON, J. W. SANGER, D. M. STEPHENS
*Sec.-Treas.,* T E. STOREY, 55 Princess Street, Winnipeg, Man.

# NOTES ON THE DESIGN OF CONCRETE MIXES

S. D. LASH, M.E.I.C. AND J. DOUGLAS LEE

*Assistant Professor of Civil Engineering and Lecturer in Civil Engineering, respectively, Queen's University, Kingston, Ont.*

**SUMMARY—A simple method for the design of concrete mixes is presented based upon three well established experimental results—the water-cement ratio theory, the water-content slump relation and the method of proportioning by absolute volumes. The proposed method is based to a considerable extent on a recent report by Committee 613 of theAmerican Concrete Institute. By means of a data sheet and a computation sheet the design of a mix for any condition is reduced to an exceedingly simple and straightforward procedure.**

## Introduction

More concrete has been placed during the past 25 years than ever before. More attention has been given to the proportioning of concrete mixes both in the laboratory and the field. On the basis of this prodigious volume of experience, certain principles governing the proportioning of concrete mixes have become fairly well established. These principles are well known to the specialist but they are not as familiar to the man who only uses concrete occasionally on small jobs. The large amount of technical literature on concrete mixing presents a confusing picture and, in many instances, the consequence is that the experience of the past quarter century is ignored and empirical rules belonging to a previous era are followed instead. The result is often either poor concrete or unnecessarily costly concrete. Proper proportioning of mixes will not guarantee good concrete. However, concrete making is like cake making in many ways and a good recipe helps a lot. It is the purpose of these notes to aid in selecting the recipe.

## Theory

In 1918, Abrams[1] stated the water-cement ratio theory. According to this theory the strength of concrete for any given cement is determined entirely by the ratio of water to cement. The greater this ratio the less the strength. The only limitation prescribed by Abrams was that the mix be workable, i.e., it must not be so wet that the larger stones sink to the bottom and the cement comes to the top and it must not be so dry that it cannot be consolidated properly. Experience has served to confirm the Abrams' theory—it is the basis of most modern methods of proportioning concrete. Perhaps to-day we should state it a little differently and say that the water-cement ratio is the most important factor affecting the strength of concrete. It is known that there are other variables such for example as the shape, size and surface texture of the aggregate. These variables, however, only influence the strength to a comparatively small extent. If we can make concrete that will come within 10 per cent of the intended strength as indicated by tests on a few cylinders we feel we are doing quite well. Within such limits the effects of other variables may be neglected. Moreover the strength does not appear to increase with decrease in water-cement ratio below a certain value even though the resulting concrete may be workable. This point seems to need further investigation.

Abrams expressed the relation between strength and water-cement ratio by the equation

$$f_c = \frac{A}{B^x} \quad \ldots\ldots (1)$$

where $f_c$ = compressive strength in lb. per sq. in. under standard conditions.
$A$ = constant — usually 14,000
$B$ = constant — varies with quality of the cement
and $x$ = the water-cement ratio = $w/c$

From a consideration of equation (1) it will be seen that, keeping other things the same, the strength of concrete may be increased either by increasing the amount of cement or by decreasing the amount of water. It sometimes seems a little unfortunate that Abrams chose to express his results in terms of the water-cement ratio rather than in terms of its reciprocal the cement-water ratio. The relation between strength and cement-water ratio is more nearly linear and can often be represented by a first degree equation of the forms[2].

$$f_c = M + N\left(\frac{c}{w}\right) \quad \ldots\ldots (2)$$

Thus the strength of the mix is proportional to the amount of cement in the cement water paste.

Figure 1 shows results of recent tests at Queen's University. It will be noted that strength increases with diminishing water-cement ratio until the latter equals 0.5.

In Fig. 1(a) the relation between strength and water-cement ratio is plotted and in Fig. 1(b) the relation between strength and cement-water ratio. The maximum error involved in putting a straight line through the latter points is about 8 per cent. This line has the equation—

$$f_c = 3800\ c/w - 3000 \quad \ldots\ldots (3)$$

A second fact, less widely known, has been established by experiment regarding the consistency of concrete as indicated by the slump test[3]. For a given quantity of water per cubic yard of concrete the consistency is practically constant regardless of the relative proportion of the other materials. This amount of water will be referred to as

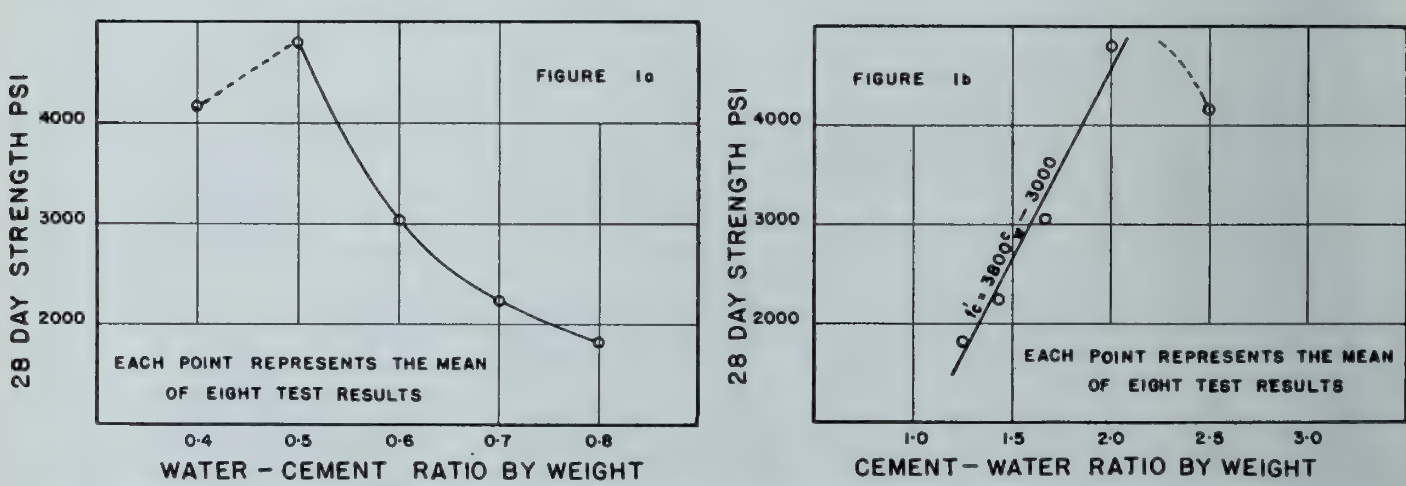



**Fig. 1—Diagrams showing the result of tests to determine (a) the relation between strength and water/cement ratio and (b) the relation between strength and cement/water ratio.**

water/cement=0.4
mix: 1-1.3-1.6

water/cement=0.5
mix: 1-1.7-2.1

water/cement=0.6
mix: 1-2.1-2.6

water/cement=0.7
mix: 1-2.5-3.1

water/cement=0.8
mix: 1-3.0-3.6

**Fig. 2—Typical slump tests of mixes having different water/cement ratios but the same water content.**

the water content and is expressed in pounds per cubic yard. Other variables influence the slump to a lesser extent—these include the size, gradation, and shape of the aggregates. For any particular material the latter factors remain constant and the slump is almost entirely fixed by the water content. This is illustrated in Fig. 2 which shows slump tests from mixes having widely different proportions of cement and aggregates but the same water content. The same results are included in those shown graphically in Fig. 3, indicating that for all practical purposes the mixes may be considered as having the same slump.

A third fact, also established experimentally, is that the volume of concrete produced by mixing known quantities of materials can be estimated quite closely by assuming that the voids between the particles of aggregate are completely filled up with cement paste. This means that air voids are assumed to occupy a negligible amount of space and consequently the volume of the concrete is equal to the sum of the absolute volumes of its constituent materials. The term absolute volume is used to indicate that it is not the loose volume including voids that is meant. The simplest practical way to find the absolute volume of any given quantity of material is to make use of the relation between density and volume:

Absolute volume in cu. ft. = Weight in lb. divided by density in lb. per cu. ft.

The densities of materials commonly used for aggregates are well established or may easily be found by a simple experiment. The density of cement may be taken as 195 lb. per cu. ft.

Support for the above theory may be found by comparing the observed densities of concrete with the calculated values. Table I shows results that have been obtained at Queen's University.

TABLE I

Comparison of Observed and Calculated Densities of Concrete Mixes

| Water-cement ratio | Observed density lb. per cu. ft. | Calculated density lb. per cu. ft. | $\frac{\text{Calculated density}}{\text{observed density}} \times 100$ |
|---|---|---|---|
| 0.4 | 148.6 | 147.5 | 99.3 per cent |
| 0.5 | 149.5 | 146.8 | 98.2 " " |
| 0.6 | 147.5 | 145.3 | 98.5 " " |
| 0.7 | 145.2 | 145.3 | 100.1 " " |
| 0.8 | 145.6 | 145.2 | 99.7 " " |

average 99.2 per cent.

The agreement is within the probable range of experiment error.

### A Simple Method of Designing Mixes

A simple method of proportioning mixes may be arrived at on the basis of the preceding three facts. Suppose that we have one cubic yard of concrete. Let this be made of

$w$ cu. ft. of water weighing 62.4 $w$ lb.
$c$ cu. ft. of cement weighing 195 $c$ lb.
$a$ cu. ft. of aggregate weighing $D\,a$ lb.
$D$ being the density of aggregate

then $w + c + a = 27$ and the calculated density of the mix is $\frac{62.4\,w + 195\,c + D\,a}{27}$ lb. per cu. ft.

Now, 62.4 $w$ is the water content in pounds per cubic yard and this will determine the slump. The quantity $\frac{62.4\ w}{195\ c}$ is the water-cement ratio by weight and this determines the strength and durability. If these quantities are known in advance, the mix can be proportioned. These quantities *are* known since the problem in proportioning a mix is to arrive at prescribed values of strength and slump.

A further problem is to divide the aggregate into fine aggregate—usually sand, and coarse aggregate, which may consist of either rounded or angular particles. The old rule, which many still follow, is to use twice as much coarse aggregate as fine. With the majority of aggregate this ratio is too great. The resulting mix is deficient in fine particles and is consequently harsher and more difficult to place than it should be. It cannot be too strongly emphasized that a concrete mix is only satisfactory if it can be consolidated properly without appreciable difficulty by suitable methods.

Experience, combined with a certain amount of theory, has established the best ratios of fine to coarse aggregate for a wide range of practical materials. This ratio depends on:—

1. The size of the coarse aggregate—with large particles, less fine material is required to fill the voids.

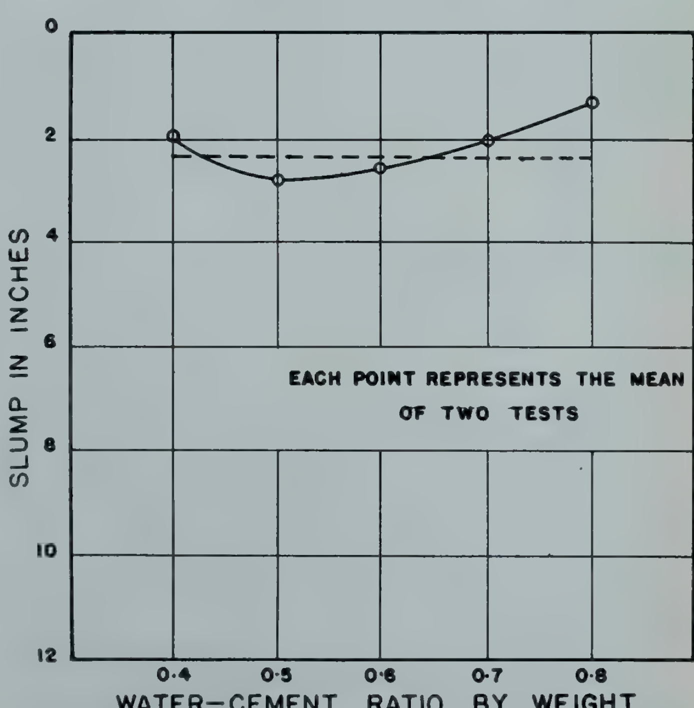



**Fig. 3—Diagram showing the result of tests to determine relation between slump and water/cement ratio.**

TABLE 1

Net Water-Cement Ratios for Various Types of Structures and Exposure Conditions[1]

| Class of Structure | Water-Cement Ratio[2] Imperial Gallons per Canadian Sack (87½ Pounds) | | | | |
|---|---|---|---|---|---|
| | Thin Sections | | Moderate Sections | | Heavy and mass sections |
| | Reinforced | Plain | Reinforced | Plain | |
| A. Ordinary exposed parts of structures, buildings and portions of bridges not subject to contact with water | 4⅝ | 5 | | 5½ | |
| B. Pavement slabs directly on ground: | | | | | |
| 1. Wearing slabs | 4¼ | 4⅝ | | | |
| 2. Base slabs | 5 | 5½ | | | |

C. Special cases:

1. For concrete not exposed to weather, and portions of structures entirely below ground the water-cement ratio should be selected on the basis of strength.
2. Concrete exposed to the action of alkali soils requires special investigation and at sites where alkali concentrations are or may become, very high Portland cement concrete cannot be recommended.
3. For concrete exposed to sea water reference may be made to CESA Specification for concrete and reinforced concrete, 1942.

[1]Adapted from Table I of the Report of Joint Committee on Recommended Practice and Standard Specification for Concrete and Reinforced Concrete, 1940.

[2]Surface moisture of aggregate must be included as part of the mixing water.

TABLE 2

Relation Between Strength and Water-Cement Ratio for Ordinary Concrete[1]

| Specified Compressive Strength lb./sq. in. | Water-Cement Ratio by Weight | Water Content Imp. Gallons per 87½ lb. sack of Cement |
|---|---|---|
| 2000 | 0.66 | 5¾ |
| 2500 | 0.59 | 5 |
| 3000 | 0.52 | 4½ |
| 3500 | 0.46 | 4 |
| 4000 | 0.42 | 3¾ |

[1]From CESA Specifications for Concrete and Reinforced Concrete A29-1942 and National Building Code.

TABLE 3

Approximate Percentage of Fine Aggregate and Approximate Total Water Content per Cubic Yard of Concrete[1]

| Max. Size[2] of coarse aggregate inches | Total water content pounds per cubic yard | | | Approximate percentage of fine aggregate to total by absolute volumes | | |
|---|---|---|---|---|---|---|
| | Slump in inches | | | [3]Grading of fine aggregate | | |
| | 1 | 3 | 5 | Fine | Medium | Coarse |
| ¾ | 315 | 335 | 355 | 46 | 49 | 52 |
| 1½ | 285 | 305 | 325 | 39 | 42 | 45 |
| 3 | 260 | 275 | 290 | 33 | 36 | 39 |

[1]Adapted from Table 5 of the "Proposed Recommended Practice for the Design of Concrete Mixes" Committee 613 American Concrete Institute.

[2]Maximum size has the following meaning:
For ¾, 1½ and 3 inch maximum size aggregate at least 5 per cent shall be retained on the ½, 1 and 2½ inch sieves respectively.

[3]Fineness Modulus: 2.2—2.6 Fine grading.
2.6—2.9 Medium grading.
2.9—3.2 Coarse grading.

Notes:

1. The above values are for reasonably well graded materials having average characteristics with angular coarse aggregate.
2. For rounded coarse aggregate decrease water content by about 25 lb., and amount of fine aggregate by about 5 per cent.
3. For stone sand increase water content by about 15 lb., and amount of fine aggregate by about 3 per cent.

TABLE 4

Density and Absorption of Aggregates

| Material | Density lb. per cu. ft. | | | Absorption per cent by weight |
|---|---|---|---|---|
| | Max. | Min. | Average | |
| Sand | 162 | 169 | 167 | 0.5 to 1 |
| Limestone | 162 | 169 | 166 | 0.5 to 1.5 |
| Trap rock | 175 | 188 | 181 | 0.3 to 0.5 |
| Granite | 165 | 172 | 168 | 0.3 to 0.5 |

TABLE 5

Surface Water Carried by Average Aggregates

| Aggregate | Percentage by weight | Gallons per Cubic Foot |
|---|---|---|
| Very wet sand | 7 | ¾ |
| Moderately wet sand | 5 | ½ |
| Moist sand | 2 | ¼ |
| Moist gravel or crushed rock | 1½ | ⅛ to ¼ |

**Fig. 4—Data sheet for the design of concrete mixes.**

2. The shape of the coarse aggregate—angular aggregate require more fine aggregate than rounded aggregates.
3. The grading of both the fine and coarse aggregates. By grading is meant the relative numbers of large and small particles in the aggregate. Specifications for aggregates (for example CESA Specification A29-42) contain limits on grading as determined by sieve analysis.

Committee 613 of the American Concrete Institute have recommended definite proportions of fine aggregate to total aggregate based on the above variables.[4] These recommendations are included in the data sheet presented above. Only the grading of fine aggregate is included as a variable though it is presumed that the coarse aggregate is "reasonably well graded." The grading of fine aggregate is classified as fine, medium or coarse and these terms are further related to the "fineness modulus." For the benefit of those who are not familiar with the latter term it may be explained that the fineness modulus is an arbitrary measure of the fineness of an aggregate and that in the case of fine aggregates it is determined in the following way:—about 2½ lb. (or 1,000 gm.) of aggregate is taken and dried, then sieved through a No. 4 sieve—any material retained on this sieve being rejected. The remainder of the sample is then sieved successively on the following sieves, No. 8, 16, 30, 50 and 100. The amount retained on each sieve is weighed and the weights expressed as percentages of the total passing the No. 4 sieve. The fineness modulus is defined as 1/100 of the sum of the percentages retained on the specified series of sieves. Table II illustrates the method of calculating the fineness modulus.

TABLE II

CALCULATION OF FINENESS MODULUS

| Sieve No. | Percentage retained on each sieve | Percentage coarser than each sieve |
|---|---|---|
| 8 | 3 | 3 |
| 16 | 35 | 38 |
| 28 | 40 | 78 |
| 50 | 15 | 93 |
| 100 | 5 | 98 |
| passing 100 | 2 | — |
| | 100 | 310 |

$$\text{fineness modulus} = \frac{310}{100} = 3.1$$

In practice the ratio of fine to coarse aggregate can usually be varied appreciably without any noticeable changes in either the economy of the mix or its ease of placing.

With the foregoing considerations in mind two forms have been prepared. One is a data sheet (Fig. 4), the other a form for recording computations (Fig. 5). The data sheet contains figures which may be used in computations in the absence of more exact information.

Table 1 gives water-cement ratios for durability under various conditions. By exposed concrete in Table 1 is meant concrete exposed to moderate or severe weather conditions such as may occur in all parts of Canada.

Table 2 (from CESA specification A29-1942 and the National Building Code) gives water-cement ratios for specified strengths of ordinary concrete, that is, concrete made from normal Portland cement under conditions which are not carefully controlled. Considerably higher strengths may be expected where conditions are carefully controlled, or where special cements are used.

Table 3 shows the approximate water content and the ratio of fine aggregate to total aggregate recommended by ACI Committee 613. Permission to present these recommendations has been kindly granted by the American Concrete Institute. They point out that the Committee Report has not yet been approved by the ACI as a whole and that changes may be made before this is accomplished. Naturally the values given for water content in Table 3 are only approximate since the consistency depends upon particle shape and grading of the aggregate. A simple test using a small trial mix will indicate whether or not the water content given in the table is correct for the materials which are to be used. If the slump does not prove to be close enough to the required figure it is an easy matter to correct it either by adding more water or more aggregate. The actual water content can then be calculated. It is unlikely that any corrections of the fine aggregate ratio will be required as the effects of small changes in the quantity of fine aggregate on consistency are not pronounced.

Table 4 gives average figures, based on a survey of published information, of the density of common types of concrete aggregates. If more accurate figures are required it is easy to obtain them by weighing the aggregate in air and water (Test for Specific Gravity and Absorption of Aggregates ASTM C127-42, C128-42).

Table 4 also indicates the absorption of water to be expected with various types of aggregates.

Table 5 (adapted from CESA Specification A29-1942 and National Building Code) indicates the approximate amount of surface water carried by aggregates.

## EXAMPLES OF DESIGN OF MIX

The use of the computation sheet (Fig. 5) can best be shown by means of an example.

### DATA

Required strength—3,000 lb. per sq. in. at 28 days.

Exposure—Ordinary exposure to weather, section of moderate thickness reinforced.

Required slump—4 inches.

Fine aggregate—Sand in a moist condition—medium grading.

Coarse aggregate—Crushed limestone maximum size 1½ inches, dry condition.

The mix will be worked out on the basis of one bag of cement.

### PROCEDURE

The above data are entered on the computation sheet (Fig. 6) and reference is made to Fig. 4 where necessary. For the given conditions of exposure the maximum water-cement ratio is found from Table 1 to be 5 gallons per sack. From Table 2 it is seen that for a strength of 3,000 lb./sq. in. the water-cement ratio should be 0.52 by weight or 4½ gallons per sack. The strength requirement is therefore the governing factor and a water-cement ratio of 0.52 is used.

To determine the approximate water content, reference is made to Table 3. Using aggregate of 1½ in. maximum size, angular in shape and designing for a 4 in. slump the water content is estimated by interpolation to be 315 lb. per cu. yard. At the same time it is noted that the fine aggregate should amount to 42 per cent of the total aggregate. These values are entered on the computation sheet.

Referring to Table 4 it is seen that the densities of the fine and coarse aggregate may be assumed as 167 and 166 lb. per cu. ft. respectively, and that the coarse aggregate will absorb about one per cent of its weight of water. The free moisture in the fine aggregate is estimated from Table 5 at two per cent by weight.

The next step is to work out the proportions of the mix on the basis of absolute volume. Firstly, the volume of water is computed by dividing the water content by 62.4. Next, the weight of cement is found by dividing the water content by the water-cement ratio and this is expressed as a volume by dividing by 195, the assumed density of cement.

```
DESIGN OF TRIAL/FIELD MIX          JOB                     DATE

Required Strength                  lb/sq.in.  at      days    Slump        ins.
Test results (av.)                 lb/sq.in.  at      days    Test         ins.

Assumed data
    Water cement ratio                       by wt.     (          gals./sack)
    Water content                            lb/cu.yd.

    Fine aggregate -
        density     =            lb/cu.ft. absolute volume
        absorption =             per cent           free moisture =        per cent
        proportion of total aggregate =             by absolute volume

    Coarse aggregate -
        density     =            lb/cu.ft. absolute volume
        absorption =             per cent           free moisture =        per cent
        proportion of total aggregate =             by absolute volume

Proportions by Absolute Volume
    In 1 cubic yard of concrete there will be:

        water      lb. =  ____        =    cu.ft.
                          62.4
        cement     lb. =  ____        =    cu.ft
                          195                                        27.00
        water + cement                =    cu.ft.
                                                 total aggregate =  _____
        fine aggregate    (    )      =    cu.ft.

        coarse aggregate  (    )      =    cu.ft.
                             Total    =    cu.ft.

Proportions by Weight

                  abs. vol.   density     wt.    mix by    wt. per batch lb.
                  cu.ft.      lb/cu.ft.   lb.    wt.
water                         62.4                             =   lb.
cement                        195                1.00          =   gals/sack
fine aggregate
coarse aggregate
                  27.00
Correction of Water for Moisture or Absorption
    free water or water absorbed in    lb. fine aggregate   = (  )   =  lb.
    free water or water absorbed in    lb. coarse aggregate = (  )   =  lb.
                                                       correction =  lb.
```

**Fig. 5—Computation sheet for the design of concrete mixes.**

DESIGN OF TRIAL FIELD MIX — JOB Sample — DATE 15 June 1943

Required Strength 3000 lb/sq.in. at 28 days — Slump 4 ins.
Test results (av.) lb/sq.in. at days — Test ins.

Assumed data

Water cement ratio 0·52 by wt. (· 4 1/2 gals./sack)
Water content 315 lb/cu.yd.

Fine aggregate - sand, medium grading
density = 167 lb/cu.ft. absolute volume
absorption = — per cent — free moisture = 2 per cent
proportion of total aggregate = 0·42 by absolute volume

Coarse aggregate - crushed limestone 1 1/2"
density = 166 lb/cu.ft. absolute volume
absorption = 1 per cent — free moisture = 0 per cent
proportion of total aggregate = 0·58 by absolute volume

Proportions by Absolute Volume

In 1 cubic yard of concrete there will be:

water 315 lb. = 315 / 62.4 = 5·05 cu.ft.
cement 315/0·52 lb. = 607 / 195 = 3·12 cu.ft
water + cement = 8·17 cu.ft. — total aggregate = 27.00 − 8·17 = 18·83
fine aggregate (18·84) 0·42 = 7·92 cu.ft.
coarse aggregate (18·84) 0·58 = 10·91 cu.ft.
Total = 27·00 cu.ft. ✓

Proportions by Weight

| | abs. vol. cu.ft. | density lb/cu.ft. | wt. lb. | mix by wt. | wt. per batch lb. |
|---|---|---|---|---|---|
| water | 5·05 | 62.4 | 315 | 0·52 | 45·5−1·2=44·3 lb. |
| cement | 3·12 | 195 | 607 | 1.00 | 87·5 =4·43 gals/sack |
| fine aggregate | 7·92 | 167 | 1320 | 2·17 | 190 |
| coarse aggregate | 10·91 | 166 | 1815 | 3·00 | 262 |
| | 27.00 | | | 6·69 | |

Correction of Water for Moisture or Absorption

free water or ~~water absorbed~~ in 190 lb. fine aggregate = (190)·02 = 3·8 lb.
~~free water~~ or water absorbed in 262 lb. coarse aggregate = (262)·01 = 2·6 lb.
correction = 1·2 lb.

**Fig. 6—Example of use of computation sheet for design of concrete mixes.**

(If the cement content of the mix is of interest it can be found directly from the weight of cement per cubic yard).

The volume of water and cement have now been found. Subtracting this sum from 27 gives the total volume of aggregate which in this example is 18.84 cu. ft. The volume of aggregate is now divided into fine and coarse in accordance with the ratios previously established. A check on the accuracy of the arithmetic up to this stage is obtained by summing the volumes, which should total 27 cu. ft.

The next step is to convert the proportions by absolute volume into proportions by weight. This is done by multiplying each figure by the appropriate value of density. For the cement and water the results are already known. In this way the weights of materials contained in a cubic yard of concrete are found. If the unit weight of the concrete in pounds per cubic foot is desired it may be found by dividing the total weight by 27. For the example chosen this works out to be 150 lb. per cu. ft. The mix is expressed in the form of a ratio by dividing through by the weight of cement. The value for water is of course the water-cement ratio. Finally the weights per batch are found by multiplying all the quantities by the weight of a bag of cement (87½ lb.).

It remains to correct the water for free moisture or absorption by the aggregate. The method of doing this will be obvious from the example.

A slump test performed on a small batch of perhaps 35 lb. is desirable to check the accuracy of the mix design. Otherwise any adjustments to the consistency may be made as the work progresses. It is interesting in this regard to examine the effects of the water content on both strength and consistency.

### Permissible Variations in Water Content

It has been pointed out that the consistency depends upon the water content per cubic yard (Fig. 3) and that a change in the water content of about 10 lb. will produce a change in slump of one inch (Table 3). At the same time it can be shown that a change of 10 lb. in the water content (3 to 4 per cent of water used) is not accompanied by a change of strength of more than 5 per cent irrespective of the position on the water-cement ratio curve (Fig. 1). This result may be expressed in another way. Varying the water-cement ratio by one-quarter of a gallon per sack will result in one or two inches change in slump, and about 5 per cent change in strength. Thus if the slump is controlled within one inch of the prescribed figure the possible variation in water-cement ratio and in strength is negligible.

### Field Control

The above reasoning leads to the conclusion that for most practical purposes strength may be closely controlled by controlling slump provided the design of the mix is approximately correct. In this way compensation is automatically made for variations in the moisture content of aggregates. Once the mix has been correctly designed the man at the mixer is then only responsible for adding sufficient water to bring the slump to the desired figure.


### Acknowledgements

The writers are grateful to Mr. C. O. P. Klotz for helpful suggestions in regard to subject matter, and to the Canada Cement Company, Limited, for kindly furnishing the cement for these and other tests.


### References


①Abrams, D. A., "Design of Concrete Mixtures," Bulletin No. 1 Structural Materials Research Laboratory, 1918.

②Lyse, Inge, "A Study of Quality, the Design, and the Economy of Concrete," *Journal Franklin Institute*, April, May, June, 1936.

③McMillan, F. R., "Basic Principles of Concrete Making," 1929, McGraw Hill.

④"Proposed Recommended Practice for the Design of Concrete Mixes Reported by ACI Committee 613." *Jour. Am. Concrete Inst.*, Jan. 1942.

# ALTERNATIVE FUELS FOR MOTOR VEHICLES

W. A. LANG

*Research Chemist, Research Council of Alberta, University of Alberta, Edmonton, Alta.*

**Paper presented before the Edmonton Branch of The Engineering Institute of Canada, on February 23, 1943.**

## Introduction

The primary source of motor fuels in the world to-day is crude petroleum. Natural gasoline and gasoline produced from oil shales, bituminous sands, etc., are here considered as related products.

Alternatives include liquid fuels obtained from coal, first by direct hydrogenation in the Bergius process; second by the synthesis of water gas in the Fischer Tropsch process; and third by high temperature carbonization producing benzol. These also include alcohols, both methyl and ethyl, used as blends with gasoline; gases, such as methane, ethane, propane, butane, acetylene and manufactured gases and gas made from solid fuels in portable producers attached to the vehicle. Hydrogen, ammonia, etc., have been tried. Powdered coal and colloidal coal, i.e., a suspension of coal-dust in oil, have also been used in diesel engines.

The vital importance of home-produced motor fuels has long been realized, especially in countries with restricted oil resources. The known oil reserves are being depleted. In wartime, the difficulty or impossibility of importing oil restricts its use to vital services. Reduction in imports also reduces difficulties of exchange. It is not unreasonable therefore to anticipate that, in many countries, gasoline may in the near future be reserved for use in aviation.

As regards the countries that have oil resources and those that have not, it may be noted that, of the total 2¼ billion barrels of crude oil produced in 1941: 65 per cent was produced in North America; 14 in Central and South America; 13 in Europe; 5 in Asia; 3 in Oceania and trivial amounts in Africa and other countries.*

The oil consumption presents a different picture. The European continent is the second largest consumer of commercial motor fuels and, prior to the war, imported about 75 million barrels of gasoline yearly, in addition to the amount produced at home. Even in the United States, the visible supply of crude oil is stated to be only sufficient for fifteen years at the present rate of consumption, and the latter is increasing rapidly.

The need for alternative fuels became obvious in the last war, and resulted in many countries conducting intensive research investigations, seeking to utilize fuels from their products, etc.

The use of indigenous fuels has been encouraged by taxes on imported fuels and by reduction of taxes on home fuels and on vehicles using such fuels. Conversions of motor vehicles to the use of alternative fuels have been assisted by partial payments and interest free loans and have been compelled by required conversion of a percentage of a motor fleet, or by required use of a percentage of home produced fuel.

Progress, however, has been slow, due to the convenience, efficiency, availability and low cost of gasoline. But the state of war throughout the world, with consequent loss of supplies of mineral oils, has hastened conversion and made Europe a testing ground for all kinds of gasoline substitutes.

Table I gives a summary of the world production of the more important alternatives for 1939. The production of each substitute in any country is shown as a percentage of the total production of substitute in that country, and the latter value is shown as a percentage of the world's production.

The subject of alternative fuels is so comprehensive that it is impossible to discuss in detail the major developments, and, further, the publication of much recent work has been forbidden.

While it is desirable that a complete power unit should be specifically designed for the particular fuel to be used, present day conditions necessitate the conversion of many existing vehicles. Even though the converted engine may not be as efficient as when used with gasoline, factors such

*For detail figures of world crude-oil production, see *Jour. Inst. of Petrol.*, Vol. 28, No. 223.

TABLE I

World Production More Important Alternative Fuels—1939

Total 104,644,700 barrels

| Alternatives | Percentage of total alternatives | Productions of alternative fuels by countries—Shown first as a percentage of world's production and second as percentage of countries' production. | | | | | |
|---|---|---|---|---|---|---|---|
| | | United States | Great Britain | Germany | Japan | France | Italy |
| Gasoline: | | | | | | | |
| (1) Natural Gas | 60 | 48 | .. | .. | .. | .. | T |
| | | 87 | .. | .. | .. | .. | .. |
| (2) Coal | 17 | .. | 3 | 11 | 2 | 1 | .. |
| | | .. | 56 | 62 | 40 | 26 | T |
| (3) Shale Oil | 1 | .. | T | .. | .. | T | .. |
| | | .. | 4 | .. | .. | S | .. |
| (4) Benzol | 9 | 2 | 2 | 4 | .. | S | .. |
| | | 4 | 35 | 23 | .. | 18 | .. |
| (5) Alcohol | 7 | .. | T | 1 | 2 | 2 | 3 |
| | | .. | 4 | 7 | 60 | 47 | 55 |
| (6) Liquefied Gas | 6 | 5 | .. | 1 | .. | .. | .. |
| | | 9 | .. | 7 | .. | .. | .. |
| (7) Methane | T | .. | T | .. | .. | .. | T |
| | | .. | T | .. | .. | .. | 11 |
| (8) Manufactured Gas | T | .. | T | T | .. | T | 1 |
| | | .. | T | S | .. | 7 | 18 |
| (9) Producer Gas | T | .. | T | T | .. | T | T |
| | | .. | T | T | .. | 2 | 6 |

T = up to 0.5 per cent. S = more than 0.5 per cent, but less than 0 per cent.

Data compiled from V. R. Garfias and R. C. Whetsel, A.I.M.M.E. Trans. Petrol. Div., 1941, 142, 246.

as lowered cost, availability, etc., may more than compensate for this.

The lower efficiency of operation with many alternative fuels has enforced some limitations on their general adaptability. With some, a new driving and mechanical technique must be learned. Some fuels have low heat values. The relative heat values of various alternative fuels are given in Table II.

The significant heat value of a fuel, as purchased, is its net heat value per pound, per gallon, or per cubic foot, according to the basis of measurement for purchase. But the significant heat value in combustion, particularly in the internal combustion engine, is the net heat value per cubic foot of the ideal air-fuel mixture, as it enters the combustion chamber. These values are given in the last column of Table II, and it is noticeable that although the heat values shown per pound range from 5,000 to 50,000, the corresponding heat values per cubic foot, at 60 deg. F. and 30 inches and dry, of the ideal mixture only range from 80 to 112. Hexane, which is one of the gasoline hydro carbons, has a value of 94. It is thus not exceptionally high.

The alternative fuels here discussed are: natural gasoline and gasoline and benzol derived from coal, compressed gases, liquefied gases, power alcohol and producer gas.

### Hydrogenation

Coal can be converted directly and almost completely into gasoline by hydrogenation, as in the Bergius process. This is a high pressure (4,000 lb), high temperature (850 deg. F.), conversion. Also coal, or coke made from coal, can be made into water-gas and the latter converted into gasoline by the Fischer-Tropsch process, which involves a low pressure and comparatively low temperature (350 deg. F.) synthesis. The latter process gives lower yields, but the capital cost is less and smaller plants can be operated. Hydrogenation is also used to make gasoline from coal tar. These processes originated in Germany and form the major source of alternative fuel in that country. The coal and tar hydrogenation plant at Billingham, England, is the only large plant available to the allied nations.

Estimates of capital and production costs are necessarily uncertain. It seems probable that the capital cost of a coal hydrogenation plant is about $250 per ton of annual output capacity, and that a forty million dollar plant is the economic size. The capital cost of a plant for production from coke through water gas is about $125 per ton of annual output capacity and a one to two million dollar plant would be economic. If it were necessary, however, to include construction of the coke oven plant, the $125 would be raised to $270 and the economic unit would be larger.

The cost of gasoline by either process, in Great Britain, is estimated to be of the order of 21 cents per gallon, even though the interest allowed was only 3½ per cent and amortization taken at 15 years at 2½ per cent compound interest.

The British Labour Party committee, after investigation, concluded that viewed solely from the point of view of providing a large measure of employment, the hydrogenation and synthetic processes do not offer a very hopeful prospect in relation to the cost involved. If this is the case in Great Britain, it must be a hopeless proposition under present conditions in Canada, where the price of competing gasoline is lower and the cost of plant construction and operation higher.

### Benzol

High temperature carbonization of coal has been the primary source of benzol motor fuel for years. Benzol has an octane rating of over 90 and is used to blend with lower octane fuels to raise their anti-knock value. Its production is limited by the output capacity of coke oven and gas works and therefore capable of only slight expansion. Furthermore, in wartime, benzene would be reserved for manufacture of explosives.

### Alcohol

Anhydrous, methyl and ethyl alcohol, blended with gasoline, in proportions of 10 to 20 per cent, are both used as motor fuels. Methyl alcohol, or methanol, can be obtained by the destructive distillation of wood but on a large scale is made by synthesis. Water-gas is heated to temperatures of 570 to 750 deg. F. under high pressure (200 atmospheres) in the presence of catalysts, the resulting product being almost pure methanol.

Ethyl alcohol is made by fermentation of sugary substances such as blackstrap molasses and sugar beets; starchy materials, such as cereal grains and potatoes. Wood and

TABLE II

Relative Heat Value of Various Alternative Fuels

| Alternative fuels | Combustibles | | | | | Inerts | | Air required per cu. ft. of gas cu. ft. | Calorific Value in B.t.u. per Cubic Foot | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Illum. $C_2H_4$ etc. % | $CH_4$ % | $C_2H_6$ % | $CO$ % | $H_2$ % | $CO_2$ % | $N_2$ % | | Gas Gross | Gas Net | Air Gas-Mixture Gross | Air Gas-Mixture Net |
| 1. Natural Gas | .. | 96 | .. | .. | . | .. | 4 | 9.14 | 972 | 876 | 96 | 86 |
| Coal Gas | | | | | | | | | | | | |
| 2. L.T.C. Bit. Coal | 8 | 46 | 12 | 7 | 17 | 5 | 5 | 8.09 | 882 | 802 | 97 | 88 |
| 3. H.T.C. Bit. Coal | 4 | 32 | 2 | 6 | 51 | 2 | 3 | 5.31 | 608 | 544 | 96 | 86 |
| 4. Coke Oven | 4 | 32 | .. | 6 | 53 | 2 | 3 | 5.02 | 580 | 517 | 96 | 86 |
| 5. L.T.C. Edmonton Coal | 1 | 37 | .. | 7 | 13 | 34 | 8 | 4.15 | 456 | 411 | 89 | 80 |
| Water Gas | | | | | | | | | | | | |
| 6. Carburetted | 9 | 8 | 2 | 34 | 41 | 3 | 3 | 4.16 | 503 | 462 | 98 | 90 |
| 7. Blue | .. | 1 | .. | 44 | 47 | 3 | 5 | 2.26 | 306 | 281 | 94 | 86 |
| Producer Gas | | | | | | | | | | | | |
| 8. Mond | .. | 3 | .. | 15 | 26 | 12 | 44 | 1.26 | 164 | 148 | 73 | 65 |
| 9. Coke Fuel | .. | 1 | .. | 30 | 10 | 4 | 55 | 1.05 | 140 | 134 | 68 | 65 |

All analyses by volume. Calorific value per cubic feet. Dry Gas at 60°F. and 30 inches.

Data mainly from Humphrey, McGill University Symposium on Fuel, and Technical Data on Fuels.

liquor from sulphite pulp mills are also used as sources of alcohol. France and Spain use their surplus of grapes as a source of power alcohol.

The disadvantages of alcohol as a motor fuel are that its calorific value is lower than that of gasoline: its vapour pressure is too low to enable an engine to start from cold, so that it is commonly used blended with gasoline. Alcohol has a great affinity for water, yet the water may separate out from a gasoline-alcohol blend if not anhydrous, particularly in cold weather.

On the credit side, alcohols have a high anti-knock value —10 to 20 per cent of alcohol by volume is equivalent to about 1 to 2 cc. of tetraethyl lead per gallon of gasoline. It is a clean fuel, and has a high latent heat of evaporation. The latter results in a lower temperature and a higher density for the carburetted mixture, which helps to make up for the lower calorific value.

Claims that alcohol production would notably assist farmers and conserve petroleum reserves have been studied by the committee on motor fuels of the American Petroleum Institute. The committee reported that "the cost of alcohol is five or six times that of gasoline, and that the use of a blend containing 10 per cent of alcohol would raise the nation's fuel bill by about 700 million dollars." They also state that experience in other countries shows that the extra cost of alcohol blends is not balanced by any technical advantage. Any gain to farmers would be lessened by the fact that they themselves buy one quarter of the motor fuel consumed. It is further considered that the large scale production of crops suited to alcohol manufacture would have an adverse effect on the fertility of the soil.

The production of alcohol for power began to decline in Europe because of economic losses, its diversion to other uses and its encroachment on food supplies. A loss of income of 105 million dollars was incurred in Europe during 1937 through subsidies to producers, tax losses, and higher fuel costs. The German subsidy to the potato alcohol producer was about $130 per ton of power alcohol, or about 39 cents per gallon. In France the subsidy was about 36 cents a gallon. The National Research Council of Canada reports the cost of alcohol, at the distillery, as 35 to 45 cents per gallon compared to a cost of 10-15 cents per gallon for gasoline at the refinery.

Notwithstanding the high cost of alcohol, it is an important alternative fuel; more than 7 million motor fuel barrels were produced in 1939, mainly in Europe.

In Australia the supply of power alcohol is to be increased by the erection of four factories with a total annual capacity of 12 million gallons from surplus wheat. This development is undertaken principally for reasons of defence, and to save exchange.

Finland has developed alcohol production from sulphite liquor to cover two-fifths of the motor fuel required on the pre-war basis.

Canada has surplus wheat. Even low grade and damaged wheat can be fermented. It is estimated that it would have required 45 million bushels of wheat, or roughly10 per cent of the amount produced in Canada in 1940, to replace 10 per cent of the motor fuel consumed in the Dominion that year. Sugar beets can be grown in some localities. There are also many pulp mills from which sulphite liquor could be obtained. The National Chemurgic Committee of the Canadian Chamber of Commerce reports that the sugar beet is the most attractive source, but questions whether the net advantage to agriculture outweighs the increase in cost of motor fuel.

### Gaseous Fuels

Gaseous fuels here discussed will be manufactured gases, natural gas and methane.

COAL GAS is made when coal is carbonized in suitable retorts or chambers. The yield and heat value of the gas depend on the coal used, the temperature and the method of operation of the retort. The gas yield will seldom be equivalent to more than 25 per cent of the heat value of the coal.

WATER GAS. Coal or coke may be wholly gasified, in a suitable generator, to form water-gas, which is produced by the action of steam on the incandescent fuel. Since this reaction is endothermic the fuel is cooled and water-gas production must be suspended periodically whilst the temperature is again raised by blowing air through the fuel bed and producing carbon monoxide for a time. Water-gas, commonly termed blue-water-gas, is often used to supplement a coal gas supply for city use. For smaller installations it may be used alone or after enriching with cracked oil—it is then termed carburetted water-gas.

PRODUCER-GAS will be discussed later in relation to its use in motor vehicles.

NATURAL GAS AND METHANE. Methane ($CH_4$) is the simplest compound of carbon and hydrogen. Natural gas contains up to 99 per cent of this gas. The same gas, known as

TABLE II—Continued

| Alternative fuels | Heat Value in B.t.u. | | | | | | Air required per cu. ft. gas or vapour cu. ft. | Calorific Value in B.t.u. per cu. ft. of Air-Gas Mixture | |
|---|---|---|---|---|---|---|---|---|---|
| | Per Gallon | | Per Pound | | Per Cubic Foot | | | | |
| | Gross | Net | Gross | Net | Gross | Net | | Gross | Net |
| 10. Carbon Monoxide | ...... | ...... | 4,370 | 4,370 | 323 | 323 | 2.38 | 96 | 96 |
| 11. Hydrogen | ...... | ...... | 61,080 | 51,630 | 325 | 275 | 2.38 | 96 | 81 |
| 12. Acetylene | ...... | ...... | 21,570 | 20,840 | 1500 | 1450 | 11.91 | 116 | 112 |
| 13. Methane | ...... | ...... | 23,810 | 21,430 | 1010 | 910 | 9.53 | 97 | 86 |
| 14. Ethane | ...... | ...... | 22,200 | 20,300 | 1780 | 1630 | 16.68 | 101 | 92 |
| 15. Propane | 125,800 | 115,700 | 21,500 | 19,770 | 2570 | 2370 | 23.82 | 102 | 95 |
| 16. Butane | 127,500 | 117,600 | 21,180 | 19,540 | 3350 | 3090 | 30.97 | 105 | 97 |
| 17. Pentane V | ...... | ...... | ...... | ...... | 3990 | 3690 | ( 38.11 | 102 | ( 94 |
| 18. Pentane L | 131,300 | 121,300 | 20,810 | 19,220 | ...... | ...... | ( 38.11 | | ( 94 |
| 19. Hexane | 136,800 | 129,500 | 20,700 | 19,150 | ...... | ...... | 45.26 | | 94 |
| 20. Benzene V | ...... | ...... | ...... | ...... | 3740 | 3590 | ( 35.73 | 102 | ( 98 |
| 21. Benzene L | 157,900 | 151,500 | 17,980 | 17,250 | ...... | ...... | | | |
| 22. Methyl Alcohol V | ...... | ...... | ...... | ...... | 860 | 760 | ( 7.15 | 105 | ( 93 |
| 23. Methyl Alcohol L | 75,900 | 66,500 | 9,600 | 8,410 | ...... | ...... | ( ...... | | ( 93 |
| 24. Ethyl Alcohol V | ...... | ...... | ...... | ...... | 1610 | 1460 | 14.29 | 105 | ( 95 |
| 25. Ethyl Alcohol L | 101,300 | 91,500 | 12,820 | 11,580 | ...... | ...... | ...... | | ( 95 |
| 26. Gasoline 60A.P.I | 149,800 | 139,700 | 20,270 | 18,900 | ...... | ...... | ...... | | .. |

Data adapted from Gas Engineers' Handbook. McGraw-Hill, 1934.

fire-damp, occurs in coal mines where it is a serious potential danger. It is produced in the refining of petroleum and occurs in the gases from the carbonization and hydrogenation of coal. It is also produced in the decomposition of sewage and recovery from this source could be increased.

The recovery of methane from coal mines has been proposed. The amount might be appreciable, as mines are cited with "blowers" from which there is an issue of upwards of 5 million cu. ft. per day of nearly pure methane. Recovery would involve drilling bore-holes in the coal in advance of mining. Costs of gas from this source are estimated at 5 cents or less per thousand cubic feet, but there would be reduced ventilation costs and reduced explosion hazards.

### The Utilization of Stored Gas in Motor Vehicles

Two systems are used for the storage of gaseous fuels on motor vehicles, namely a low pressure system in which the vehicles are equipped with flexible gas-bags and a high pressure or compressed gas system in which metal cylinders are used.

The low pressure system was developed in England during World War I for use with manufactured gas, but it can be used equally well with methane or natural gas. The fuel was stored at low pressure in a gas-bag attached to the top of the vehicle. The maximum capacity is approximately 500 cu. ft., sufficient for only 10 to 20 miles. But refueling stations were established along the highways. The fuel-bag has considerable wind resistance and its life is relatively short. This system, although crude, is comparatively cheap and can be used for vehicles which have regular routes.

Later, rigid containers in which gas was stored up to 150 lb. pressure were designed. These consisted of rubberized fabric as in pneumatic tires. Still later, metal cylinders known as "gas traction bottles" have been used with pressures up to 3,000 lb. per sq. in. They vary in size and shape and in the metal used.

The city of Birmingham uses a nickel-chromium-molybdenum steel cylinder, of 8 in. inside diameter, 0.22 in. wall, 5 ft. 10 in. overall length and weighing 124 lb. This cylinder holds 330 cu. ft. of gas measured at ordinary temperature and pressure.

These cylinders can be used for six years but this may be increased to seven, or the average life of a commercial vehicle. Hydraulic tests to 4,500 lb. are required annually for bottles operating at 3,000 lb. Bursting tests have shown that no fragmentation takes place.

From three to seven bottles are usually installed. They are either rigidly connected to the frame of the vehicle or are attached on a trailer. Pressure reduction is usually effected in two stages: the first stage lowering the pressure to less than 10 lb. The gas and air are mixed in a special attachment to the carburettor.

The gaseous fuels most commonly used, in compressed form, are manufactured gases, but methane and natural gas can be used more efficiently, because of their higher calorific and anti-knock values. Actually on a weight basis, methane has 13 per cent higher calorific value than has 60 deg. A.P.I. gasoline and it is particularly suited to high compression engines. Investigations have shown that methane gas consumption can be reduced 30 per cent by raising the compression ratio from 7 to 1 up to 15 to 1.

With a converted vehicle, the disadvantages of compressed manufactured gases are fourfold:

1. The power output is lowered by ten or more per cent. Theory shows that one cubic foot of the ideal fuel-air-mixture has a lower heat value with manufactured gas than with gasoline. Also, with gasoline, the latent heat of evaporation cools the charge and thus increases the intake; the heavier molecules result in bigger volume increase on combustion, and the more rapid rate of combustion increases efficiency. With an engine specially designed, full power output with gaseous fuels can be obtained by using higher compression, or by supercharging.

2. The converted vehicle is limited to routes upon which it can be refuelled. This requires special compressor stations and storage cylinders, which would have a high capital cost. It is suggested that bus or truck companies, having definite routes would have the most suitable conditions for operating on compressed gases.

3. The equipment is heavy. In ordinary vehicles the gasoline and gasoline tank weighs about 10 to 12 lb. per gal. of fuel, whereas for vehicles using compressed gases there would be an increased load of about 100 lb. in the form of cylinders, valves, etc., for each equivalent of a gallon of gasoline. This weight, naturally, would reduce the pay load of the vehicle, and where motors are taxed on a weight basis, might put the vehicle into a higher taxation class. Most countries, however, have encouraged alternative fuels by taxation concessions.

4. The range of travel is limited, especially when a gaseous fuel with a low heat value is used, unless a large number of cylinders are carried. One 300-ft. cylinder of town gas is roughly equivalent to only one gallon of gasoline.

These disadvantages apply to manufactured gas, and would be notably reduced if a higher heat-value gas, such as methane or natural gas, were employed.

It is difficult to assess costs for the conversion of motor vehicles to gaseous fuels, and for their operation. Probably the most comprehensive analysis available is that given for the Birmingham Corporation Gas Depertment, by Dr. J. S. Clarke.* He has estimated the costs of a compressed town gas scheme for a fleet of 40 buses each running approximately 100 miles per day and having a fuel consumption per mile of 0.2 gallons of gasoline. His estimate gives a total operative cost of 6 cents per bus mile, equivalent to gasoline at 30 cents per gallon.

### Portable Producer-gas Plants with Motor Vehicles

French technicians seem to have originated the portable-gas-producer, but most of the initial developments were carried out in Great Britain. Progress in adopting these plants has been slow, particularly in Britain. People accustomed to gasoline were loath to change to a set-up of lowered efficiency and with unknown difficulties, even though operational costs were less. In 1938 there were only some 9,000 motor vehicles operating on producer-gas in Europe. The exigencies of war, however, caused a rapid change over, so that in 1941 it was estimated that there were about 450,000 vehicles propelled by this gas—a fifty-fold increase in three years.

A portable producer-gas plant is either designed as a separate unit carried on a trailer attached to the motor vehicle or is incorporated into the chassis of the vehicle. It consists of the following principal parts:

1. The producer itself, in which the gas is made;
2. The coolers, in which the hot gas leaving the producer is reduced in temperature;
3. The filters, in which the gas is cleaned;
4. The controls, by means of which the quantity of gas and air supplied to the engine are regulated;
5. A water regulator if required and a starting fan, unless petrol is employed as a supplementary fuel for starting and for peak loads.

The majority of producer plants for motor vehicles have been designed and built in Continental Europe, where petroleum supplies are limited and the use of indigenous fuels is encouraged. Most continental types were designed to operate on charcoal. Wood, coal and other fuels are now employed, but the equipment should be designed for the particular fuel to be used.

The simplest gas-producer consists essentially for a bed of incandescent carbon, through which air is blown. The oxygen of the air combines with the carbon forming carbon monoxide and some carbon dioxide. These gases, with the

*See *Jour. Inst. Fuel*, Vol. XIII, No. 70, Feb. 1940, pp. 102-117., nitrogen, leave the producer, but only the carbon monoxide is combustible. Heat is thus generated and the producer would soon become too hot. If steam is introduced with the air, it also combines with the carbon forming hydrogen and carbon monoxide, which gases enrich the product. If, however, the fuel employed produces tarry volatile matter when heated, it is necessary to crack or destroy the bulk of this tar by causing it to pass through the fire zone; a down draught or cross draught producer is then employed.* In such a case it may not be necessary to add moisture to the air-blast. The tar, however, is never completely decomposed, and these producers are less easy to operate than the updraught.

The hot gases leaving the generator pass through a cooling and purifying system. It is essential that any tar filtering medium must be easily cleaned or replaced; and the resistance to gas flow must be low. B. Goldman and N. Clarke Jones show, for a wide range of producers and fuels, a heat value ranging from 125 to 160 B.t.u. per cubic foot.

Producer gas can be made from a wide range of carbonaceous materials, but the choice made affects the gas quality, engine performance, cylinder wear and ease of operation of the producer, and of the gas cleaning equipment.

The more important solid fuels are wood, charcoal, anthracite, high and low-temperature coke, etc. Recently peat, peat coke, brown coal and even soft woods containing up to 40 per cent of moisture have been successfully used in producer plants. The reactivity of anthracite and coke can be increased by activating, then by chemicals. Sodium carbonate is recommended.

In a producer-gas vehicle, the gas enters the mixing chamber comparatively warm and possibly saturated with water vapour. The heat value of the resultant warm air-fuel mixture, under these conditions, may be lower than those shown in Table II. This naturally results in power loss. Other causes of power loss are those cited under manufactured gases. Other disadvantages with producer gas are:

1. The weight and the space occupied by the equipment.
2. Difficulty of obtaining fuels by uniform quality. Variations in the fuel may cause engine trouble.
3. Solid fuels are not as easily handled as liquid fuels, and occupy greater space for equal mileage.
4. Portable producer gas systems require regular servicing. This includes the dirty task of cleaning the gas filters.
5. Producer gas has a high percentage of carbon monoxide, which is toxic.

On the other hand, there are advantages which may outweight the disadvantages. Among these are:

1. The lowered cost of operation, particularly in countries where oil supplies are imported.
2. The availability in some countries of suitable fuels which can be distributed over a wide radius and stored easily.
3. Less danger of disruption of service by enemy action. Gasoline storage tanks and gas compressor stations are vulnerable to enemy air attack.

Few figures as to operating cost are available, but 12 lb. charcoal or 20 to 22 lb. of dry wood are stated as equivalent to one gallon of gasoline. In an experiment with agricultural tractors it was found that 12½ lb. of low temperature coke was equivalent to a gallon of gasoline in acreage plowed.

Probably the most reliable operational data for England are those given for the Thomas Tilling Company, who have operated a number of Eastern National Modified Government type of producer plants for two small omnibus depots with a total average of 48,000 miles per month. The average fuel cost at the Maldon depot is 1.37 pence per mile; this includes the cost of gasoline for starting and labour for activating anthracite. Additional costs for filling hoppers and extra labour for starting up amounts to 0.3 pence per mile, giving a total of 1.67 pence per mile compared with 2.75 pence for gasoline and 1.52 pence for diesel oil. The fuel is mainly good quality anthracite activated with sodium carbonate. These figures are for fuel and do not include capital charges.

In 1937, the French Department of Agriculture conducted tests on all leading makes of portable wood-gas and charcoal-gas plants under service conditions. Test equipment comprised 20 vehicles including light passenger cars, light and heavy lorries and a 27 seater passenger bus. The distance covered by each was over 1,000 miles, in typical motoring country. The vehicles were required to maintain a minimum average speed of 30, 25 and 21 miles per hour for light, medium and heavy vehicles respectively. But in the test all vehicles showed higher speed averages. In no case was more than 5 minutes required to start the vehicle. All wood-burning vehicles were started without gasoline, on gas generated by means of a small blower driven from the battery. After halts of 10-15 minutes there was still enough gas in the pipes and scrubbers for immediate starting. The average time to clean the filters was half an hour.

In the tests, 70-100 miles were covered on one filling of the generator, and sacks of fuel for a further 100 miles were carried without serious encroachment on the pay-load. Refueling was carried out at a convenient time by merely removing a lid and dumping fresh fuel into the hopper. It was estimated that with charcoal at $20 a ton, the equivalent for gasoline would have been 12 cents per gallon.

Despite the prejudice against, and the disadvantages of converted producer-gas vehicles, many countries have recognized them as the best emergency solution for lack of gasoline and have passed compulsory measures for engine conversions to producer-gas propulsion.

Table III gives the estimated number of converted vehicles for a number of European countries.

Progress in conversions in Great Britain has been slow; there were 23 vehicles using producer-gas in 1938 and in October 1942, there were still only 1,383, but legislation in 1942 calls for 10,000 before July, 1943. A standardized producer known as the "Government Emergency Gas-Producer" is recommended. A government committee has also investigated the most suitable fuels and drawn up specifications.

In April 1940, when Sweden's imports of gasoline stopped, there were only about 1,000 portable producer-gas fueled vehicles. By the end of 1941 there were 75,000, 61 per cent of the country's total pre-war fleet of lorries and buses and about 17 per cent of the motor cars had been converted; thirty-nine per cent of these used wood, the balance used charcoal.

TABLE III

Producer Gas (Gasogene) Vehicles

*Journ. Inst. of Petroleum*, Vol. 23, No. 223)

| Country | Number of Vehicles, 1941 |
|---|---|
| Germany | 231,000 |
| France | 51,000 |
| Denmark | 11,656 |
| Finland | 10,000 (1940) |
| Belgium | 6,023 |
| Norway | 5,563 |
| Italy | 5,000 |
| Holland | 1,770 |
| Sweden | 75,000 |
| Russia | 40,000 (1940) |
| Total | 443,012 |

The joint information bureau of the Swedish Insurance Company state that producer gas vehicles cause twice as many accidents as occurred with gasoline vehicles before the war, even though traffic is now curtailed. The reason stated is that the lowered power compels frequent change of gear. The driver, however, endeavours to maintain a uniform speed as long as possible, and to make up for lost time by ignoring safe speeds on curves and crossings and when overtaking other vehicles.

*For information on various types of motor-vehicle gas producers, see E. A. Allcut, Producer Gas for Motor Transport, *Eng. Jour.*, April, 1942.

In 1940 over 700 agricultural tractors were working satisfactorily on producer gas in Western Australia. The producers were standard types made and marketed in Australia. The fuel was hardwood charcoal. The cost of the producers was given as about £90.

Producer-gas vehicles using wood blocks for fuel are becoming increasingly important in Soviet agricultural and timber industries. Such tractors have been successfully used for all farming operations, including threshing. In the Archangel region, the timber industries are to convert the whole of their automotive rolling stock and some of their stationary machinery from liquid to solid fuels.

### Liquefied Gases—Bottled Gas

Under modern methods, in petroleum refineries, a liquefiable hydro-carbon gas can be profitably separated from wet natural gas. Another large source of liquefiable gas is as a by-product in the manufacture of synthetic gasoline from coal. In the Fischer-Tropsch process, about 10 per cent of the output is recovered in this form.

The liquefiable gas is mainly propane, normal butane and isobutane, and when sold in liquid form is commonly termed bottled gas. Propane and butane are too volatile for inclusion in gasoline. They may, however, be liquefied, transported and stored under comparatively low pressure.

The total output has increased rapidly with improved methods of fractional distillation in America, and with the expansion of hydrogenation in Europe The consumption of liquefied gas in the United States increased from 223 thousand gallons in 1922 to 555 million gallons in 1942, or an average increase of well over 30 per cent per year.

Although the use of liquefied gas has been confined largely to domestic purposes, it makes an ideal fuel for internal combustion engines, for which it has four advantages: no oil dilution occurs; the fuel burns cleanly; it has an octane rating of over 100 and a high latent heat of evaporation. While only a small number of private automobiles have been adjusted to use this fuel, it has proved very satisfactory for tractors, trucks, buses, stationary engines, and rail motor coaches. It was estimated that in the United States in 1940, roughly 17 per cent of the bottled gas marketed was used for internal combustion engine, and this in a country where the need for substitution had not become serious.

The future of bottled gas is uncertain because new uses for the constituent gas will restrict production, whilst new uses for the product will limit its availability for motor fuels. Utilization of certain constituent gases for production of super-aviation fuel has increased rapidly during recent years. Thus, normal butane is utilized in isomerization plants. Iso butane is being segregated wherever possible for alkalation with unsaturated hydrocarbons to produce 100 octane gasoline. Propane is used to make propylene for synthetic rubber and is also blended with motor gasoline to increase volatility when butane supplies are low.

### Conclusion

In conclusion, the applicability of alternative fuels in Canada should be considered. In view of the present shortage of metal and rubber, as well as of gasoline, it is not likely that compulsion will be applied to enforce the war-time use of alternative fuels, but, nevertheless, some conversion is probable. For post-war developments, the possibilities of alternative fuels, especially producer gas for agriculture in Canada, warrant attention.

Alternative fuels appear more suited to the larger units than to passenger cars. The equipment should be specifically designed for the fuel and the use of converted units regarded only as a temporary makeshift.

It would obviously be better, if in a given territory all vehicles used the same fuel and not a wide assortment of fuels. The optimum fuel will obviously not be the same throughout Canada. In the north country, wood or charcoal seem probable. In many places a low temperature coke or char might be the best choice, and it is worth noting that our western low rank coals would probably produce a highly reactive fuel on carbonization. In southern and central Alberta a more immediate development with natural and bottled gas seems probable.

The great advances in aviation probable in the post-war world make it likely that the use of gasoline in agriculture and industry will be restricted, or perhaps rendered prohibitive by its cost. It does not even seem possible that sufficient diesel fuel, at reasonable cost, will be available for all needs, especially since diesel oil can be converted into gasoline.

### Acknowledgment

The author wishes to express his sincere thanks to Mr. Edgar Stansfield, M.E.I.C., chief research engineer, Research Council of Alberta, for his suggestions and helpful criticism during the preparation of this paper.

## DISCUSSION

A lengthy discussion followed presentation of the paper. The more important points in the discussion are here summarized.

Several speakers took a more optimistic view of the available crude oil resources. It was suggested that the potentialities of certain oil areas have not been fully investigated while in certain countries the oil fields, although not developed as rapidly as those of the United States, have had a more rational development, and in all likelihood their life would be much longer. Even when the output of the U.S. fields begins to diminish it does not follow that oil consumption will be curtailed, since petroleum from other fields would be transported to all parts of the world. Furthermore the bituminous sand deposits at McMurray are an important potential source of gasoline.

That gasoline may in the near future be reserved for aviation and similar preferred uses, or that its cost as a preferred fuel would prohibit its use for farm tractors, etc., was considered probable. Should this occur, alternative fuels would become of vital importance. Research investigations on alternative fuels should be undertaken now in preparation for the time when gasoline is no longer available.

It was felt that the lowered power output of producer-gas-propelled vehicles might somewhat limit their use. But since most tractors and motor engines have a higher power rating than is commonly used, the above disadvantage might not be serious.

It was realized that the present day motor car engine is the result of 40 years of intensive research and development, and furthermore, that an engine designed specifically for gasoline would not work equally well with a low calorific fuel. If producer gas, or other gaseous fuels, are to compete with gasoline when the war is over, an effort should be made to have engines designed specifically for the fuel.

Reference was made to several local producer gas plants which had not proved satisfactory. This brought forth the information that the committee appointed by the British government to investigate the use of producer plants reported that a producer should be specifically designed for the particular fuel to be used. They further stated that small changes in detail or dimension might make the difference between success or failure. It was recommended that only producers of proven value should be encouraged. The attempted introduction of unsuitable designs, especially in early stages, would delay sound progress. It was further

*(Continued on page 466)*

# A QUARTER CENTURY OF STEEL PRODUCTION AT SYDNEY

M. R. CAMPBELL

*Assistant Superintendent, Open Hearth Department, Dominion Steel & Coal Corporation, Ltd., Sydney, N.S.*

The demands made on the steel industry of Canada since the beginning of the present conflict have been met by continuously increased production which, in the year 1942, amounted to some 3,120,000 net tons.

That the industry has been able to meet the challenge is due in large measure to the farsighted policy followed in the years of peace. Pursued during bad times as well as good, this policy has led to the initiation of far-reaching plant improvements and expansions, and the development of better products.

At the end of the hostilities, in 1918, the plant of the Dominion Iron and Steel Company at Sydney, Nova Scotia, returned to the manufacture of its peace-time products of rails and fittings, blooms, billets, bars and rods, and wire and nails.

At that time, its physical equipment consisted of four small blast-furnaces, a fifteen-ton bessemer converter, twelve tilting open-hearth furnaces, billet, blooming and rail mills, rod and bar mills, wire and nail mills, a 16-in. merchant mill, and a 110-in. sheared-plate mill nearing completion. A two-battery Koppers coke plant supplied blast-furnace coke.

### Pig Iron Production

Blast-furnace operations following the war continued at rates required for steel making. One furnace was run intermittently on foundry pig, but this involved the importation of special ores and was abandoned in 1929. The furnaces were small, and, burdened with Wabana ore, were capable of somewhat lower tonnages than their counterparts on better ores.

Studies indicated that economies of importance could be effected by the operation of larger furnaces. Accordingly one furnace was enlarged and equipped with McKee revolving top, automatic stock-line recorder, and blast-temperature control. Three high efficiency stoves replaced four of old design. New gas-washing equipment was provided. This furnace was "blown in" in 1930 and has been a consistent producer of basic iron.

In 1940, a second furnace was similarly equipped.

The installation of additional steel-making furnaces since the outbreak of war has raised the requirements of basic iron to a point exceeding existing blast-furnace production. To increase iron output and to provide for relining shutdowns, a new larger furnace is nearing completion. It embodies the latest developments in the equipment found effective in previous installations.

In the future it is expected to further increase output per furnace by the installation of a plant to crush, size and sinter the ore-burden.

### Steel Ingot Production

During the war of 1914-18 considerable tonnages of basic Bessemer-duplex steel were produced at Sydney. Under peace-time conditions this operation was found uneconomical and was discontinued. Steel-making continued on a straight open-hearth basis.

Steel-producing economy was based on a plentiful supply of relatively low-cost iron with smaller percentages of higher-cost scrap. The open-hearth process on this high-metal basis was first carried out using all limestone as flux. Excessive slag volumes dictated by the high phosphorus content of the blast-furnace iron restricted furnace output. Experiments disclosed the advantages of two-slag practice which was adopted as standard. Although high-iron charges have imposed metallurgical difficulties resulting from the analysis of Sydney iron, it has been possible to place operations on a war basis without any notable disturbance to peace-time metallurgical balances resulting from shortages of scrap.

Among the notable trends during the years just before and following the 1929 depression was the demand on the part of Canadian railways for better steels to meet the exacting service requirements imposed by faster and heavier trains. For railway forgings a steel of a high degree of cleanliness and with high fatigue strength was specified. Since no steel commonly supplied possessed the quality necessary to meet these specifications, an extensive programme of investigation was instituted. After experiments extending over several years and involving the production and study of hundreds of heats, a satisfactory practice was evolved. This practice, based on closely controlled charging, melting, finishing, and pouring technique, produces forging steel of consistently high quality. From it have been made a large proportion of the axles now in service on Canadian railways, as well as forging ingots, the largest in Canada weighing up to 60 net tons. The ingots made for marine forgings for the Dominion ship-building undertaking, have been made according to this practice and its application has extended to the variety of special steels required for the materials of war.

In 1937, the first step leading to the expansion and modernization of steel-making facilities was taken by the installation of two Babcock-Wilcox Sterling type boilers of the most modern design. These boilers, fired with cleaned blast-furnace gas with powdered-coal auxiliary-fuel, supply steam at 450 lb. to a 9,500 kva. generator. Exhausting at 150 lb. steam from this unit drives low-pressure generating equipment. In 1942 a third boiler unit of the same type was added. Steam from this boiler will drive a larger high-pressure condensing generator soon to be installed.

Following the completion of the first boiler-units, a 10-ton direct-arc electric-furnace was put into operation in the open-hearth department for the production of special steels. In putting this furnace into operation no operators were brought in. Men with no previous experience were trained and their performance has proved highly satisfactory.

The year 1938 saw another important step toward increased production when a modern gas-producer plant was built. This plant which proved to be the nucleus of a large increase in steel-capacity consisted of three water-cooled Wellman gas-producing machines, equipped with full automatic control. An ancilliary coal-handling plant, capable of preparing and distributing coal for a ten-producer installation, was provided. This producer plant replaced a battery of obsolete hand-fired producers, and the improvement in gas quality materially increased open-hearth production.

On the completion of the producer plant, work was commenced on an extension to the pouring bay of No. 2 open-hearth shop, which housed two 100-ton furnaces. In this bay was erected a 175-ton Morgan ladle crane. This work was completed early in 1939.

Construction was then begun on two 100-ton tilting open-hearths of McKee design. Work was well advanced at the outbreak of war and thereafter was vigorously pushed to completion. The first furnace completed made its first heat in March, 1940, the second going into production a month later.

At that time the additional capacity provided by new installations had increased ingot output by about one-third, a valuable contribution to Canada's production at such critical period.

In 1941, with plans for expanded rolling capacity well advanced, steps were taken to provide further steel output by the contruction of a third open-hearth furnace. Begun late in 1941 this furnace, similar in design to the other two, produced steel in July, 1942.

With these additions, ingot capacity now represents an increase of 50 per cent over 1937 rating.

### Testing and Heat Treatment

In the physical testing and examination of steel products as well as in the tightening of metallurgical control, enlarged facilities and modern equipment have been provided. An important addition in this direction was the purchase in 1938 of a Zeiss Neophot micro-metallographic camera and microscope. This, used in conjunction with new polishing equipment, has been of great value in handling the enormously increased volume of testing imposed by the making of steels for war purposes.

For speeding up carbon analyses of steel in process, a carbometer and carbanalyzer were put into service in 1940.

The production of rails and fittings for Canadian railways has always been an important part of the output of the Sydney plant. Many important developments in rail equipment have been brought about in the last quarter century, such as increased rail-length, increased weight per yard up to the present maximum of 130 lb., the use of the "head free" rail, the development of high-carbon tie-plate, etc. No development, however, has been of such importance as the discovery of means of preventing internal fissures or "shatter cracks" in rails.

Over a period of years, Mr. I. C. Mackie, engineer of tests, at Sydney, carried on investigations to determine the nature of these defects. He found that shatter cracks developed in the cooling of rolled rails through the temperature range below 662 deg. F. More important, he demonstrated that they could be completely eliminated by slow cooling from this temperature to some 100 degrees above normal outside temperatures. This process is now carried out in closed boxes, each holding the rails from one heat. The cooling cycle averages 20 to 24 hours.

Since the patenting of the Mackie retarded cooling process, more than one million tons of rails thus treated have been rolled in Canadian mills for service on Canadian railways. It is evident that the virtual elimination of the transverse fissure as a cause of rail failure has been of incalculable value in maintaining our vital rail lines under the stress of war-time traffic.

### Rolling Mills

With the exception of large forging ingots, all steel production at Sydney is rolled in the mills of the plant. An increase in steel capacity must therefore be accompanied by corresponding increases in rolling capacity if proper balance is to be maintained.

In the blooming mill this increased capacity was partially provided for by the installation of additional soaking-pit capacity. A row of recuperative soaking-pits was installed in 1938, by Amsler-Morton Company of Pittsburgh. These furnaces have performed to the satisfaction of the operators, giving uniform and closely-controlled heating with a minimum of scale loss.

Billet-mill capacity was increased in 1939 by the addition of a seventh mill-stand to the original Morgan mill. The additional stand enabled the mill to take a 5 by 6 in. bloom instead of the 5 by 5 in. bloom formerly rolled. Twist guides were replaced at this time by roller guides, with a marked decrease in surface defects in the rolled product. This mill had previously been electrified by the installation of the 3,000 hp. motor formerly used on the 110-in. plate-mill drive.

The first post-war step in improving the wire and nail mills involved the replacing in 1923 of obsolete galvanizing equipment by a continuous unit of considerably greater capacity. No further changes were made until 1936 when a complete new cleaning-house, equipped with rubber-lined brick vats and modern handling machinery was completed. In this year also a continuous patenting-furnace for the annealing of spring-roping and other high-carbon wires was put into operation. New Bliss nail-machines purchased at this time introduced marked economies in the manufacture of nail specialties.

In 1937, two Vaughan continuous wire-drawing machines were put in as well as a motor block for the drawing of nut stock up to ⅞ in. The Vaughan machines increased production three-fold over the conventional drawing frames. This mill is now fully equipped to draw steel of all analyses in diameters from ⅞ to .022 in. and to supply nails of every kind from 12 in. 00 gauge to ⅜ in. 20 gauge.

The most recent development in providing mill capacity has been the resumption of operations in the 110-in. sheared-plate mill. This mill, completed after the close of the Great War, remained in operation only a few months. Much of the mill equipment was later put into service elsewhere in the plant or disposed of. With the resumption of demand for plate occasioned by the shipbuilding programme, work was begun on rehabilitating the mill in 1941. This involved the purchase of a new mill-motor drive, a roller leveller, table motors, etc., and the redesign and rebuilding of the slab-ingot reheating-furnaces. The mill was rushed to completion at all speed, operations beginning some two months ahead of schedule. It has now been in operation for more than a year; its production almost entirely going into ships' plate.

### Coking Plant

Shortly before the armistice in 1918, a new coking plant was completed at Sydney. The plant consisted of two batteries of Koppers ovens with a by-product recovery plant, and a British Baum coal-washing plant. Until the war ended, benzol toluol and zylol were produced as by-products.

During the years following 1918, benzol was produced and sold for motor fuel. Toluol and zylol were recovered and sold as crudes.

In 1922, a third battery of Koppers ovens was constructed. This battery was idle until 1939 when coke demand was increased by the need for more blast-furnace production.

In 1940, a new benzol plant was put into production, supplying refined benzol toluol and solvent naphthas to the munitions industry.

Operated in conjunction with the coke plant is a chamber sulphuric-acid plant, entirely rebuilt in 1930. Acid made here supplies plant needs for the production of ammonium sulphate, for benzol washing and for steel-pickling.

### Brick Making

During the last war the maintenance of steel furnaces was rendered extremely difficult by the inadequate supply of suitable refractories. Steps were immediately taken to remedy this situation by the construction of a silica-brick plant at the Sydney works, to utilize local materials. This plant has for the past twenty years supplied all plant silica-brick requirements.

### Service Departments

Improvements in the equipment of plant maintenance departments include the construction of an electrical repair shop in 1920, and a modern iron foundry in 1926. The purchase of modern machine-tools for the machine shops has enabled this department to meet the demand for replacement parts otherwise procurable with difficulty, if at all.

### Conclusion

The fourth year of the war finds the Sydney plant of the Dominion Steel and Coal Corporation possessed of balanced and well-integrated facilities for the maintenance of its present rate of steel production. An increase in output 50 per cent greater than pre-war figures has been made possible by the implementation of a far-sighted policy designed to enlarge, improve and modernize each step in production while promoting investigations and research in the direction of improved quality. All these have been accomplished without disturbing the economy which has made this plant the only Canadian steel-producer wholly self-sustained by raw materials mined within the Empire.

# COTTON YARN DYEING

ROBERT J. G. SCHOFIELD, Jr.E.I.C.
*Canadian Cottons Limited, Hamilton, Ont.*

**Paper presented before the Hamilton Branch of The Engineering Institute of Canada on March 20th, 1942.**
**Awarded the John Galbraith Prize* for 1942**

The art of colouring fabrics and yarns has been practised from time immemorial, and there are references to coloured cloths in the early books of the Old Testament, and in the works of ancient historians. The dyes used were vegetable dyes—extracts of leaves, wood, bark, roots, and fruits of plants and trees. Cochineal, which is sometimes included in this group, is not a vegetable dye, but is derived from the dried bodies of red insects reared in Mexico and Central America. Mineral dyes used were Prussian blue, chrome yellow, chrome green, iron buff and khaki. They were produced by precipitating a coloured pigment on the fibre.

With the discovery of synthetic mauve in 1856 by the English chemist Perkin, a vast new field of dyes was opened up. Most of the dyes used to-day are synthetic compounds having their origin in coal tar. Dyestuffs, whether of artificial or vegetable origin, are complex compounds of the element carbon, in association with other elements; more especially with hydrogen, nitrogen, oxygen or sulphur. They belong to the aromatic type of compounds.

Until quite recently, dyeing was guided by practical experience, and carried on as an art, mostly handed down by tradition. In those days the dyeing processes were the master's secrets, the results of repeated trials and costly experiments, and quite often no written record was kept.

To-day, dyeing is a science as well as an art. The dyestuff manufacturers supply a great deal of technical data concerning their dyes. Handbooks are prepared, giving the most suitable method or methods of application and fastness properties of each dye. Dyestuff laboratories are equipped to match shades on all types of material with all types of dyestuffs. Technical experts are available to give advice concerning any difficulty that may arise in the practical application of dyes. The machinery manufacturers supply all information required concerning the characteristics and uses of each piece of equipment.

Thus it would seem that a dyer's position should be an easy one. However, that is not always the case, when dealing with processes in which there are so many variables.

The machines used in yarn dyeing are designed to suit specific methods or processes. In some machines the yarn moves continuously through a stationary dyebath; in others, the dyebath is circulated through the yarn which is held fixed. Some are of the open vat type, while others are of the enclosed pressure type.

There are many types of machines used for cotton yarn dyeing, but they fall in three main classes:

(a) Skein dyeing machines;
(b) Chain dyeing machines;
(c) Package dyeing machines.

They may be constructed of wood, cast iron, copper, or stainless steel. All of these materials have some desirable features, but the stainless steel—due to its properties—has the widest range of usefulness. Wood retains colour and is difficult to clean properly in changing from one shade to another. Cast iron and copper, while suitable for particular types of dyeing, are susceptible to corrosion by various chemicals used in dyeing. In modern machines, automatic temperature control and automatic operation of valves play an important part, since the more automatic a process is, the more consistent will be the results obtained from batch to batch.

A measure of the efficiency of a dyeing machine is its liquor ratio; that is, the weight of liquor in the dyebath per pound of yarn. Dyestuffs are not completely exhausted from solution, and the percentage of exhaustion differs from dyestuff to dyestuff. Hence the smaller the volume of liquor used per pound of yarn, the greater is the amount of dyestuff extracted from the solution and taken up by the yarn. The lower limit of the liquor ratio depends on the solubility of the dyestuff; consequently, in practice, the liquor ratio is fixed within safe limits.

* The John Galbraith Prize is one of the Institute zone prizes offered in competition annually for Student and Junior members and is named after a past-president of the Institute.

### Skein Dyeing

This modern machine permits the dyeing of several shades in one operation. It consists of a long tank which can be divided into compartments by removable partitions over which is erected a rack of mechanically operated arms extending horizontally over the dyebath. The arms on which the skeins are loaded, revolve on their own axes and, being mounted on an eccentric, rotate elliptically, moving the skeins up and down in the dyebath (Fig. 1). This type of machine is expensive to buy, but utilizes materials and labour efficiently, is suitable for all classes of dyestuffs, and delivers the yarn in good physical condition. For loading and unloading, the rack can be raised free of the dyebath.

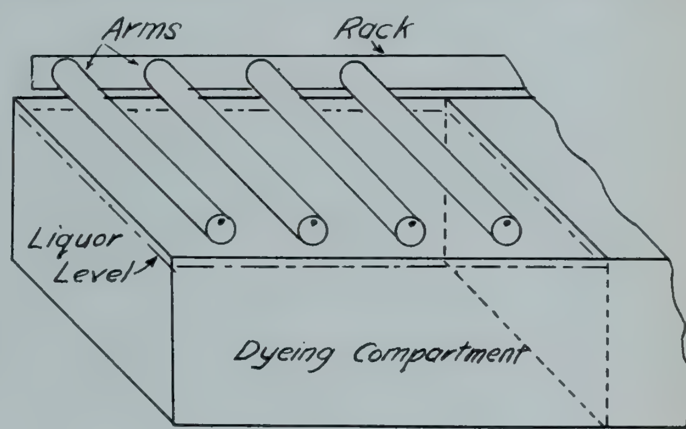



**Fig. 1—Skein dyeing machine.**

### Chain Dyeing

A chain consists of a number of strands parallel together lengthwise. The chain may be of any length depending on the use to which it is to be put. A convenient length is 6,000 yds. The chain is wound in a spiral wind reversing at the end of the traverse, on a wooden roll about 4 ft. long, giving what is called a ball warp. These rolls are then placed on stationary carriers and the ends of the chains are run through the machine, the ball warps unwinding at a constant linear speed (Fig. 2). In modern machines, as many as 30 chains may be dyed at the same time.

The machine consists of several compartments containing the dyebaths, wash water, or chemicals, with rubber covered squeeze rolls between them. The chains are guided through the various baths by immersed guide rollers, and are kept apart by passing them through eyelet racks before entering and when leaving each compartment. The squeeze rolls between each compartment aid penetration and levelness. The dyebaths made up in the compartments are known as standing baths. Feed or make-up dye is added periodically either by hand or by automatic controls, to keep the concentration in the bath at the starting level. Otherwise, the yarn passing through the bath would gradually exhaust the dye, with consequent fading of the shade.

### Package Dyeing

To reduce dyeing cost by eliminating operations, utilizing materials and labour more efficiently, to secure more positive control over process variables, to produce more levelly dyed and better penetrated yarn in the best physical condition, the trend is towards the dyeing of yarn under pressure in enclosed machines. In such a machine it is impossible to see what is going on, therefore automatic controls play an important part in establishing and maintaining the proper temperature, direction of flow, and time cycles in the dyebath.

The yarn is wound on hollow perforated metal tubes or springs; the tubes being $\frac{5}{8}$ in. inside diameter, the springs $1\frac{3}{8}$ in. inside diameter. On both these, the yarn traverse is about 6 in. and the overall length of the tube or spring approximately $6\frac{3}{4}$ in. Ordinarily, about 16 ounces of yarn are wound on a package. To save "blocking off" spindles, a lighter package may be wound, increasing the number of packages. A heavier package, up to about 22 ounces can often be used, depending on the type of dyestuff for which the process calls. Increasing the weight of yarn per package decreases the liquor ratio, hence the dyeing efficiency is increased.

A knitted sock is used on the spring to prevent the yarn from catching between the coils. These tubes or springs are placed over cruciform or perforated spindles, which in some cases are connected to a false bottom of the machine, in

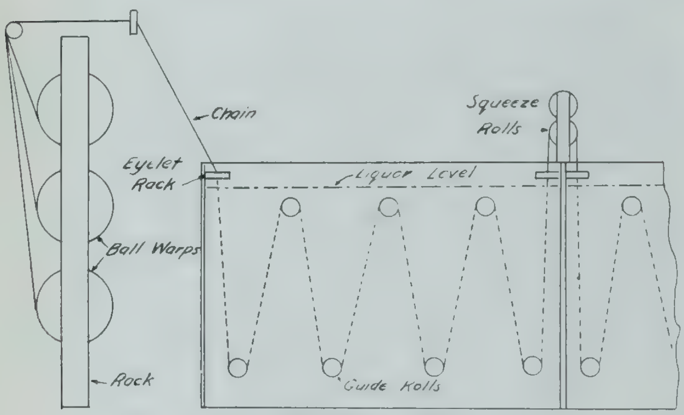



**Fig. 2—Chain dyeing machine.**

others to a removable header which can be inserted in the machine. The number of packages per spindle and the number of spindles govern the capacity of the machine.

In the false bottom type of machine (Fig. 3-a), the packages are loaded on the spindles, and a metal cap is placed over the last package. The cap has an attached rod which is inserted into the open end of the spindle. The pressure of the machine cover keeps the spindle cap in place and also compresses the packages on the spindle to a uniform density.

In the removable header type (Fig. 3-b), an annular metal plate is fitted over the spindle which has a closed end. The plate is forced on, compressing the packages, and is either bolted on or has spring lugs which fit into depressions in the spindle head.

The cover of the machine is bolted down, the dyebath from an auxiliary tank is circulated radially through the packages, and back to the auxiliary tank through an overflow pipe. Periodically the flow is reversed through the packages, either by manual or automatic operation of the four-way valve.

At completion of dyeing, the packages from the fixed spindle type machine have to be removed by hand, extracted in a basket type centrifugal extractor, and then dried in a heated chamber. With a removable header type, the header can be placed over a vacuum extractor, and the moisture is removed with the packages still mounted on the spindles. The header can then be placed over a hot air blower and dried in a few hours.

In these machines, heat is supplied through closed steam coils in both the enclosed tank and the auxiliary tank. Open steam coils are objectionable because the condensed steam increases the volume of dye liquor and may introduce impurities.

### Dyestuffs

A plentiful supply of soft, pure water is necessary for good dyeing results. Filters are used to remove suspended solids; chemical treatment to remove other impurities and hardness. Calcium and magnesium salts form water insoluble precipitates with dyestuffs and soaps, causing unsatisfactory results. Iron also causes objectionable stains—particularly on bleach and pastel shades.

Dyestuffs are sold as pastes or powders and are best kept in air and water tight containers, in a cool dry atmosphere. Freezing is injurious to paste types, but does not harm the powder types. Moisture often causes the powders to cake, an undesirable feature.

The dyestuffs are grouped according to type:

(a) direct; (b) basic; (c) sulphur; (d) vat; (e) naphthol.

Each type has a full range of shades from yellow to black. The types are distinguished from each other by their fastness under various conditions and by their chemical reactions. Each type may be used in any of the machines described previously, but some machines are better suited to certain dyestuff types than others.

The choice of dyestuff type to be used in matching a customer's shade is governed by the fastness properties and brilliancy desired, and the cost of production. Drapery shades generally need only be fast to light, awnings must be fast to light and weathering, hosiery must be fast to washing, slack suits must be fast to light and washing.

Thus it is apparent that the same dyestuffs cannot be used to obtain a certain shade for each of the above materials. Generally speaking, the cost of dyeing per pound of yarn for a given shade is least expensive for the sulphur type; the direct, basic, naphthol, and vat types becoming successively more expensive.

#### (a) Direct Dyestuffs

These dyes are fairly inexpensive and have moderate fastness. They are water-soluble and are generally used at the boil. They exhaust well, especially with the addition of common salt, or Glauber's salt.

There are special direct dyes which are very fast to light. Certain others may be made faster to light by an after-treatment with copper sulphate and acetic acid. After-treatment of some dyes with sodium bichromate or chromium fluoride, and acetic acid, improves the fastness to water, washing, or cross dyeing. Most direct dyes being sodium salts or organic compounds, the replacement of sodium by chromium tends to render the dye more water-insoluble.

After-treatment of certain direct dyes with diazotized paranitraniline increases their fastness to washing, in many cases a deepening of the shade also resulting. Diazotization of some direct dyes with nitrous acid and subsequent development with a phenolic, naphtholic or aromatic amine compound also materially increases the fastness to water and washing. A slight to complete change of shade may ensue, depending on the dyestuff, or developer used.

#### (b) Basic Dyestuffs

These dyes have very little or no affinity for cotton, but may be used after the cotton has been suitably saturated with a mordant. The basic dyestuffs form an insoluble compound with the mordant and are thus fixed on the fibre. These dyestuffs are soluble in acetic or formic acid solution and are used in such solutions. They give very brilliant full shades but have poor fastness to light; however, in fastness to washing some of them are superior to direct dyes.

Basic dyes may be used for topping direct or sulphur dyeings, which act as a mordant, in order to adjust small deviations in shade or to obtain greater brightness. Small percentages do not materially change the fastness properties of the ground dyeing.

(c) SULPHUR DYESTUFFS

Most of these dyestuffs are insoluble in water. However, they are readily dissolved in the presence of sodium sulphide and some alkali such as soda ash or caustic soda. In fastness to washing, acid, cross-dyeing, and perspiration, they surpass the direct dyestuffs. The light fastness of most sulphur dyestuffs is better than all but a few direct dyestuffs. The sulphurs are comparatively inexpensive, hence they are employed for the dyeing of heavy shades of navy blue, brown, olive, green and black.

In general, sulphur dyeings are dull in shade. The affinity of sulphur dyestuffs for cotton is less than that of direct dyestuffs, so that salt is used to secure better exhaustion. For greater economy, a standing dyebath can be used, and the addition of dyestuffs for each succeeding batch can be cut to 75 or 50 per cent of the original amounts.

Various after-treatments are used to secure desired effects. Sodium perborate or hydrogen peroxide are often used to increase the brightness of blues. However, this treatment sometimes decreases the fastness to washing. Sodium bichromate and copper sulphate after-treatment increases the fastness to light and washing of most dyeings. It also prevents any change in shade by after-oxidation; however, the shade is also altered more or less strongly. This after-treatment should not be carried out in iron vessels. Hot soaping with the addition of some alkali increases the brightness of most dyeings, at the same time softening the goods.

(d) VAT DYESTUFFS

There are five groups of vat dyestuffs:
(1) Anthraquinone; (2) Indigoids; (3) Indigo; (4) Hydrons; (5) Indigosols

With the exception of the indigosols, the vat dyestuffs are water-insoluble. However, they are soluble in an alkaline solution of sodium hydrosulphite and this solution is called a "vat." From this reduced solution, the vat colours dye the cotton fibre. The original compound is then reformed in and on the fibre by subsequent oxidation either by air, or other oxidizing agents.

The reduced solution usually differs in colour from the ultimately resulting dyeing. This gives a visual method of determining the extent of the reduction, but it is best to use chemical methods for exact determination.

1. ANTHRAQUINONES:

In all round fastness to light, washing, perspiration, etc., the anthraquinone dyestuffs occupy a unique position among cotton dyestuffs, and they are used where the highest demands upon fastness are made. Because of their generally very good fastness to soda boiling, chlorine and hydrogen peroxide, most anthraquinone dyestuffs can be used for coloured bleaching goods.

2. INDIGOIDS

The dyestuffs of this group are similar in dyeing behaviour to the anthraquinone types. However, they do not possess quite as good fastness. They are cheaper than the anthraquinone dyestuffs, so they are quite useful where the highest fastness is not required.

3. INDIGO

Indigo blue occupies a special place in the range of vat dyestuffs. It combines good fastness properties with low dyeing cost.

Indigo has no great affinity for cotton. To obtain heavy depth of shade it is necessary to build it up in steps. The yarn is alternately dyed and oxidized as often as required until the desired depth is obtained. Consequently, it is best dyed by the skein or chain process. In both cases, the yarn is dipped in the dye, then oxidized in the air, and the process repeated to depth.

4. HYDRONS

These dyes, because of their chemical composition may be reduced in an alkaline solution of sodium sulphide or sodium hydro-sulphite. Consequently, they can be dyed along with sulphide colours, or with vat colours. The dyeing cost is low and the fastness to light and washing is good. Unfortunately the shades are limited to navy blue, olive and black.

5. INDIGOSOLS

These are stable water soluble preparations of the reduction compounds of the vat dyestuffs. The dye is applied from aqueous solution, thus simplifying the dyeing method. The vat dyestuff is then fixed in and on the fibre in a special developing bath by the simultaneous action of an acid and an oxidizing agent, such as sulphuric acid and sodium nitrite.

The indigosols, however, have poor affinity for the cotton fibre, so their chief use is for the dyeing of pale shades.

(e) NAPHTHOL DYESTUFFS

The process for dyeing with naphthols is divided into two parts:

(a) Impregnation in a naphthol solution.

(b) Development of the impregnated material in a solution of a diazotized base.

Between these two operations, the yarn is hydro-extracted if in package or skein form; or nipped between squeeze rolls, if in chain form. Care must be taken that no light falls on the yarn in this state, since it has an injurious effect on the dyeing. The depth of shade is determined by the concentration of naphthol in the impregnation bath.

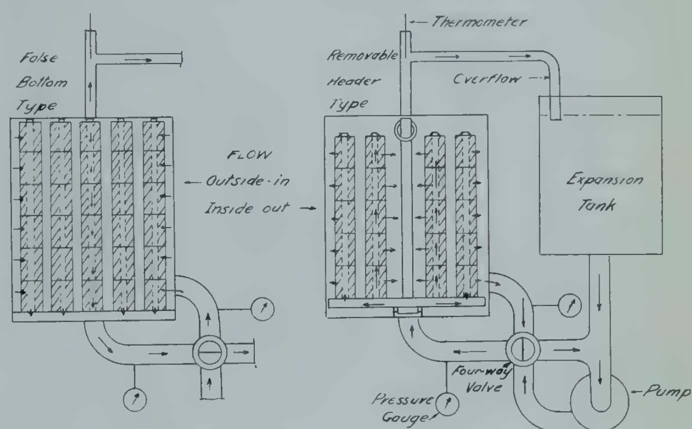



**Fig. 3—Package dyeing machine.**

Their fastness to light is good to very good, while the fastness to washing, soda boiling and perspiration is also good. The naphthols produce very bright shades and are used particularly for scarlets, reds and maroons of good fastness, which are not usually dyed with vat colours because of the expense involved.

DYEING AUXILIARIES

Such compounds are penetrants, levelling agents, retarding agents, waterproofing agents, and various synthetic resins. In most cases, these materials are synthetic organic chemicals built as it were to suit specific needs or overcome difficulties in dyeing processes.

Cotton in the natural state contains pectins and waxes. These would cause imperfect dyeings if penetrating or levelling agents were not available to dissolve or emulsify the impurities and allow the dyestuff to penetrate all fibres in the yarn. To secure even dyeings when using rapidly exhausting dyestuffs, retarding agents are used to slow the absorption of dye by the fibres. Certain dyeing processes tend to leave the yarn in a harsh condition, but softening agents can be used to overcome this effect.

Since all dyeings are made from solutions with water as a base, it follows that any inherent waterproof quality of the original cotton is destroyed during dyeing. Hence, dyed yarn must be treated with a wax emulsion or aluminium soap if it is to be used in a water-proof material. Synthetic resins have a variety of uses in the treatment of yarn to secure desired effects of "handle" or feel.

# OUR STAKE IN THE PEACE

WILLIAM E. WICKENDEN

*President, Case School of Applied Science, Cleveland, Ohio, U.S.A.*

**Address delivered at the Fifty-ninth Annual Dinner of The Connecticut Society of Civil Engineers, Inc., at New Haven, Conn., March 23, 1943, and reproduced with kind permission of the Society**

**NOTE—Dr. Wickenden is no stranger to members of The Engineering Institute of Canada. His address, "The Second Mile," delivered at the annual meeting of the Institute in 1941 at Hamilton, has made him many friends. That classic address has been reprinted many times and given a wide distribution both in Canada and the United States.**

**The address which follows deals with the engineer in post-war planning, and post-war activity. Canadian readers should keep in mind that Dr. Wickenden is speaking to an American audience. When he says "we," he means Americans, but the wisdom of his words is almost equally applicable to Canadians.**

**This address attempts to solve the critical problems of the relationship of government to private enterprise. It is one of the few worthwhile utterances that admits there is a useful place for both in post-war co-operation. It points out with emphasis the engineer's opportunities and responsibilities in the present and future problems of the peace.—(Ed.)**

It is fitting that our old men should dream dreams and our young men see visions, but experience is still the most reliable teacher. This is a good time to gather its fruits. We are at the pivotal point of this war. Until now, we have been losing. We are just beginning to win. Our fighting plans have now been matured. Our procurement programme is in full swing. The difficult problems of logistics have been worked out. Our fighting forces have had their baptism of fire. The broad strategic programme has proved to be sound. There remains now the staggering task of execution.

Planning is moving to new ground. It is significant that Mr. Churchill, who is no callow visionary, in his speech of March 21st spent so little time invoking the fighting spirit and the fortitude of his people, or in the exposition and defense of war plans, but rather sketched so boldly and broadly the architecture of Britain's plan for peace. It is said that wise men make mistakes, but fools repeat them. It is a good time to take counsel with ourselves. There are four lessons we should have learned from World War I.

*The first is that lack of planning is fatal.* If you do not prepare your defense until the country is invaded, it is then too late. If you do not plan for peace until the armistice is signed, it is equally too late. If you trust to your powers of improvisation on the ebb tide of post-war reaction, they will let you down. It is not enough to have the blue-prints ready in the files; it is equally necessary to condition the people for their acceptance. Emotionally exhausted civilians homesick for normalcy—which is likely to mean coffee and silk stockings and gasoline—and war-weary veterans on the rebound from overseas experience can not be expected to design a brave new world.

The second lesson is that *the dislocations of peace are more likely to be fatal to civilization than the shock of war.* Dr. Fosdick, New York's eminent preacher, has a pet story to illustrate that point. It is about a man who fell from his roof while doing his chores. A neighbor who visited him in the hospital remarked, "Your fall must have hurt you a great deal." "Never hurt me a bit," was the quick reply, "it was the stopping that nearly killed me." No doubt those were the sentiments of the Romanoffs, the Hapsburgs and the Hohenzollerns. War creates cohesion; peace releases the forces of anarchy and revolution.

Third, *war may change a nation's destiny and the nation fail to perceive it.* We entered World War I a debtor nation. For nearly three centuries we had drawn heavily on Europe's surplus capital to open our vast domain, provide it with waterways and railways, gain access to its fuels and minerals, establish manufactures and supply power and communications. Merely to keep the interest paid called for an annual export surplus of 600 millions of dollars. Our home market for manufactures was elastic; as technique advanced and volume rose, costs fell and outlets multiplied. Our home market for the products of agriculture was inelastic, with a swivel-chair generation eating only half as much per capita as did our open-air grandfathers. It suited our convenience to protect manufactures with a tariff dyke and to let our agriculture surplus flow over the spillway at the market prices of the world. We came out of the war a creditor nation. On paper Europe owed us 25 billions. To get interest and even a trickle of our principal back we should have needed to take in an import surplus of a billion a year. All our instincts revolted. There was Europe in dire need of all we had to sell; here were we geared to an immense surplus of production. We wanted to sell—for cash, so we lent billions to keep the game going until Wall Street blew up in our face.

Finally, *we should have learned that an unplanned post-war programme leads to a false refuge in negative solutions.* Having created world unity in fact, we denied it in thought and action. We entrusted collective security to an international debating society without police powers. We trusted our own defense to a reduction of armament. We sought to weaken aggressors instead of strengthening the forces of law and order. Even our most exalted gesture of internationalism, the Kellogg-Briand Pact, on close inspection was little more than a pious resolution on what not to do. Meanwhile, at home we gave ourselves up to the enjoyment of the fake and fluff, the wise-cracks and illusions of the Hollywood Era, when it was more important to be smart than wise, when glamour out of a make-up kit was preferred to charm acquired through painstaking cultivation, when first we were all to grow rich through the effortless magic of stock-market inflation, then were all to gain security by spending more than we produced. Faced by an economic collapse without precedent, we seemed to have no choice except between a do-nothing paralysis and a programme of random improvisation whose one connecting principle was the indefinite expansion of the national debt.

Now we are eating the Dead Sea fruits of twenty-five years of disillusionment with an unplanned peace. We are confident of our ability to bring this military crisis, however stupendous, to a successful conclusion, but we are shaken with misgivings of our ability to create a post-war world worthy of the sacrifices. These misgivings are not only undermining our morale, they are inhibiting our diplomacy in the wavering areas of South America, in the Mediterranean basin and in India; they are negativing our not-too-ardent efforts to fortify the stamina of the Chinese; they are enfeebling the response of occupied lands to our bids for their moral resistance; and they are inhibiting an all-out effort on our production front. Two war-workers in Cleveland who recently staged a little private slow-down were heard to remark "Aw, what's the hurry? When this show is over we'll both be on the street in two weeks!"

In asking you to look with me beyond the war's horizon, I owe it to you to make it clear in advance just where I stand. I am an all-out anti-inflationist and anti-isolationist. To be an *anti* is a cheap way known to politicians of gaining credit for a strong position. Antis are a dime a dozen, but I use this way because what I am *for* is not so easy to label and define. Let me put the case on the grounds any Yankee can understand—we can not afford inflation and isolation. The famed New England conscience forbids me to stop there; we must seek grounds where idealism and practicality converge.

With inflation we should have little difficulty. Any one who has seen the ruin, disunity and social disintegration inflation leaves in its wake—even partial inflation as in

France and Italy—or the deranging effect of complete inflation on the mentality of whole peoples, as in Austria and Germany, becomes an easy convert to the most drastic pay-as-you-go war economy. Whenever Congress clamps the lid on prices and wages and jacks up taxes to our utmost ability to bear, we ought to stand up and cheer.

Surely we are not entering this inferno of "blood and sweat and tears" merely to get out old world back. This time there can be no doubt that we are irrevocably committing ourselves to world responsibilities. Win or lose the war, we shall have to pay for it anyway; we are simply inheriting it. Win or lose the peace, the price is inexorable; the one great nation to emerge with vast reserves of wealth will have to foot the bill. Do you desire to lessen the hazards of fire or of disease? Community living will be found the cheapest and most effective way. Even so, insurance is the surest and cheapest way to cover financial risk.

Peace is not mere absence of conflict. It is a social structure which must be carefully and painstakingly rebuilt. Its arrival can not be instantaneous. There will be necessary preliminaries—a policing job to restore order; a feeding job to restore vigor to enfeebled peoples; a rehabilitation job to make ravished areas self-sustaining; a job disentangling titles to lands and properties ruthlessly expropriated or "legally" bought with worthless marks; a moratorium to administer if mankind is to be protected from the crushing weight of universal debt, and all these jobs we shall inherit and they will not be short ones. By the time a permanent settlement can be mapped out we shall be deeply involved, probably permanently.

A world-wide commitment for security will after all be no radical departure from our past. The Monroe Doctrine has been co-extensive with our security zone in the past; now that zone has become a global area. It is not only our political destiny that is at stake, but our economic and spiritual future as well. The resolution just submitted to the Senate by two Democrats and two Republicans—one of the latter born in New England and the son of an engineer, although Ohio now proudly claims him—will doubtless awaken a vehement protest from the "America First" group, "Why waste our shrunken substance on a world of down-and-outs? Better to set a rigid quarantine against the plagues that will soon be ravishing them!"—or some such appeal to supposed self-interest. Have we not yet learned our costly lesson, that America can not remain an island of freedom in an ocean of tyranny, an island of security in an ocean of violence, an island of sanity in an ocean of paranoia, an island of good faith in an ocean ruled by gangsters? No more can America hope to be an island of plenty in the midst of an ocean of want and of woe.

This is no mere counsel of idealism; there are stern costs to be counted. If we choose to become a hermit kingdom within a closed economy, the first score to write off will be everything we have put into the lend-lease programme; this time there will be no will-of-the-wisp of reparations. The next score may be charged up against our hoard of gold, five-sixths of the world's entire supply and supposed to be worth some 23 billions of dollars. For what—filling teeth and making watch chains? Hardly. Unless we restore this gold to its historic function as a currency base, as a foundation for international credit and as a medium of settlement of trade balances, it becomes merely so much lustrous metal, priced in the markets of the world by the law of supply and demand, and probably shrunken to a mere fraction of its former worth. Then comes the score to be charged up against our war-time investments, the 40 or 50 billions we shall have put into increased capacity for producing metals, chemicals, machine tools, aircraft, fighting equipment, synthetic rubber, and the like—for much of which there will be no outlet in a home market clamoring for consumer's goods. Following this there will be a score to be settled for our increased acreage whose products no one will be needing. Meanwhile millions of jobs will be liquidated while our demobilized fighting men and civilian workers contend bitterly for the bones that remain.

Win or lose, we shall have to pay for the peace any way. We can pay for it by withdrawing into a closed economy, which may mean the writing off of perhaps a hundred billions of our capital, without a chance of recovery, or we can pay for it by underwriting the world's recovery and the extension of civilization, in which case we may not only do considerable good, but also have a sporting chance of getting our money back with an honest profit.

Any such programme ought to begin on the engineering level—food, sanitation, shelter, restored communications, and renewed means of subsistence. When fighting ends, an army of 5,000 American engineers should be all mobilized equipped and ready to move into the stricken areas as pioneers, explorers and missionaries of the peace to come, in the highest Hoover tradition. Such an army of engineers could learn as well as give, and map the ground for a rehabilitation programme in which our industries could play a major role.

With the immediate tasks of food, sanitation, subsistence and order in hand, we might well begin the task of restoring the world's shattered economy.This might begin by digging our gold out of "Them thar hills" down in Kentucky and putting it back to work in the form of capital loans to restore currency, establish credit, reopen trade channels, create outlets for capital goods. Uncle Sam would have to learn to be neither the world's Santa Claus nor its Uncle Shylock, but the world's banker, not handing our purchase power for quick recovery with a lavish hand as in the early 20's, but prudently supplying working capital to be kept in the business on the prospects of the borrower's renewed prosperity with a margin of gain sufficient to support, and in time to repay, the loan.

Dollar diplomacy? Yes, if you will, but carrying with it moral responsibilities in the peace plans for world reconstruction of almost incalculable weight. The nation with food and money can almost literally re-plan the world. It can pick its borrowers. It can insist on strong, integrated economic units with a chance to prosper instead of a world process of Balkanization which dooms every petty political unit to frustration. It can insist on a policy of open trade channels which will give the smaller and poorer and more crowded nations a chance to live and to prosper. Such a policy, no less than military policing can be a world force for peace. Hjalmar Schacht, wizard of Nazi finance, knew what he was talking about when he said "If goods do not cross frontiers, armies will."

The modern key to wealth is at the opposite pole from the economics of the robber barons, as perpetuated in the obsessions of ultra-nationalism. It is only a meagre and a transient wealth that is gained by pillaging one's neighbors, keeping them poor and refusing to do business with them. Industry has discovered a more excellent way—more, better and cheaper goods, produced in great volume by high-paid workmen using the most advanced technology where supplies of materials are most favorable, and sold in the widest markets at the lowest cost. This principle is not respector of mere political sovereignty.

It cannot operate in close confinement. This doctrine brings us back to our premise that in the long run idealism and self-interest tend to become one. If fate has appointed us to be the world's banker, we can insure our own prosperity only as we create it for others.

Economists do not seem to agree on many points, but on this they seem to be of one mind, that we can not maintain our prosperity merely by producing to consume. To prosper we must not only produce, but INVEST. What we invest, we devote to increasing our means to produce and adding to its efficiency. We do this in part through our savings and in part by borrowing from the future through the mechanism of credit, sluicing money through expenditures for plant, equipment and labor into purchasing power to be added to that which comes from producing consumable goods. The price of prosperity has been estimated at the flow of 20 billions a year into our economy, as an expansive force. To meet the war's emergency we have been anticipating our normal flow of investment for many years to come. How then can this expansive force be maintained when peace comes and our own demand for capital goods threatens to fall to a mere trickle? After a transient boom, while our own deficits of consumption and the world's tragic depletion are being made up, then what?

Frankly, I can see but one chance to preserve the expansive forces of economic freedom and vigor. There are still immense areas of the world which sustain overcrowded populations at a bare subsistence level. The war will have brought millions of men, who in the past have asked little more than that the daily rice bowl should be filled, into contact for the first time with a civilization which offers some hope of plenty, and of the means to defend their national life. Primitive agriculture and handcraft, however idealized by Gandhi, hold out no promise of betterment. Human experience offers but one hope, and that is industrialization. The United States alone will have the capital to finance and the industrial capacity to undertake the huge job of industrializing such areas as India and China. Is not the industrialization of now backward populations an invitation to doom through pauper competition? In seeking thus to keep our own capital and our own industrial capacity at work, are we not merely putting off the inevitable? Yes, but so is a man riding upon a bicycle. Like him, we are living in a dynamic equilibrium. Our fathers' wealth was in land, solid and permanent; ours is in plant and machinery, in knowledge and skill, valuable only when working.

Let us turn our view for a time to the domestic horizon. For nearly fifteen years our most conspicuous social trend has been a growing concern for economic security. Our people have come face to face with the fact that the removal of the great mass of the population into industrial centers has destroyed the natural security of an earlier generation rooted in the soil. When adversity comes, there is no place to go, except on relief. Like every other highly industrialized nation, we are bowing to the inevitable of social insurance. How far will this trend go? Is it compatible with the democratic faith, born at Plymouth Plantations, that men are expected to look out for their own? Britain is weighing its Beveridge Plan and the United States has received, if somewhat contemptuously, the massive report of its Delano Committee.

If you will grant me three guesses, I will hazard a prediction that our American plan of social security will attempt to set up three guarantees, one of subsistence, one of a chance to work, and a third of a chance for young people to get a start in life. Is this radical socialism, a dangerous drift to the left? Possibly, but I doubt it, for the three minimum essentials were inherent features of our earlier way of life. When the birthright of security on the soil is lost, men look to organized society for an equivalent. The degree of danger to free institutions depends on the degree of stability which can be developed in the industrial system. Keep it running at normal vigour, and few Americans are interested in collectivism; permit it to falter and to stall, as in the late 30's, and the leftward drift may become a sweeping tide.

As we have noted, the economic machine runs on two sets of cylinders, one fed by production, the other by investment. The former gives us little trouble in itself, but the latter is unduly sensitive to stimulus and has troublesome stalling tendencies. In order to get a more effective regulator, it seems probable that we shall have to develop some new kind of partnership between government and free enterprise, and especially to draw on the resources at government's command not only to check excessive stimulus to investment, but also to supply deficits when private sources grow jittery and contract. We have been getting what our chemical confreres call a "pilot plant experience" with such a partnership in the war effort. It is government which has guided industry out of its normal channels, altered its plant and product beyond recognition, set limits to materials, to credit and to profits, and stripped it of the reserves which it might have saved to finance its ultimate return to peace-time channels. Inevitably, government will have to pilot industry back again.

Clear thinking on just what government and free enterprise can each contribute to a lasting partnership may be particularly helpful at just this point. First, let us remember that the problem we have to solve calls for multiplication rather than division. The witness of experience is clear on one point, namely that democratic government is not and perhaps cannot be an effective agency for creating wealth, but by its very responsiveness to shifting popular will, an agency for distributing it. Government is an agency of division and not of multiplication. Whenever it has tried its hand at creating wealth, as it has in Russia, it has found itself compelled to take on dictatorial form, no matter what its avowed political theory.

Let us note at this point a parallel between economics and thermodynamics. I do not refer to their traditional academic dryness. Energy, we all know, tends to run down hill, to spread itself thinner and thinner until it ends in impotence. If you want to make it do useful work, you have to concentrate it, confine it, guide it in cylinders or blades, and possibly step it up into current of high potential. All this, as you know, goes against the natural instinct of steam and electricity. It calls for special skill in design and management and for endless precautions against waste. This is something democratic government can not do. It can spend, but not save; it can provide insurance, but can not lead men to take risks; it can make work of sorts, but not multiply normal jobs, and its executive decisions do not conform to the business standards of enterprise and prudent risk, but are made with an eye to the election returns. There is no need to dilate on government's weird book-keeping or the magic of rubber yardsticks. Details don't matter much when the principle is basically wrong. It just can't be a democracy and create wealth. It has to leave that function to free business organization outside of the structure of government.

Government is, of course, a partner in the wealth-creating business just as the bearings and guides of an engine are partners in the power-making business. These bearings and guides never put an ounce of thrust into the pistons, but they can discourage the pistons mightily if they are badly lubricated or out of alignment. This partnership of government and free enterprise assumes an overshadowing importance in the face of the debt we shall inherit from this war. At the least reckoning, every dollar of our productive assets, every dollar we have saved and invested in farm land, in urban real estate, in mines and oil wells, in factories and transportation systems, in power or communications services, or in the whole mercantile enterprise, will be mortgaged with a dollar of debt. Will America be solvent or will it be sunk?

The fact that we will owe the debt to ourselves will make it easier to bear. What really matters is not how much we will owe, but how much income we will have to carry it. If I owe $10,000 and earn $2,000. I am broke; if I owe $10,000 and earn $50,000, the bank will be glad to carry me. There are three ways to deal with debt: the first is the way of repudiation, either direct or through the subtler magic of inflation, and this is the way to ruin; the second is the Spartan way, to grin and bear it, to pull in the belt and cut the standard of living, and this is the way to paralysis; and the third way is to dwarf the debt into insignificance by speeding up our production of new wealth, which is the only road that leads to a brave new world.

For this third way there is an inspiring precedent. A century and a quarter ago Britain came to the end of the Napoleonic wars in great distress, burdened with debt, faced with the collapse of employment, haunted by unrest as demobilized soldiers and sailors roamed the streets, her sea trade in ruin, and the whole outlook black. Two decades later Britain was incomparably the richest and most powerful nation the world had ever known. How had this miracle been wrought? By taxing capital out of existence? By devaluating Sterling? By going on the dole? By becoming a Soviet collective? None of these. Britain's might was the fruit of new wealth, wealth that had never existed before, fashioned out of British science, British invention, British enterprise, British industry and gleaned from every corner of the world.

In government's new partnership with free enterprise the role of policeman will not suffice. Politicians seem to find it difficult to grasp how much more the public has at stake in the advancement of science and technical arts than in any scheme of taxation or regulation or policing of capital structure, or limitation of rates or prices. One recalls in this connection the visit of the Parliamentary Commission to the laboratories of the great Faraday to view the evidences of his epochal discoveries in electricity and magnetism. Turning to one seemingly useless gadget the Prime Minister is said to have remarked with a sneer, "Of what possible use is a thing like that?" "Ah, my lord," replied the patient Faraday, "some day you may be able to tax it." Some day you may be able to tax it! What prophetic words! Last year the industry built upon the apparently useless gadget turned into our public treasuries in this country alone about half a billion dollars, a mere fraction of the wealth created in a single year, yet a sum incomparably greater than the entire cost of winning all our knowledge of electricity and magnetism. *Ignorance, rather than perversity and greed, is still man's costliest enemy and research, in the long run, still man's most profitable investment.*

Our most vaunted triumphs of the technical arts are in reality mere challenges to our ignorance. Somewhere back of the lights in this room is a coal pile; if we turn 30 per cent of the coal's energy into electric current we do well, and then turn only 8 or 10 per cent of the current into useful light. Of the precious gasoline we put into our automobiles, we use only about 8 per cent to drive down the road—the exhaust, the cooling water and the friction of the engine and transmission dispose of the rest. Will you trust government to narrow this gap of ignorance, or leave that job to individual initiative and free enterprise?

Government has its role in the economy of tomorrow, but its role is that of a friendly banker and investor, checking inflationary trends in times of prosperity and sustaining the flow of investment in times of recession, distributing some of the fruits of industry in the form of public works and services and of social insurance, but the creation of new wealth is the job of free enterprise. This is the evangel which engineers everywhere, as ministers to the general well-being, have to proclaim.

In the building of the peace we have not only a gospel to preach but work to do. I have mentioned the role which should be ours as the pioneers of relief and rehabilitation, as explorers on the frontiers of international finance. Meanwhile we have a job to do in formulating a science of public investment with measuring sticks as sound as those engineers now apply to private undertakings. Government knows how to spend, but it does not know how to invest. Criteria are lacking. The two yard-sticks an engineer applies to every private project—will it work? and will it pay?—are good but not enough. To these must be added—what are the alternative costs in public relief? what are the social returns in regional development? and possibly many more. In a word, public investment is not a two-dimensional but a multi-dimensional problem for the engineer to solve. On some of these dimensions the engineer must do teamwork, with the social scientist, and to-day the two scarcely speak the same language. It will not do to write the economist off as a dealer in abstractions, or the political scientist as a dealer in "globaloney" or the sociologist as a sentimentalist saying solemn things about the obvious—we must learn to do team-work with these men or we may find ourselves on the side-lines.

If government is to become a true partner in our economy our profession must supply to it a generation of public servants who will bring into government some of the same dynamic character we supply to industry, some of the same alertness to make investment which will contribute to the multiplication of wealth. We must supply to the world of private effort in ever greater numbers men who will bend every effort to the creation of new products and to the development of more efficient processes; but above all we must supply to every area of industry and of government the new type of trustee-manager who is neither capital's man nor labor's man nor the customer's man nor the government's man, but is able to reconcile their common interest in the teamwork of production. Some of this task each of us can do through his daily job, but there is a large and growing part that we can not do at all unless we pool our effort and our influence through the organizations of our profession. Lacking this, we are merely skilled technical workers and not true professional men.

When I survey the by-products of our war effort and the means of well-being we are adding to our store—our vastly augmented production capacity, our amazingly advanced production technique, our renewed discipline, our widely shared technical knowledge and skill, the marvellous fruits of war invention and research, and especially our reborn faith in oursleves and our national destiny after the devitalizing pessimisms of the depression—I find it hard to be gloomy about the future. Our larders may be lean, our wardrobes threadbare, our homes and plants short of equipment, our automobiles obsolete, our tires worn thin and smooth and our balance sheets debt-ridden when peace comes, but when in human history has a generation faced future with such fabulous means to well-being IF—and was any IF so important?—if we can organize that future on worthy lines. This is no time for engineers to wrap themselves in the mantle of isolated individualism—let us get together and be about our business.

# ROYAL ELECTRICAL AND MECHANICAL ENGINEERS

COLONEL R. B. MAXWELL
*Assistant Adjutant General R.E.M.E., British Army, London, Eng.*

**NOTE—In February of this year, Colonel R. B. Maxwell, Assistant Adjutant General R.E.M.E., spoke to the Institution of Mechanical Engineers in London, about the relationship of mechanical engineers to the R.E.M.E. This was described as an informal meeting and the speaker was careful to point out that, as the views expressed might be controversial, he wanted it understood that they were his own and not necessarily those of the War Office. However, as the chairman of the meeting was Major-General E. B. Rowcroft, director and head of the R.E.M.E., it may not be amiss if Colonel Maxwell's comments are accepted at face value.**

**In view of the discussions that are taking place in Canada relative to the merits of the R.E.M.E. set-up for the Canadian forces, and the evident opposition that has developed in those circles most likely to be adversely affected by such a change, it is interesting to read—even between the lines—Colonel Maxwell's account of the early development in England.**

**The following is not the complete address, but just those portions which would seem to be of special interest to Canadian engineers.—Ed.**

It is not for me to express political views about the direction of the British Army between the last war and the beginning of this one or bring to your well informed notice that the British Army always serves loyally and without question the wishes and the desires of the Government of the day, irrespective of what other nations may be doing and the requirements of trade and home industry. Our repeated reverses, at the beginning of this war, caused surprise and alarm in the minds of the indomitable British public. This quality is our secret weapon. Time passed on quickly but there was little improvement in our efforts to get our enemies down. It was becoming increasingly apparent that this was a new type of war—an engineers' war—a war of machines in which the necessity for machine mastership from all aspects loomed ever larger before us.

In August, 1941, an interim report was published by Sir William Beveridge's Committee on the "Use of Skilled Men in the Services" presented by the Ministry of Labour and National Service to Parliament by command of His Majesty. The opening passage of this and the interim report reads as follows:—

> Sir,
>
> To the Right Honourable Ernest Bevin, M.P., Minister of Labour and National Service.
>
> 1. TERMS OF REFERENCE.
>
> We were appointed by you on the 9th June last as a Committee instructed to "examine in consultation with the three Service Departments, the use now made in the Royal Navy, the Army and the Royal Air Force of skilled men and to advise in the light of the operational and maintenance commitments of the three Services.

Jumping on to paragraph 27(e) of this Beveridge Report—reads:—

> The Army is not a centralised Service like the Navy or the Air Force, but a combination of distinct corps and of units with, in many cases, strong local associations of sectional traditions. The loyalty both of men and of their commanders is often, in the first instance, a loyalty to their particular unit or corps and sets up obstacles to transfer which do not occur in the other services. The machinery of transfer is necessarily more complicated.

Sir William Beveridge, whom one might call "the great social engineer," was only stressing how "cap badge conscious" the Army really is, whereas the Navy and the Air Force each wear one badge. We have heard of the ingrained discipline of "esprit de corps" and of dying for the sake of the regiment and the reverence with which all regimental colours are held. These are centuries old traditions, and custom. These teachings cannot be eradicated in a day. All regiments and corps are justly proud of their past traditions and their pride, in some cases, thus naturally tends to cloud the urgency of change in the vital requirements of the immediate present.

### Pooling of Mechanical Resources

Now to paragraph 33 of this Beveridge Report—reads:—

> The Army is based upon corps and upon units; we do not undervalue the importance of seeing that each unit is closely-knit and self-reliant. But neither unit nor corps should seek to be self-contained. Break-up of the engineering work of the Army, between corps and units to the extent to which it is carried to-day, involves duplication of workshops and multiplication of reserves of skilled men and special equipment. The most economical use of scarce resources depends upon pooling them as fully as possible. Extensive use of armoured fighting vehicles makes it certain that for their sake there must be skilled men and equipment capable of difficult mechanical repairs within reach of the front line, however that may move.

What the far-sighted Beveridge said and ruminated on in the months leading up to February 1942, after extensive tours to all Service Units, bore fruit in the recent battles in North Africa. In General Montgomery's advance between 23rd October and the 23rd November, 1942 (this, of course, was after R.E.M.E. had been formed), of 1,200 tanks incapacitated 1,000 were repaired by first and second echelon R.E.M.E. Mobile Workshops and put back into the battle; only 200 had to be evacuated out of the fighting zone. This was an improvement in maintenance service to the Army out of all recognition to that provided in previous North Africa campaigns. R.E.M.E. had started off well.

We now go to paragraph 44 of this Beveridge Report—reads:—

> *A Corps of Mechanical Engineers.* The other proposal is that there should be established in the Army a Corps of Mechanical Engineers. The success of the Navy in making good use of mechanical engineers is not due solely to the fact that the naval problems are simpler than those of the Army. It is due also to the fact that the Navy has had for so long an engineering branch of high authority and has had other technical branches specialised on torpedoes and electricity or ordnance. The Navy is machine-minded. The Army cannot afford to be less so. The Navy sets engineers to catch, test, train and use engineers. Until the Army gives to mechanical and electrical engineers, as distinct from civil engineers (I think here Sir William Beveridge was referring to the main function of the Royal Engineers) their appropriate place and influence in the Army system, such engineers are not likely to be caught, tested and trained so well as in the Navy; there is danger that they will be misused by men whose main interests and duties lie in other fields.

Whether a Corps of Mechanical Engineers to serve the whole Army is essential is obviously a question in which there can be many lines of thought and many divergent opinions, but I may say that for some years there has been in the Army a body of opinion which held that such a corps should be formed and this view was gaining wider support as a result of this war's teachings even before Sir William's report was published.

### New Methods for New Tasks

The Beveridge Report reads:—

> The Army, under our audit of the use of skilled men, shows less well than do the other Services. This is due mainly to the fact that the Army's problems in this field are harder. But, in part, it is due to failure to realise the organisational changes involved in substituting for an Army mainly of *foot soldiers* an army mainly dependent upon machines and technicians. The officers and men of the Army are of the same breed and spirit as their fellows in the Navy and the Air Force. But they can work only within the frame of an organization and the frame needs to be changed as the nature of war on land is changed. Mechanization of an Army should begin from the top.

So this masterly report goes on, and near the end we find a sentence which reads:—

> Among the changes suggested in paragraphs 29 to 42 we regard as vital the technical review of establishments, the pooling of mechanical resources and the re-organization of selecting, sorting and trade testing arrangements. Underlying these and a condition of their achievement is the giving to mechanical and electrical engineering, as distinct from civil engineering, its appropriate place and authority in the higher councils of the Army.

The responsibility for investigating the points in favour of and against the formation of a Corps of Mechanical Engineers from an Army aspect was delegated to Lieut.-General R. M. Weeks, C.B.E., D.S.O., M.C., then the Director General of Army Equipment, a man of science with a discerning knowledge and background of engineering experience, distinguished soldier and industrialist—he is now the Deputy Chief of the Imperial General Staff. General Weeks, assisted by a select committee, went into the matter fully, being very open-minded. After pondering the matter deeply and taking into account all reports, including the most important—those from the battlefields—he recommended to the Army Council that this corps should be formed. As a result many regard General Weeks as the legitimate father of the R.E.M.E. Between the last war and this war, the idea of forming such a corps was flirted with on a number of occasions but the deliberations which took place came to nothing. It fell to the lot, however, of Major-General P. O. Edgcumbe, C.B.E., M.C., appointed as the chairman of the R.E.M.E. Committee, to form this new corps. Sir William Beveridge made abundantly clear, as seen from some of the passages in his report, all the difficulties involved and it is only right to say on behalf of the War Office that these in the main were overcome before the publication of the Beveridge Report so far as tradesmen were concerned. It has now been decided to comb the whole Army of officers with electrical and mechanical engineering qualifications, with a view to their transfer to R.E.M.E. to meet, in part, the shortages in the same way in which the tradesmen deficiencies were met.

It can be seen that there were in addition many generals, and the body of public opinion, thinking on parallel lines that something drastic had to be done about dealing with this war of machines and the recommendations of this Beveridge Report were not of course without considerable influence. Sound reasons and economy always appeal to Their Lordships of the Treasury especially when these are made by probably the most eminent of all leading economists Sir William had paved the way for the War Office, who always have quite rightly to use convincing and persuasive arguments to Their Lordships before their approval is granted to any new venture.

On the 22nd May, 1942, the formation of the new corps with the title "The Royal Electrical and Mechanical Engineers" was authorized by Royal Warrant and was born on the 1st October, 1942. The functions of this corps are briefly:—

1. Inspection and maintenance of tanks, wheeled vehicles, all artillery (including field, anti-aircraft and coast defence), small arms and machine guns, radiolocation, fire control and all other instruments, signalling equipment and transmitting sets and the installation of coast artillery machinery.
2. Recovery and repair of all the above equipments consequent upon ordinary wear and tear or battle casualties.
3. Investigations into defects of design and recommendations for improvements.
4. Advise on prototype design from a maintenance angle.

So on 1st October, 1942, a complete chain was established for the direction and co-ordination of the R.E.M.E.—thus charged to serve the whole Army everywhere—starting with the Director of Mechanical Engineering in the war Office, Major-General E. B. Rowcroft, C.B.E., and passing down through deputy directors to the R.E.M.E. officer who acts as a technical adviser to the Commander—be he Army, Corps, Division, Brigade or Unit. Each formation, therefore,—Army, Corps, Division, Brigade and certain individual Units—now has its own mobile workshops and R.E.M.E. engineering staff. Backing these are the great static base workshops in this country and in all theatres of war where any type of repair to any equipment can be effected and where any necessary manufacture of parts or production of equipment can be undertaken. Base workshops in Egypt vary in size and one has as many as 9,000 men—the largest.

Experience of the past three years has shown that engineers, especially those attached to units, individually or with Light Aid Detachments, which consist of one officer or Armament Artificer Warrant Officer assisted by 15 to 20 tradesmen, must always be fighting soldiers and much valuable work has been done by these small workshop detachments in France, the Middle East and elsewhere. Light Aid Detachments frequently have to do repair work on tanks, vehicles, guns and other equipment under fire and the recovery and evacuation of badly damaged tanks and other equipment, which is a R.E.M.E. responsibility, can be quite an exciting affair. The new corps is therefore combatant and selected officers are sent to the Staff College. The officer personnel of this corps have, therefore, to be tough and trained as engineer specialists in the various types of equipment which have to be handled as well as to be Staff Officers and advise formation commanders how these equipments are to be dealt with under battle conditions.

### Field Organization of R.E.M.E.

Much as I should like to be able to give you a picture of the R.E.M.E. field organization I am not permitted, for security reasons, to expound on this in detail, but will try to portray in broad outlines just what the new corps does in the field and leave you to fill in the gaps from your own imaginations.

The R.E.M.E. maintenance organization starts with small units, detachments and even single craftsmen right in the front line, in fact the recovery sections are among the first to land on the beaches, frequently work in front of the front line and recover vehicle casualties, not only our own but those of our opponents, from the teeth of the enemy. In earlier campaigns the boot has tended to be on the other leg. These are the officers and craftsmen who have most of the thrills and they must be able to improvise, to work in impossible conditions—and to fight—according to the needs of the moment.

Behind these there are the second echelon mobile workshops whose main function is repair by exchange of assemblies and components—new parts for old—and believe me their function is an engineer's nightmare. It consists of work, pack up, move, unpack, work, pack up and move again. To organize work under such conditions needs considerable acumen especially when the advance is 1,400 miles in 80 days from El Alamein to Tripoli.

Then we have the third echelon workshops which are semi-static and which work by reconditioning and exchange of assemblies. Theirs is a more systematic role and except when an extremely swift advance is in progress they may remain on the same site for weeks at a time and have their work brought to them. To use General Rowcroft's own words, however—there is need for a very flexible organization between 1st, 2nd and 3rd echelon workshops—as in fluid warfare the dividing line must be viewed with a very liberal eye.

Here I might mention that the R.E.M.E. Staff Officers who advise the formation commanders have to be "town planners" as well as engineers. They must reconnoitre the countryside and select exactly the right spots to locate the various workshops, taking into consideration the nature of the ground, wide dispersion, the operational plan, accessibility to roads and/or railways, camouflage and possibly even the disposition of wrecked vehicles to avoid long haulage.

Finally, we have the large base workshops fourth echelon, where almost anything can be repaired or manufactured and these shops are in fact complete engineering works and sometimes employ as many men as some of our large industrial engineering works at home. Last but not least there are the small port workshop detachments whose work is similar to that of the front line craftsmen except that they look after vehicles and guns on disembarkation and attend to minor faults and repair damage caused by landing or in transit—especially after long sea voyages—corrosion, fatigue of springs, etc.—or the troubles of intense cold—Arctic route to Russia.

You may be able to visualize the extent of the R.E.M.E. organization apart from the large numbers vital to the Air Defence of Great Britain, if I tell you that in the first and second echelon repair *only* there are about 25 R.E.M.E. officers and between 700 and 1,000 R.E.M.E. tradesmen in each and every division, including airborne and marines. Multiply these figures by the number of divisions and add the skilled craftsmen required to man the larger rearward and base workshops and you will have some idea of the huge skilled-man-power bill for a force such as recently landed in North Africa and why R.E.M.E. needs so many engineer officers and skilled craftsmen.

Then to paragraph 60 of the Beveridge Report:—

> "But war is a judgment of results, not of zeal or ability or intentions. If what has been tried hitherto has not succeeded, there is need and time, and this is the time, for stronger measures. Now is the time to build our coming Mechanical Army."

In conclusion I hope I have made clear how important it is for R.E.M.E. to have the very best type of young engineer in its ranks, whether as officers or skilled supervising N.C.O's. The success of *any* venture depends on the quality of the men who undertake it. In modern battles it is the margins that count and the victorious commander will usually be the one who can bring the greatest weight of armour and metal to bear, not only on the first day of battle, but more especially on the fourth, fifth or sixth day when even a small margin of tanks over his opponent may prove decisive, and there R.E.M.E. plays one of its most valuable parts, by restoring to battleworthy condition in the shortest possible time the greatest number of vehicle casualties.

Unfortunately, engineers are in short supply. A committee has been working under Lord Hankey to balance the demands of the services and industry and that committee's work has been invaluable and has had the whole-hearted co-operation of the professional engineering institutions.

We must aim to draw closer the relationship between industry and the engineering arms, such as R.E.M.E., in the Services. Much can be learnt by both from each other but only fully so when our mutual problems are well understood. We, on our side, look forward to the time when the designer and production engineer in industry will have a direct link with the engineer in the theatre of operations so that many of the problems which arise there can be quickly rectified, as this war is going to last a long time yet.

## ALTERNATIVE FUELS FOR MOTOR VEHICLES

**Discussion** (*Continued from page 454*)

suggested that, if success was to be attained, supervision of the types of producers used, etc., should be under the control of a responsible organization and it was thought, in the case of farm tractors, makers of tractors could cooperate.

A possible shortage of wood and charcoal was foreseen should a considerable number of vehicles be converted to use producer gas. This has happened in some European countries but these countries are now using other solid fuels. It was suggested that a reactive char can be produced from low rank coals and that this might be the most logical fuel for producer plants in western Canada. The possible use of charcoal from straw was considered but this is not promising because of the bulky nature of the straw and the small yield of charcoal.

The use of compressed natural gas for fueling, trucks, buses, etc., was discussed. One firm had already investigated the possibility of this development but found that the cost of compression equipment was high in this country, and that there would be a saving of only a few cents per equivalent gallon of gasoline. The risk that the government might levy a tax on such fuel discouraged its introduction. However, if the price of gasoline were increased, development of natural gas as a fuel for motor vehicles appears probable.

The use of steamer cars such as White, Stanley, and Brooks, which were fueled by kerosene or other liquid fuels, was introduced. The general opinion expressed by those who had either driven or ridden in these cars was very favourable. Evidence of low cost and efficient operation was suggested. Boiler troubles had been experienced with steamer cars, but the art of boiler making and the development of new steels in the last two decades would, it was felt, overcome this difficulty. The use of steamer cars during periods of low temperature was also considered. A solid fuel might be considered for future use. One question asked was why the steamer car is not now an important means of transportation.

Several speakers said that butane and propane were being used in California for internal combustion engines and that there was less oil dilution than occurred with gasoline. This also applies to other gaseous fuels. The cost of converting a car to use liquefied gas was small, and when engines with higher compression than now used are designed, the power output with this fuel would be greater than that obtained with gasoline.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## THEY CAN OPEN EUROPE'S GATEWAYS

Royal Engineers' Triumph

*By* Howard Clegg

When the layman thinks about invasion he thinks about communications. Nearly four years of global war have made him as familiar with this department of strategy as with elementary attack and defence. And among the strongest links in the chain of communications are the ports.

Accounts of British raids on French ports have given some idea of their structure—the moles and basins and artificial canals, extending, with their piers and wharves and floating docks, for miles behind their narrow entrances.

Every yard of those intricate port facilities will be needed to maintain communications as soon as the Allied forces begin to land to attack the Fortress of Europe. Germany and Italy know that. They also know that the intricacy and the extent of artificial construction make it easy for them to render the ports useless when they are forced to withdraw.

At this moment they are planting their demolition explosives. The Allied armies will find havoc and obstruction in place of unloading facilities. But all that has been foreseen. Even while Britain's troops were withdrawing from France and preparing for the Battle of Britain the Royal Engineers were planning ahead for the day of re-entry. They foresaw the need for special units trained and equipped to replace havoc by order as speedily as possible.

### New Companies Formed

The fall of France and Battle of Britain created both the need for immediate organization and the opportunity for practical experience. Britain had become the Allies' sole base in Europe for the assembling of supplies. Lend-lease was in prospect. Dock facilities were inadequate to handle the immense shipments which would arrive; and the facilities which did exist were being bombed. The decision was made to build new ports especially to handle military shipments. The work was to be done by military labour.

To begin the work promptly a company of skilled tradesmen, experienced in port construction, was borrowed from the Department of Fortifications and Works. Meantime Britain's Royal Engineers got busy organizing their own companies for the work. They formed units to construct port railways, to build heavy earthworks, to quarry stone. They enlisted every class of skilled artisan, trained them all in quick methods and short-cuts, gave them the newest and most efficient mechanical equipment, and put them to work constructing new docks and jetties for big ocean-going ships.

The success of this enterprise goes a considerable way toward explaining how Britain was fed and supplied despite the damage done to her harbours by the Luftwaffe. But interest centres now in the readiness of these men to cope with the immense and vital problem of re-habilitating, in the course of invasion, demolished Axis ports.

### With the Spearhead

They are organized for that job. The organization is simple and flexible. It has at its head the Director of Transportation whose Deputy D.D.Tn. (Docks) is also responsible for the operation and maintenance of the ports. The Construction and Repair division of his command is set up in Groups, each Group consisting of two Port Construction and Repair companies or one P.C. and R. company and one Port Repair Ship under the command of a Lieut. Colonel who is something between a consulting engineer and a contractor's agent in his operational functions. Each company is a self-contained operating unit with comprehensive equipment and specialist personnel covering the whole range of construction trades.

When invasion starts these companies will go ashore close up to the spearhead. As soon as a port is in Allied hands they will be thrown into action to build temporary wharves and jetties for the landing of the most urgently-needed supplies. Then they will re-build the demolished docks so that the full flow of traffic can pour through. (Brother units, Port Maintenance companies, will see to the re-equipping of the wharves with cranes, derricks and landing gear.)

Their job will be as exciting as it will be interesting. The Germans will leave booby traps and delayed action mines. The Luftwaffe will be there if possible to delay the work with high explosives and incendiaries.

### High-Speed Work

Speed of construction is recognized as one of the most effective counter-measures against interference, as well as being vital to the progress of the offensive. Consequently the Port Construction and Repair Companies have mobilized resource and inventiveness to cut down to a minimum the work that must be done on the scene. New materials, new devices and new methods have resulted in what appear to be miracles of performance. Old habits, customs and prejudices have been thrown overboard. Here is just one proof:

When Lend-lease shipments began to arrive and saturate Britain's home port facilities, the Royal Engineers found it necessary to construct two 300-ft. jetties in 30 days. Normally the work would have taken 90 days; for obtaining and driving piles is not a fast job. The Port Construction and Repair companies improvised a method of building jetties with railway trestles. The job was finished in a month. Now they have developed a special trestle for the work.

When Allied troops pause on the soil of Europe to bless the Quarter-Master General for the presence of plenty of everything, a big part of their tribute will be due to the men of Britain's Army Port Construction and Repair companies who fixed the vital link in communications.

## THE U.S. THUNDERBOLT

From *Trade and Engineering* (London, Eng.), June 1943

It may now be disclosed that one of America's latest fighters, the P47, known in this country as the Thunderbolt, is in action with the United States Eighth Army Air Force in Britain, and has already destroyed several of the enemy's best fighters, F.W. 190s. This is the first war theatre where it has been reported in action. The Thunderbolt is a single-engined, single-seat, low-wing monoplane with conventional retractable landing gear. It is a large and heavy machine, having a wing span of 41 ft., a length of 32 ft., and a height of 13 ft., and its weight of 13,500 lb. is almost double that of the British Spitfire fighter. The power plant is a Pratt and Whitney 2,800 radial engine developing 2,000 hp., to which is fitted a turbo-supercharger. The motor drives a Curtiss four-bladed automatic-control, full-feathering airscrew. Cruising range is put at 1,000 miles, but the P47 is capable of being fitted with long-range tanks, which will enable it to escort the Fortress heavy bombers for great distances.

There are two notable features of the Thunderbolt. One is the "blower" working off the exhaust instead of the mechanical super-charger driven directly by the engine, which is employed in British and other fighters; the other is its extremely heavy armament. This consists of eight 0.5 machine-guns, which have a combined rate of fire of 6,400 rounds a minute, or more than 100 rounds a second. These guns fire a weight of lead which is the equivalent of twenty 0.30 machine-guns. The Thunderbolt was designed and built by the Republic Aviation Corporation of America, and is now in full-scale production. It is intended for high altitude work, and the service ceiling has been put at 40,000 ft.

The results obtained with the Thunderbolt will be watched with interest in this country, where many people have doubted the suitability of the turbo-supercharger for fighter aircraft. Pilots who have flown it in action are well satisfied, however, saying that it is not only fast and manoeuvrable, but has a high rate of climb and stands up well to diving at very great speeds.

## A SOLUTION TO THE MISSISSIPPI RIVER PROBLEM

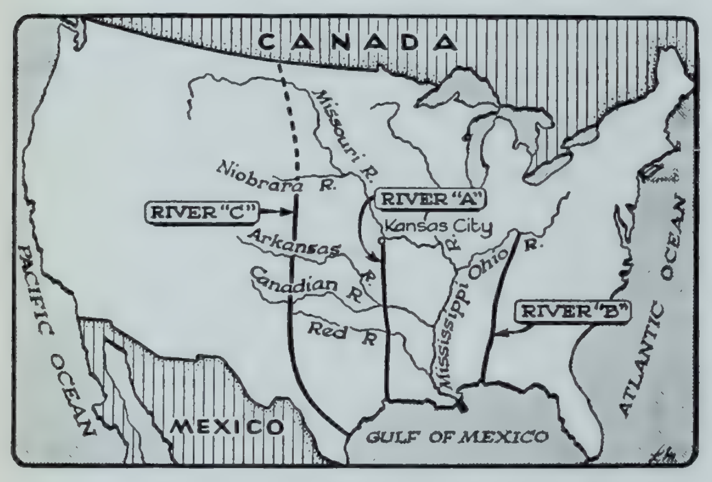
**Abstract from an address to the Board of Directors of The Broadway Association**

By Dr. T. Kennard Thomson, *Consulting Engineer, New York*

The Mississippi and its branches are again in flood, and this one promises to be worse than the disastrous flood of 1844. The floods of 1912 and 1916 and many others were bad—but that of 1927 was the worst since 1844.

In 1927 the flow was estimated to be 3½ million cu. ft. per sec. (while the average flow of the Niagara river is only about 220,000 cu. ft. per sec.), more than one million of our citizens suffered direct loss and millions of acres of cultivated lands were flooded that year.

More than one billion dollars were lost, 700,000 people lost their homes and more than 200 their lives. The number of people whose health was shattered and lives shortened was enormous.




The drainage area of the Mississippi and its branches is 1,240,000 sq. mi., or 41 per cent of U.S.A. and *one river can never be made safe* to drain that area.

The levees near New Orleans try to hold the water 50 or more feet above the surrounding country, and a break causes the country to be flooded into Texas, 250 miles from the Mississippi. The actual expense of repairing the levees, etc., is enormous.

A safe and profitable job can be done by constructing three new rivers, A, B and C (see map) and then reconstructing the present Mississippi, and connecting these rivers by the Arkansas, Canadian, and Red rivers—to regulate the flow when one is dry and the others in flood.

Work on A, B and C should start at the Gulf of Mexico, as shown on the map, and as each 50 miles is completed it could be used for navigation, etc. River A would extend up to Kansas City, about 700 miles; B to the Ohio river, also 700 miles, and C to the Niobrara river, about 1,000 miles (it would, later on, be extended to the Canadian boundary). These four rivers should have non-corrodable lining for sides and bottom, with a depth of from 25 to 40 ft. and as wide as necessary for safety.

There would be a drop of from 500 to 3,000 ft. from the northern end of these rivers to the Gulf of Mexico, which represents enormous potential water power.

Storage basins should be provided to save the present annual loss of one billion cubic yards of top soil, now being washed into the gulf.

Water power development, irrigation, reclamation, reforestry, etc., would add enormously to the value of this project. So, instead of the huge annual loss due to floods, and dry seasons, the cost would be returned in profits many times, and the entire continent, including New York (the chief taxpayer) would be greatly benefited.

The author has been advocating this plan for over 25 years and feels that now is the time to carry it out, to create real and continued prosperity.

## THE SEALING OF POROUS CASTINGS

From *Engineering* (London, Eng.), June 18, 1943

The occurrence of porosity in castings of various metals is well known in the foundry and although its incidence is by no means inevitable, it is generally unpredictable and involved more often than not the rejection of the affected casting. Unfortunately, the defect may escape detection until it is revealed by machining, when the spongy structure is evident, or by that slow percolation known as "weeping" when the casting may be actually in service. Although porosity in a casting is at all times wasteful, it is doubly so in the present circumstances and it is of interest, therefore, to record that a method has been developed by which porous castings can be made sufficiently sound for use, this method consisting of the impregnation of the pores with a plastic material subsequently changed by baking into a hard impermeable substance.

The method has been developed by Messrs. Commercial Structures, Limited, Staffa-road, Leyton, London, E.10, in collaboration with Messrs. Bakelite, Limited, 18, Grosvenor-gardens, London, S.W.1. The operation is a simple one. As practised at the works of Messrs. Commercial Structures it consists of blanking up all openings in the casting, after it has been cleaned of moulding sand, etc., and connecting the interior by means of a flexible pipe to a hand-operated pump. This pump delivers the plastic material in a fluid condition and at a pressure ranging from 50 lb. to 600 lb. per sq. in. into internal spaces. The pressure is varied between these limits in accordance with the strength of the casting and the duty it is designed for, and is recorded on a gauge. Similarly, the type of sealing fluid may vary; where porosity is due to fine channels, the fluid is clear, but where these are coarser a filler is incorporated. The pump is capable of exerting pressures up to 5,000 lb. per sq. in. The casting is stood in a tray to catch the fluid forced through the walls and the process of impregnation is carried out at normal room temperatures.

When the fluid has reached the external surface of the casting, the latter is drained and removed to an electrically-controlled furnace, in which it is subjected to a temperature of 85 deg. C. in order to remove the solvents which form the vehicle of the resinoid material. The temperature is then raised to 110 deg. C. and maintained at that level for about an hour; a further rise to 135 deg. C. with another hour's treatment then follows. The Bakelite material which has filled all the pores in the metal is thus cured and thereby transformed into a solid impermeable mass which, it is stated, is insoluble in water, petrol, oil, alcohol and other solvents, and is capable of resisting high-temperature steam. If the casting is very spongy, a second impregnation and curing may be necessary, but, normally, one is sufficient. After curing, a high test pressure may be applied. The treatment is applicable, in an equally satisfactory manner, to both ferrous and non-ferrous metals, the latter including the light metal alloys.

## POST-WAR AVIATION

From *The Engineer* (LONDON, ENG.), June 25, 1943

Post-war aviation was the subject of the 1943 Wilbur Wright Lecture, given by Mr. Edward Warner, at the Royal Aeronautical Society some days ago. In that long series of lectures, few have ranked in interest with it; 1943 will be looked on as a vintage year. As vice-chairman of the Civil Aeronautics Board of the United States, Mr. Warner speaks with authority and has, moreover, access to the detailed records of some of the largest civil aviation organizations in the world. From the point of view of the travelling public, perhaps the most striking of the curves he showed was that illustrating the great drop in the number of fatal accidents to passengers during the last fifteen years. In 1929 it was thirty per 100 million passenger miles flown, and in the twelve months just ended it had sunk to two. This striking improvement is due in large part to the growing use of multi-engined aircraft. If, for instance, the failure of the engine in a single-engined aircraft were likely to cause a forced landing every 10,000 miles, then with two engines instead of one, and the craft able to fly on one, there is not likely to be a forced landing in less than 100 million miles; such is the rarity of the "double event." The one exception would arise in the rare cases when both engines were affected simultaneously by a single cause, such as running entirely out of fuel or the bursting of one airscrew chancing to damage the other, events which of course very seldom happen. The reduction in the fatality rate of no less than 97 per cent must cause the public attitude to air travel to be much more favourable than it used to be, and the extent of future use will depend chiefly on the cost charged and the comfort and convenience of the service. Reasonable safety will be assumed.

No air route can be more important than that across the Atlantic; the present service being a war growth, costs hardly enter, but Mr. Warner gave a detailed analysis of costs of running the famous "DC3" aircraft on major air lines within the United States during the spring of last year. This craft is approved under American regulations for a maximum take-off load of 25,000 lb. and carries accommodation for twenty-one passengers, which number, together with 500 lb. to 1,000 lb. of mail, can be carried over a distance of 500 miles at a cruising speed of some 180 m.p.h. This is equivalent to a pay load of about 3 tons. If it had to fly 3,000 miles instead of 500, it would need nearly 3 tons of additional fuel, and its pay load would almost vanish. Hence, without some overload capacity it could not, on these figures, undertake a transatlantic service, though with a 10 per cent overload it would be able to carry ten or a dozen passengers. As a result of the analysis above mentioned, Mr. Warner gave the inclusive cost per mile run as 68 cts. If one assumes that the cost per mile on this longer stage would be much the same, the cost of flying 3,000 miles would be about £500; so that if there were ten or twelve passengers they would need to pay about £50 a head. The larger aeroplanes taking 100 passengers, which are more likely to be used, would have less proportionate aircraft staffing costs (some 12 per cent of the total) and a lower transatlantic rate than £50 might be possible. But even that rate would be a competitive one with surface transport, especially as the whole of the flying could be done in a single night journey. If mails were carried the finance should be easier, since when air mail rates are charged to the public they are much above passenger rates. It is not suggested that such figures would apply to a stratosphere flight at almost double the speed in a pressure-cabin aircraft, but there is little doubt that those whose time is so valuable as to call for such journeys would be willing to pay much higher rates. The normal services would no doubt be run at the most economical speed, which under present conditions would lie between 220 and 250 m.p.h., depending on size. Although Mr. Warner does not himself hazard any prediction of North Atlantic fares by air, he does forecast a probable post-war average of as many as 600 passengers a day in each direction. Rates for ordinary cargo, however, cannot be expected to compete with land transport figures and still less with carriage by sea, but if a rate of 10d. per ton-mile proves to be attainable, some special goods will no doubt be sent by this rapid route.

Apart from the long stages essential for crossing the Atlantic, and for some stages in the Pacific, there will in general be little need to plan for distances of over 500 to 1,000 miles. Longer stages mean higher fuel costs per passenger mile, as there are fewer passengers; it is useful to remember that 10 per cent of the total load represented by the weight of fuel is needed to take the aircraft 1,000 miles and 30 per cent for a 3,000-mile journey. Actually, the distances go up slightly faster than the fuel weight, since the load of the aircraft is less in the later stages of a long journey.

---

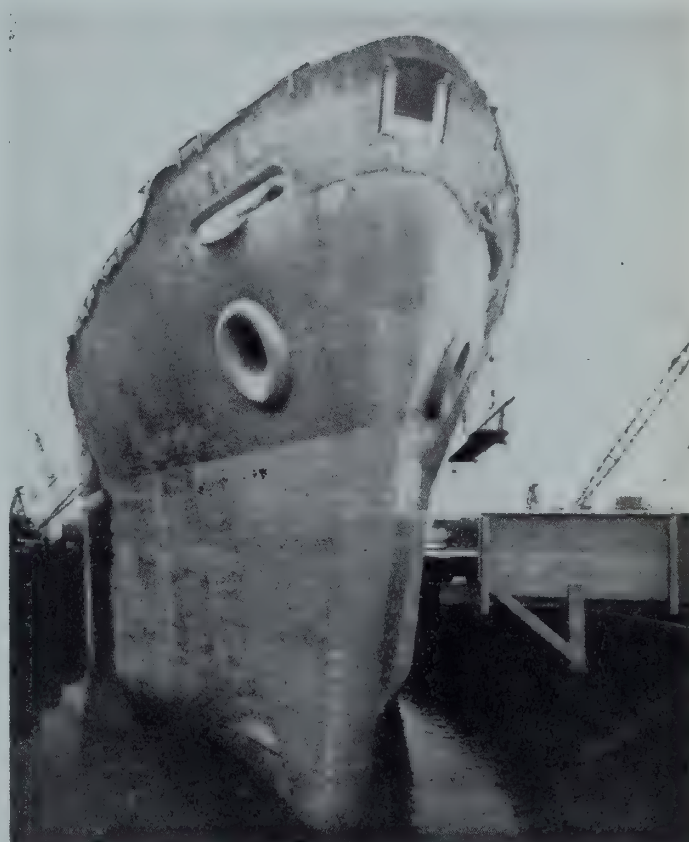


*Photo Engineering News-Record*

**CONCRETE BARGE "BELAIR No. 1" LAUNCHED AT SAN FRANCISCO**

**The first reinforced concrete ship-shaped barge to be launched at the Belair shipyard of Barrett & Hilp on San Francisco Bay, under contract for the United States Maritime Commission, was christened and floated in its graving dock at high tide on June 16. This is the first of 26 of these 366-ft. barges that are to be launched at this yard. The bottom of the vessels is 7-in. thick and the side walls are 6-in. thick.**

---

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

### NEW ARMY REGULATIONS FOR SELECTION, TRAINING AND RANK OF TECHNICAL PERSONNEL

The much discussed topic of the rank given engineers upon entering the army has been settled by an order issued by National Defence Headquarters under the title "Canadian Army Routine Order No. 3319." This order covers conditions applying to the selection, training and rank of all candidates. The sections quoted herein apply particularly to technical personnel.

It is interesting to note that in all cases except where the applicant already has qualified for a commission in the reserve army, all candidates enlist as privates. Candidates with suitable technical qualifications and experience enter as privates but, when posted to a district, will be granted status and pay of cadets as from the date of enlistment.

Another feature worthy of note is that technically qualified candidates now have the option to return to civil life if they are not accepted by the selection board. This is a great improvement and will eliminate those disturbing cases where technical personnel, badly needed in industry, had to serve in the ranks, without any prospect of using their special training.

This order places the Army in a disadvantageous position in relation to the Navy and Air Force, because these latter two services still offer engineers commissions upon entry.

An effort to overcome this situation has been made by N.D.H.Q. in the issuence of a circular letter from which the following is quoted:

"Notwithstanding the provisions of R.O. 3319, officer candidates possessing special technical qualifications such as, in the opinion of the Master General of Ordnance, fits them for employment as Ordnance Mechanical Engineers, may be appointed to the Canadian Army Active as Provisional 2nd Lieutenants.

"No appointment as above will be made without the prior approval of N.D.H.Q.

"Officers so appointed will be required to proceed to an Officers Selection and Appraisal Centre for appraisal by an Officers' Selection and Appraisal Board. On approval they will be despatched to an Officers' Training Centre, or to Corps or Basic Training Centre for such further training as may be necessary."

This seems to be a round-about way of overcoming the situation as far as Ordnance is concerned, but how about Signals and Engineers ? Their shortage of technical officer material does not seems so critical as it is in Ordnance, but can they compete for this scarce commodity under these restrictions ? It seems logical that the engineer will go to the service where he is offered a commission immediately, rather than enter as a private and do a preliminary training that will run not less than five months and probably much longer.

There is no denying the advantages of having technical officers well grounded in basic training, including the handling of men, but under these regulations certain of the services have all the advantages when it comes to attracting candidates. It is too bad there is not some other system that would be more equitable to all concerned.

Following are the clauses relating to technical personnel from Army Routine Order No. 3319, dated June 17th:

1. (a) Soldiers of the Active Army on General Service—

(i) Candidates from Training Centres will be required to serve a minimum of five months of which at least two months must be in the capacity of N.C.O. Instructor, before being recommended to Officers' Selection and Appraisal Board, the normal sequence of training being as follows:

Basic Training.

Corps Training.

School of Instruction at Corps Training Centres.

Period of duty of not less than two and not more than four months as an A/I at a Training Centre.

If selected by the O.S. & A. Board to proceed directly to O.T.C. they will be granted the status of Cadet upon arrival at O.T.C. If selected to proceed to O.T.C. after further training, they will not be granted Cadet status until arrival at O.T.C. after successful completion of the further training specified by the Board. If rejected by O.S. & A. Board they will be returned to the H.W.E. or Unit concerned (from whence they came).

(b) Soldiers of the Reserve Army—

Other ranks of the Reserve Army will be required to enlist into the Active Army as Private Soldiers and will be eligible for recommendation as Officer candidates after having complied with the provisions of 1 (a) (i) above. Due regard will be given to previous training and experience.

(c) C.O.T.C. Cadets—

(i) Other rank candidates from Contingents of the C.O.T.C. will be required to enlist in the Active Army to carry out any necessary further training at Corps Training Centres before being recommended to O.S. & A. Board, the sequence of training being as follows:

Corps Training.

School of Instruction at Corps Training Centre.

Period of duty of not less than two months or more than four months as an A/I at a Training Centre.

Due regard will be given to previous training and experience.

(ii) After July 16, 1943, candidates will proceed to the Corps Training Centre in the rank of Private and will be granted Cadet status only on arrival at the O.T.C. if and when selected by the O.S. & A. Board. If rejected by the O.S. & A. Board, they will be returned to the Corps Training Centre concerned.

(iii) The following exception should be noted. Candidates who shall have graduated from universities during the period from 1st January, 1940, to 16th July, 1943, inclusive, with the degrees described in C.A.T.P. No. 8 paragraph 5(a) and (c) and who, therefore, are exempt from service in the ranks, will be accepted into the Active Army in the rank of P/2/Lieut. up to 16th July, 1943, from which date sub-paragraphs 5(a) and (c) of C.A.T.P. No. 8 are cancelled. Such Provisional Officers, on appointment will proceed to Corps Training Centres to await quotas to O.T.C.'s.

(d) Officers of the Reserve Army (including C.O.T.C.)—

Candidates who are qualified officers in the Reserve Army, including C.O.T.C., who by age and category are eligible as Reinforcement Officers, will, regardless of the date of such qualification, be required to attend a Special Officers' Course at an appropriate Corps Training Centre. They will proceed to this course in the rank of P/2/Lieut. (Active) and on attaining a standard of training satisfactory to the Commandant will be despatched to the Officers' Selection and Appraisal Centre. If selected by the O.S. & A. Board they will be included in quotas to O.T.C. as P/2/Lieuts. If rejected, they will automatically return to their former Reserve status.

(e) Candidates from Civil Life—

Candidates possessing particular technical qualifications or civil experience which may be required by any Corps will be referred by the Corps concerned to a N.D.H.Q. Committee who will pass on their technical qualification. If acceptable, they will be enlisted as Private Soldiers in the Active Army, posted to a District Depot where they will be granted the status and pay of Cadet, effective the date of enlistment, and sent to O.S. & A. Centres. If selected they will proceed to complete the required training as outlined in sub-paragraph 1 (a) (i) above in the status of Cadet. If rejected, they will be given the option of returning to civil life by discharge through the Depot of enlistment or continuing in the Active Army as Private Soldiers. Personnel attending Basic or Corps Training Centres as Cadets will follow the normal course but will have the privileges of Sergeants.

3. Notwithstanding anything contained in paragraph 1 hereof, the Commandant of a Training Centre or Commanding Officer of a Unit is hereby authorized to accelerate the progress of any candidate through the normal sequence of training if he considers such acceleration warranted by reason of the candidate's previous military training or unusual aptitude, provided that all candidates from Training Centres or Units must serve at least two months as A/I's or N.C.O.'s respectively.

5. The following candidates also are exempt from the procedure outlined in paragraph 1 and will qualify in accordance with the Routine Orders as shown:

Provisional Officers for H.W.E. Employment, appointed in accordance with C.A.R.O. 3321.

Reserve Officers selected for Active Army appointment under C.A.R.O. 2820.

7. Only in the most exceptional circumstances will deviation from the terms of this order be considered by N.D.H.Q."

## INTERNATIONAL RELATIONS

Dr. C. J. Mackenzie, acting president of the National Research Council, has recently returned from abroad. During his stay in London the officers of the senior technical societies took advantage of the opportunity to meet with him. There was a discussion of the relationship between these societies and the Engineering Institute of Canada both from the point of view of war conditions and for peace time. It is expected that the splendid relationships which have always existed between the old country institutions and the Engineering Institute of Canada will be developed further as opportunities are presented.

Those who attended this meeting in honour of past president Mackenzie were as follows:

| | |
|---|---|
| Sir John Thornycroft | —President. Institution of Civil Engineers. |
| Sir William Stanier | —Past President. Institution of Mechanical Engineers. |
| Prof. C. L. Fortescue | —President. Institution of Electrical Engineers. |
| Dr. C. C. Paterson | —Past President. Institution of Electrical Engineers. |
| Dr. David Anderson | —Senior Vice-President. Institution of Civil Engineers. |
| Dr. H. J. Gough | —Vice-President. Institution of Mechanical Engineers. |
| Dr. K. Brasher | —Secretary. Institution of Electrical Engineers. |
| Dr. H. L. Guy | —Secretary. Institution of Mechanical Engineers. |

## THE ENGINEER, THE ARMY, AND HANSARD

From the record, it is apparent that it is no part of Institute policy to participate in matters of a political nature, but it is a part of Institute policy to do everything possible to aid engineers when it is thought that injustices are being done. It is also a part of Institute policy to do everything possible within the field in which it is competent to act, that may aid in the successful prosecution of the war. Both these points of policy would seem to be served by reviewing some questions and answers that were exchanged on the floor of the House of Commons not long ago.

For a long time there has been comment and criticism of the many failures to give to engineers and technical persons appointments to positions—both civilian and military—which require technical knowledge; also of the failure to give promotions and authority to engineers in certain active services where the engineer's work is the most important part of the services' activity. Some months ago the Institute set up a committee to examine these things, and to recommend actions which might be taken. This article is not to deal with that committee, but rather with pertinent questions raised in the House—and particularly with the answers.

*Hansard* reports that on July 21st and 22nd Mr. A. R. Adamson (West York), asked several questions related to the use of technical personnel by the Government. The answers were given by Mr. W. C. Macdonald (Halifax).

Much of the information required for the answers is common knowledge in military and engineering circles, and the balance is easily attained. In view of the incompleteness of the answers and the consequent misconception in the minds of those not informed, the *Journal* is presenting herewith additional statements which it is considered are necessary to a full answer. This is being done in justice to the hundreds of engineers in the services, and for the information of those in civilian employment.

The added information has been obtained from reliable sources such as official releases, conversations and correspondence with members overseas and in Canada, with engineers in the Imperial Army, and from books of reference.

### Army Technical Development Board

*Questions:* Mr. Adamson:

1. Who are the director-general and deputy director-general of the Army Technical Development Board ?
2. What are the technical qualifications of each ?

*Answers:* Mr. Macdonald:

1. Director-General, Mr. J. E. Hahn; Deputy Director-General, Mr. J. H. Crang.
2. Of Mr. J. E. Hahn are: Educated University of Toronto and Osgoode Hall; served in France as Brigade major, 11th Canadian Infantry brigade in great war; successful manufacturer of electrical instruments, foundry products, machine guns and rifles.

   Of Mr. J. H. Crang are: two years at Technical School, Toronto; two years at Upper Canada College, Toronto; artillery officer in Canadian militia for many years; assistant director of artillery, Ottawa, June to November, 1942; intimate knowledge of firearms acquired over the last thirty years; for considerable time closely associated with manufacturing concerns producing steel products.

Of the Deputy Director, the Canadian Who's Who makes no mention of any business connection other than brokerage and provides no evidence of training in technical matters or in firearms, other than to list "shooting" among his recreations. It is a well-known fact that up to the time of his appointment to the technical board, he had no business experience of any kind except as a stockbroker.

The work of the Army Technical Development Board (A.T.D.B.) includes, design of new weapons, improvement of existing weapons and equipment, and a study of armament used by the Allies and the enemies for possible adoption in the Canadian Army.

### Ordnance Officers

*Questions:* Mr. Adamson:

1. How many of the district ordnance officers are qualified engineers?
2. How many ordnance officers on the stores side of the R.C.O.C. have obtained the rank of (a) Colonel; (b) Brigadier?
3. How many ordnance officers on the engineering and mechanical side have obtained the rank of (a) Colonel; (b) Brigadier?
4. How many officers of the R.C.O.C., (a) engineering side; (b) stores side, have been given the Canadian war staff course?

*Answers:* Mr. Macdonald:

1. Nil.
2. In Canada and overseas on the stores side (including administration, provisioning, salvage storekeeping and accounting: (a) 17; (b) 5.
3. In Canada and overseas on the engineering and mechanical side, (including mechanical maintenance and mechanization): (a) 9; (b) 1.
4. From Canada and overseas, on the engineering and mechanical side (including mechanical maintenance and mechanization): (a) 2.
   On the stores side (including administration, provisioning, salvage, storekeeping and accounting: (b) 8.

Regulations provide that the Senior Ordnance Officer in a district can be on the stores (O) side or the engineering (E) side. It is interesting to see that there is not even one D.O.O. in a District who is an engineer. The *Journal* understands that there has never been one. This seems strange in a service whose most important work is of an engineering nature.

In a highly mechanized war it seems strange, too, that the staff course is given to four times as many stores men as to engineers. How are the engineers going to qualify for administrative positions in their own services if they are not given the necessary courses? And how can such services be carried out with the maximum of efficiency if the senior officers have no technical knowledge or experience?

### R.E.M.E. vs. Ordnance

*Questions:* Mr. Adamson:

1. Have steps been taken by the Canadian army overseas to establish a separate corps, similar to the Royal Electrical and Mechanical Engineers (R.E.M.E.) responsible for all mechanical and electrical maintenance in the field?
2. If so, what steps have been taken in this regard?
3. Upon whose advice?
4. Have similar steps been taken with respect to the Canadian army in Canada?
5. Have the armies of the other British dominions and India formed a separate corps to undertake this engineering and maintenance work?

*Answers:* Mr. Macdonald:

1. A corps of electrical and mechanical engineers has not as yet been formed in the Canadian army. The organization of repair and maintenance services now in effect in the British army consequent upon the formation of the R.E.M.E. has not been adopted by the Canadian army. Consideration of the formation of such a separate unit will await the observations of responsible officers of the Canadian overseas army after experience gained regarding its operation in the British organization. In the meantime, the personnel concerned remain with the Royal Ordnance (Canadian) Corps.
2. Answered by No. 1.
3. Answered by No. 1.
4. See answer to No. 1.
5. Information available here not sufficiently definite.

The Royal Electrical and Mechanical Engineers have been in existence since May, 1942, and have had a great part in the successful North Africa and Sicily campaigns. After these wonderful exhibitions there should be plenty "observations of responsible officers" readily available. The R.E.M.E. is wholly a technical organization, officered by technical men and entirely within the control of technical personnel.

The correct answer to No. 5 is that the R.E.M.E. set-up has been adopted by Australia and India. It would have been interesting if this information could have been given in the House at the time it was requested.

### Ordnance Training Centre

Mr. Adamson also asked questions as to the qualifications of the two senior officers at the Ordnance Training Centre. The answers indicated that the C.O. had had an engineering training. The statement that he had "studied civil engineering at the University of Toronto" is misleading. The information the *Journal* gets is that he attended the university for only one year, and that he has been a stockbroker for his entire business career. In spite of all this, he may be an excellent C.O., but it does seem that some technical knowledge would be useful to the director of such a centre. Are there no engineers available or competent for such positions?

Members of the Institute have been interested in these things for a long time. The engineers in the army who are most affected by these anomalies are not in a good position to voice their complaints. Therefore it is hoped that civilian engineers will continue their interest, and will give support to proposals that are intended to get for the technical man as good a "break" as for the non-technical, and at the same time increase the efficiency of the fighting units.

It is encouraging to see that these long vexed questions are getting into the House. It is too bad that the answers are not more revealing.

## WASHINGTON LETTER

In a recent letter, a friend of mine commented at some length on the Washington Letters which have appeared to date and remarked that the cumulative effect was to "raise the curtain a little on the shape of things to come." This effect has been largely incidental but it is not possible to live in the thick of the Washington situation for a year and a half without catching exciting vistas of a more ample life and hearing the overtones of a more harmonious world order. It is true that one's idealism is tempered by the frustrations which are our most common day-to-day experience, that red tape and selfish motivations are often in evidence and that, in General Somervell's telling phrase, "the future is clouded with the dust of battles yet to fight." But the underlying trend has been encouraging.

Problems which looked insoluble a year and a half ago —technical, administrative and strategic problems—have yielded to satisfactory solutions. Some of these problems have been so great that their solutions have marked new mile posts in the progress of human society. These letters have often commented on the extension of engineering horizons. The engineering accomplishments in respect to synthetic rubber, the great expansion of the steel industry, the aircraft and shipbuilding programmes, the developments in plastics and communications have all been of heroic proportions. But there is another phase equally heroic and equally important to engineers. Some years ago a friend of mine was giving me his views regarding the difficulties in the way of a planned economy or, for that matter, in the way of any social planning short of the automatic controls of supply and demand. His contention was that any planning on a sufficiently comprehensive scale to cover the situation in any one country would break down by virtue of sheer difficulty and complication. He pictured what appeared to him to be the impossibility of planning the production of all the multifarious components of a modern industrial society in an efficient manner and in such a way that they would all come out even. Well, in the last year and a half this problem has been faced and the machinery for its solution has been set up and is in operation. And the scope of the solution has been projected on a world scale, across the international boundaries of twenty-seven nations, and in the face of global shortages of materials, man-power, communication and production facilities. The Controlled Materials Plan is in operation and the original jibe that C.M.P. stood for Confusion Made Permanent is fast being forgotten.

I recently took part in the global allocation amongst the United Nations of the over-all available supply of pen nibs! The various Joint Boards and their sub-committees are now functioning fairly smoothly. It has been an interesting experience to sit on the U.K. section in Washington of Joint Raw Materials Board. It was also a recent privilege to represent Australia at the first meeting in Washington of the Commonwealth Supply Council which is chaired by the Rt. Hon. Col. Llewellin. The work of the Combined Production and Resources Board is of great importance and carries vital implications for the post-war world. The functions of the Office of Lend-Lease are undergoing a subtle change. With its appointment under the Controlled Materials Plan as claimant agency for all lend-lease countries, it moves into the realm of international controls. As always, Canada is in the vanguard of all these developments as I learned in conversation at lunch the other day from Mr. E. P. Taylor, former Canadian Head of the British Supply Mission and now Canadian representative on the Combined Production and Resources Board and also from Mr. Carl Fraser, the administrator of Canada's new Mutual Aid Plan.

* * *

Another remark in my friend's letter caused me to go back and skim through the Washington Letters written over the last year. I was surprised to notice how little they reflected the dire and tragic events through which we were passing during the period they cover. It has always been a major point of complaint against the engineering profession that its members are largely indifferent to the social implications of their handiwork and the taint of suspicion remains that war is not as distasteful to engineers as it should be. It is therefore to be hoped that the dispassionate tone of these letters is not mistaken for indifference to both the horrors of war and the engineer's responsibilities therein. The tone, of course, is partly due to the necessities of an official connection. It also serves as a cloak for immediate emotions and is in keeping with the projection into the future of the possibility of an atonement on the part of the engineering profession.

Nevertheless, looking back, there are many things which perhaps should have found a place in these letters. After the war, it might be salutory if some of the engineering, as well as strategic, failures of this war can be made known. My letters may have sounded complacent and far removed from the dangers and grim realities of the modern world. This is a pity because engineering thinking in the future must take these realities very much into account. In the last year, I have talked to people who went through the fall of Malay and Singapore, have come to know personally some of the refugee families living in Australia whose belongings and relatives just disappeared behind the advancing Japanese lines, not to be heard from again; have seen confidential films of conditions in the islands of the Southwest Pacific; have visited some of these islands and talked to the troops and shared their conditions. I have sat in on discussions and poker games with hard bitten, hard fighting American airmen back for repairs from New Guinea and Guadalcanal. These lads are doing a real job; they are really tough and have few illusions. It will not be possible to fool those who come back. I have seen the hard lines in the faces of my Australian relatives and friends from Darwin, Moresby and North Africa. I know what it is like to look for a temporary landing field, at night, on a small blacked-out island and to make preparations for a forced sea landing. It has been possible for me to know on several occasions how close the margin has been between disaster and success. And while the trend of present events seems to justify past optimism and apparent complacency, the task ahead is still immensely difficult and will require all the realism and hard thinking of which engineers are capable if they are to play their full share in winning the war and the peace. There will be nothing automatic about it,

E. R. Jacobsen, M.E.I.C.

## FAILURE OF MATERIALS

Recently much publicity has been given to cases in the United States where defective steel plates and copper wire were supplied to government contracts, for which the companies were indicted for faking their mill tests and otherwise falsifying their inspection and testing records.

These are serious offences at any time but particularly so in time of war. Under present conditions they are glaring cases of direct sabotage. It is to prevent failures such as these, that standard specifications are established. With such standards available there is only one means by which such failures can occur, namely failure to check the product adequately. Only by such checking and inspection can the purchaser know that he is receiving what he ordered and paid for and all standard specifications permit such inspection by the purchaser.

In Canada, there have been established by government departments tremendous inspection organizations, besides which there are several competent private companies. It is to be hoped that between all these forces, combined with the integrity of the manufacturers, there shall not be discovered in Canada cases similar to the few reported by our neighbour to the south.

## WARTIME BUREAU OF TECHNICAL PERSONNEL

The following notes concerning the recent activities of the Wartime Bureau of Technical Personnel will no doubt be of interest to our members.

During the month of May there were changes in the Bureau's staff. In the Toronto office Mr. S. R. Frost was loaned to the Industrial Mobilization Survey, Department of Labour—National Selective Service, while Mr. D. C. Nickle returned to his previous employer, Gypsum, Lime and Alabastine (Can.) Limited, which firm had donated his services to the Bureau. This left the office short two men and to fill the vacancies Mr. G. G. Mills, previously Permit Officer, was transferred from Ottawa and Mr. R. H. Harcourt was engaged to undertake a period of training at Ottawa before being sent to Toronto to fill the other vacancy. Mr. Harcourt is a graduate of the Royal Military College and has had many years engineering and business experience on construction work. He was assistant engineer on the construction of sections of the Welland Ship Canal and since retiring has devoted his time to civil work, relief administration, home guard, etc., in his home district of Port Colborne, Ontario.

A meeting of the Advisory Board of the Bureau was held on May 18th. One of the principal matters under discussion was the question of guidance to students at matriculation level. The Board passed a resolution requesting the three Institutes sponsoring the Bureau to take joint and immediate action to make available, at centres across Canada, suitable engineers or scientists who would act as counsellors to students, parents and high-school principals. One phase of the work of these counsellors would be that of giving publicity where desirable to the Dominion Government plan of financial aid to well-qualified but needy students who may wish to enter science courses at the universities.

Work continued in the allocation of 1943 science graduates. By the end of April the only service appointments which had been definitely confirmed were those of 128 graduates who were entering the Navy. By the end of May notification had been received of a further 230 who had been accepted for technical appointments, either in the

Army or the Air Force. Permits were granted to civilian employers during May covering the engagement of 416 members of this year's graduating class. Selection of further candidates for the Army and Air Force is proceeding.

Under the joint arrangement made with National Selective Service controlling summer employment of science undergraduates, there is every reason to believe that practically all of these students have been successful in securing suitable employment. Special provision had been made by National Selective Service to enable a certain number of undergraduates to take employment on the various projects connected with the Alaska Highway. This type of work is highly suitable from the point of view of gaining useful experience, and the fact that it was available made it possible for a number of students from western universities to secure such experience at a reasonable distance from their homes.

During the month of June, Mr. R. H. Harcourt, who had been in training in Ottawa, was posted to Toronto to fill one of the vacancies which had occurred there.

Under the scheme by which the Department of Labour offers financial assistance to certain science students in the various provinces, the Bureau is required to assist in the selection of individuals to be helped. In those centres where the Bureau has a regional office, the regional representatives have been delegated to perform this duty. Steps were taken to secure the services (in honorary capacity) of local professional men, with broad knowledge of conditions in the community, to represent the Bureau on selection committees in those university centres where there is no regional office of the Bureau. This was done at Fredericton, New Brunswick; Quebec City; Regina, Saskatchewan; and Edmonton, Alberta.

Some hardship had been occasioned in the case of undergraduates working for the summer, by the fact that their earnings were being subject to the usual deductions for income tax which apply to those who are working steadily all the year round. It is not normally possible, in cases where the total yearly earnings are under $660, to recover these deductions without considerable delay. In an Order of the Minister of National Revenue dated May 21st, employers are now permitted to refrain from making these deductions in the cases of students whose earnings for the summer period will definitely not exceed the $660 exemption figure.

As the supply of suitable prospects for vacancies filed with the Bureau has become more limited, employers, who, of course, are aware of this condition, have generally tended to take much quicker action in dealing with references from the Bureau. They are also more ready to consider an applicant, even though his qualifications may not exactly fill their specification; and they appreciate that, while reference from the Bureau is in no sense a recommendation, the preliminary selection made by the Bureau is of some value.

During the month, 1,627 interviews were granted by the Bureau's staff; 408 questionnaires were added to the files; and 572 permits to employ technical persons were issued.

The number of questionnaires received was the smallest in many months, and was due to the fact that the only forms sent out were in response to requests. Most available sources of technical personnel have been thoroughly canvassed and from now on the majority of the registrations will have to come from follow-ups of those who have already been sent a questionnaire.

## AFFAIRS OF OTHER SOCIETIES

A notice has been received recently from K. F. Maitland, secretary of the Institution of Structural Engineers, London, England, that at the annual meeting of that society, held on the 28th of May, Major A. H. S. Waters, V.C., D.S.O., M.C., M.Inst.C.E. M.I.Struct.E., M.I.Mech.E., was elected president of the Institution for the session of 1943-44.

This is a second term for Major Waters as he held this same office for the session of 1933-34.

## CORRESPONDENCE

### Post-War Reconstruction

The Editor,

The Engineering Journal.

Dear Sir:

Mr. Cochrane's paper in the April issue is particularly interesting in that it represents a courageous attempt to get down to brass tacks, insofar as the dollars and cents are concerned, in planning for construction programmes in the period immediately after the war. Mr. Firestone's article is interesting from a number of points of view and particularly in his linking of the functions of the Advisory Committee on Economic Policy and the Advisory Committee on Reconstruction. For instance, the basing of Canada's programmes strictly upon Canadian conditions and statistics is an important point. Professor Coventry's article on "Soil and Water Conservation" is also very timely. Some of the major projects in the United States, such as the Tennessee Valley Authority and the Boulder Dam development and others, have all tended to make the general public more conscious of the importance of this matter. In the last analyses, soil and water and sunlight are the main necessities of human life and we do well to consider the conservation of these constituents wherever we appear to be in danger of losing them. Akin to soil and water conservation is the forestry problem discussed by Mr. Irwin.

It has been my privilege to follow rather closely the post-war plans which are being made in Canada, the United States, and Australia, and I have had discussions with officials, both government and private, who are preparing these plans. I have also been in the position of acting in a liaison capacity between the three groups and have travelled more or less extensively in all three countries. It has recently been a very interesting experience for me to work in Washington with Dr. Coombs, the Director General of Post-War Reconstruction in Australia. It may be of interest to know that Australia has recently set up a Ministry of Post-War Reconstruction with a Cabinet minister who is charged with responsibilities in this field and with the direction of a special Department of Post-War Reconstruction under the permanent headship of a director general.

One of the good omens for the post-war world is the extent of the machinery which has been set up for the successful prosecution of global war. The Joint Raw Materials Board, Joint Food Board, Joint Shipping Administration, the Combined Production and Resources Board are all moves in this direction. On a small scale various joint boards between Canada and the United States will continue to prove useful after the war. At the recent conference in Washington, Mr. Churchill hinted at the possibility of extending these joint discussions in a more formal way to Russia and China. So far these efforts have been directed mainly at the prosecution of the war but we are now beginning to see the same type of co-operation in the international field. The International Food Commission which recently completed the first conference at Hot Springs is a good example. This conference is the first major post-war international conference. In the United States we have the recently formed Office of Foreign Relief and Rehabilitation Operations and, in the United Kingdom, the British and Inter-Allied Bureau on Post-War Requirements.

It is only natural that our main interest as engineers in post-war reconstruction should be from the point of view of its engineering aspects. There is, however, a danger of over-simplifying the problem and of relying too much upon what might be accomplished by way of physical reconstruction. Even further, it would be a danger to extend the engineer's predilection for complete blueprints to the solution of the over-all problems which will face the world after the war. Our main task will be that of accomplishing the conversion and supplying interim work during that difficult

*(Continued on page 479)*

# JOINT MEETING

## THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
## THE ENGINEERING INSTITUTE OF CANADA

# Toronto, September 30, October 1-2, 1943

## ROYAL YORK HOTEL

## *TENTATIVE PROGRAMME*

### Thursday, Sept. 30

9.00 a.m. Registration.

10.00 a.m. **STEAM POWER**

Speakers: **E. G. Bailey,** *Vice-President, Babcock & Wilcox,* New York.

Canadian speaker to be announced later.

12.30 p.m. **Luncheon**

Speaker: **Brigadier-General Julian Hatcher,** *Chief of Field Service Division, Office of the Chief of Ordnance, Washington, D.C.*

2.30 p.m. **TRANSPORTATION**

Speakers: **Paul W. Kiefer,** *Chief Engineer, Motive Power and Rolling Stock, New York Central System, New York; member of Committee on Research, Association of American Railroads.*

**J. T. Bain,** *Chief Engineer and Superintendent of Maintenance, Trans-Canada Airlines, Winnipeg, Man.*

8.00 p.m. **POST-WAR PLANNING**

Speakers: **Ralph E. Flanders,** *Past-President, ASME; Chairman Committee on Economic Development, Washington; President, Jones & Lamson Machine Co., Springfield, Vt.*

**Principal F. Cyril James** *of McGill University, Montreal, Que., Chairman of the Advisory Committee on Reconstruction for Canada.*

### Friday, Oct. 1

9.30 a.m. **CONSERVATION OF MATERIALS**

Speakers: **Howard Coonley,** *Chairman, Conservation Division, War Production Board, Washington, D.C.*

**C. B. Stenning,** *Canadian Chairman, Joint War Production Committee on Conservation, Ottawa, Ont.*

12.30 p.m. **Luncheon**

Speaker: **H. J. Carmichael,** *Co-ordinator of Production, Department of Munitions and Supply, Ottawa.*

2.30 p.m. **MAN-POWER UTILIZATION**

Speakers: **Lawrence A. Appley,** *Deputy Director, War Man-power Commission, Washington, D.C.*

**A. L. Ainsworth,** *Vice-President and General Manager, The John Inglis Company Ltd., Toronto, Ont.*

7.30 p.m. **Dinner**

Toastmaster: **C. J. Mackenzie,** *Past-President EIC., Acting President, National Research Council, Ottawa.*

Speaker: **Charles E. Wilson,** *Executive Vice-Chairman, War Production Board, Washington, D.C.*

### Saturday, Oct. 2

9.30 a.m. **PRODUCTION ENGINEERING**

Summaries of outstanding contributions of production engineering, particularly in ordnance and aircraft manufacture.

Speakers: **L. E. Carr,** *Technical Director, British Ministry of Supply, Washington, D.C.*

American speaker to be announced later.

12.30 p.m. **Luncheon**

Speaker: **Professor J. C. Cameron,** *Head of Industrial Relations Department, Queen's University, Kingston, Ont.*

* * *

### Round-Table Discussions

BY INVITATION ONLY

Companies or individuals who are interested in participating in these discussions are asked to communicate with Headquarters so that invitations may be issued.

The subjects discussed will be as follows: Metal Cutting, Plastics and Plastic Plywoods, Synthetic Rubber, Fuel Substitutes for Petroleum Products, Powder Metallurgy, Statistical Control of Quality in Production.

***A COMPLETE PROGRAMME ALONG WITH INSTRUCTIONS FOR MAKING RESERVATIONS WILL BE MAILED TO ALL MEMBERS EARLY NEXT MONTH.***

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Brigadier J. L. Melville,** M.C., E.D., M.E.I.C., was recently appointed chief engineer of the First Canadian Army overseas.

At the outbreak of the present war, Brigadier Melville resigned his position as commissioner on the War Veterans Allowance Board in the Dominion Department of Pensions and National Health to command the First Canadian Pioneer Battalion of the Royal Canadian Engineers. In 1941 he was promoted from lieutenant-colonel when appointed to command R.C.E. Headquarters Corps Troops in England. Last year he was promoted from colonel to his present rank and was posted at Corps Headquarters in England.

Born at Glasgow, Scotland, in 1888 he came to Canada in 1913. In the last war, he went overseas with the engineers as a lieutenant. He served in France and Belgium from August 1916 to April 1919. He was awarded the Military Cross for his services with the 10th Field Company and a bar to the cross for bridging operations at Canal du Nord.

**R. B. Chandler,** M.E.I.C., general manager of the Public Utilities Commission at Port Arthur, Ont., is the newly elected chairman of the Lakehead Branch of the Institute.

R. B. Chandler, M.E.I.C.

Born at Stratford, Ont., he was educated at the University of Toronto where he graduated as a B.A.Sc. in 1912. Upon graduation, he went to Saskatoon where he was employed as assistant city engineer. From 1914 to 1916 he was resident engineer with the Board of Grain Commissioners for Canada at Saskatoon and Calgary. He joined the staff of C. D. Howe & Company, at Port Arthur, in 1916, and was employed as a designing and supervising engineer until 1923 when he became a partner in the firm. He left the firm in 1933 and did some private practice for a couple of years until he was appointed general manager of the Public Utilities Commission of Port Arthur, in 1935. Mr. Chandler has acted as consulting engineer on construction of important industrial plants including terminal grain elevators, warehouses and docks; in 1930 he made an investigation of grain handling facilities in Argentina.

Mr. Chandler is at present president of the Association of Municipal Electric Utilities of Ontario and is also a member of the Special Legislation Committee of the American Waterworks Association, Canadian Section.

**Dr. F. A. Gaby,** M.E.I.C., past president of the Institute, was elected a member of the Executive Council for Ontario of the Canadian Manufacturers' Association at the 72nd Annual Meeting of the Association held in Toronto recently.

**A. L. Carruthers,** M.E.I.C., has been appointed, a few months ago, chief engineer of the Department of Public Works of the Province of British Columbia. He was born in Sarnia Township, Ont., and was educated at the University of Toronto. In 1904 he joined the Canadian Northern Railway and was employed as an instrumentman, bridge inspector, resident engineer, and from 1911 until 1917 as a divisional engineer. At that time he became district engineer for the Department of Public Works of British Columbia at Prince Rupert, B.C. He was appointed bridge engineer of the Department at Victoria, in 1923, a position which he held until his present promotion. Mr. Carruthers was vice-president of the Institute in 1941-42.

**Dan Anderson,** M.E.I.C., has left Allied War Supplies Corporation, Montreal, and accepted the position of assistant to the manager, Southern Canada Power Company, Montreal.

**G. Gordon Gale,** M.E.I.C., president of the Gatineau Power Company has been elected by the Graduates' Society of McGill University as one of its representatives on the university board of governors.

**A. B. Cooper,** M.E.I.C., general manager, Ferranti Electric Company Limited, has been elected a member of the Executive Council for Ontario, of the Canadian Manufacturers' Association at the 72nd Annual Meeting of the Association held in Toronto recently.

**James S. Cameron,** M.E.I.C., manager of the telephone division of the Northern Electric Company has been elected honorary treasurer of the Graduates' Society of McGill University.

**Major H. J. G. McLean,** M.C., M.E.I.C., district ordnance mechanical engineer of Military District No. 2, Toronto, has been awarded the E.D.

**L.-P. Cousineau,** M.E.I.C. of Dufresne Engineering Company Limited, has recently returned from Passe-Dangereuse where he was employed on the construction of a regulating dam for the Aluminum Company of Canada for the past 18 months. He is at present superintendent on construction of a concrete and earth-fill dam at St. Alexandre, County of Kamouraska, Que., with the same contractors.

**A. J. Farrell,** M.E.I.C., has recently left the employ of Manufacturers Life Insurance Company of Montreal and joined the staff of Gunite & Waterproofing Limited, Montreal, as technical sales engineer.

**R. A. Hendry,** M.E.I.C., of Halifax, has left the Department of Highways of Nova Scotia and is at present engaged as construction engineer with the Department of National Defence (Navy), at Halifax.

**Major R. H. Wallace,** M.E.I.C., First Canadian Survey Regiment, R.C.E., overseas, has recently been promoted to this rank. Major Wallace has been overseas since 1940. Before joining up, he was employed with Canadian Starch Company at Cardinal, Ont.

**C. E. Nix,** M.E.I.C., has recently joined the staff of Bechtel-Price-Callahan, at Edmonton, Alta.

**Ernest Peden,** M.E.I.C., who lately had been employed with Foundation Company of Canada Limited at Montreal is now on the staff of Gore & Storrie, consulting engineers of Toronto.

**A. Sandilands,** M.E.I.C., has been transferred from branch manager of Canadian Telephones and Supplies in Regina, to the same position in Edmonton, Alta.

**J. S. Neil,** M.E.I.C., has left his position as test engineer with Canadian Western Natural Gas, Light & Power Company, Calgary, to join the engineering staff of McColl-Frontenac Oil Company at Calgary. Mr. Neil is a graduate of the University of Alberta in the class of 1930 and had been with his previous employers since 1935.

**F. J. Ryder,** M.E.I.C., has been transferred from the Toronto office of Canadian Bridge Company Limited to Walkerville, Ont. He will be welcome back in the Border Cities Branch where he has rendered valuable service while being employed with Motor Products Corporation, Walkerville, and Taylor and Gaskin, Detroit, before moving to Toronto a few years ago.

**F. S. Small,** M.E.I.C., is now construction engineer with United Shipyards Limited, Montreal. He was previously employed with Fraser Brace Limited at LaTuque, Que.

**Alexander Wilson,** M.E.I.C., has left Canadian Comstock Company Limited, Halifax, and is now employed with Toronto Shipbuilding Company at Saint John, N.B. Up until a few years ago, Mr. Wilson was engaged in consulting work in Montreal.

**B. A. Margo,** M.E.I.C., of the Aluminum Company of Canada Limited was recently transferred from the Montreal office to Shawinigan Falls, Que.

**K. A. Brebner,** M.E.I.C., has left Canadian Car Munitions Company, Cherrier, Que., where he was plant engineer and is now employed in the engineering department of the Aluminum Company of Canada Limited, at Arvida, Que. Before joining the Canadian Car Munitions, Mr. Brebner was plant engineer with Price Brothers & Company, Riverbend, Que.

**A. R. Bonnell,** M.E.I.C., has recently returned from Trinidad, B.W.I., for a few months holiday. He is at present at home in Sussex, N.B. He was employed on the construction of the naval base at Trinidad.

**Lieut.-Colonel W. B. Pennock,** M.E.I.C., of the Royal Canadian Engineers is at present stationed at Petawawa, Ont. Before joining up, Colonel Pennock was with the Pennock Engineering Company at Ottawa.

**C. R. Jacobs,** Jr.E.I.C., is now located at the Belvedere, N.J., plant of the Hercules Powder Company as an inspector for the Inspection Board of the United Kingdom and Canada. He was graduated in chemical engineering from the University of Alberta in 1939 and was employed for some months after graduation by the Swift Canadian Company Limited at Edmonton.

**Fernand Marchand,** Jr.E.I.C., has left the staff of Canadian Westinghouse Company Limited, at Hamilton, and is now employed as a junior engineer with Defence Industries Limited at Westmount, Que. He is a graduate of the Ecole Polytechnique in the class of 1940.

**Max Gershfield,** Jr.E.I.C., has recently joined the Royal Canadian Air Force and is at present stationed at St. Boniface, Man. He was previously employed by Wartime Housing Limited at Fort William, Ont.

**W. W. Preston,** Jr.E.I.C., of the university staff at the University of Alberta is at present employed by Horton Steel Works Limited, Fort Erie, Ont.

**Claude Bourgeois,** Jr.E.I.C., a graduate of the Ecole Polytechnique in the class of 1940 is now employed with Canadian Celanese Limited at Drummondville, Que. He was previously with Plessisville Foundry at Plessisville, Que.

**R. W. Mitchell,** Jr.E.I.C., has left the Merck & Company Limited, Montreal, to take the position of chemical and maintenance engineer with Chas. E. Frosst & Company, Montreal. He was graduated in chemical engineering from McGill University in 1933, and had been with his previous employer since his graduation.

**Chas. A. Auclair,** Jr.E.I.C., has recently joined the staff of the Inspection Board for the United Kingdom and Canada and is at present stationed at the Montreal plant of Canadian Liquid Air Company. Upon graduation from the Ecole Polytechnique, in 1941, he went to work with Beauharnois Light, Heat and Power Company, at Beauharnois, and a few months later he joined the staff of Arthur Surveyer and Company, consulting engineers, Montreal, where he was employed until his recent change of position.

**Georges L. Archambault,** Jr.E.I.C., of the Aluminum Company of Canada Limited who was transferred last October from Arvida to Shawinigan Falls is now in charge of the planning department of the fabricating division at Shawinigan Falls.

**D. D. C. McGeachy,** S.E.I.C., is at present engaged in torpedo inspection work for the British Admiralty Delegation and is at present stationed at New York after having spent some time at Falls River, Mass. He graduated in mechanical engineering from Queen's University in 1940.

**Major Maurice Nantel,** S.E.I.C., has been invalided out of the army and has returned from overseas, recently.

**L. A. Long,** S.E.I.C., who graduated last spring from the University of New Brunswick is now employed with Northern Electric Company of Montreal.

**J. M. Garton,** S.E.I.C., a chemical engineering graduate of McGill University in 1942, is employed with Imperial Oil Limited at Sarnia, Ont.

**Ernest Dauphinais,** S.E.I.C., has left the employ of Foundation Company of Canada Limited at Montreal and has accepted a position as electrical engineer with Saguenay Telephone Company, Chicoutimi, Que. He graduated at the Ecole Polytechnique in 1941.

**Reginald Bing-Wo,** S.E.I.C., has recently been appointed to the position of junior engineer with the water development branch of the Department of Agriculture at Regina, Sask. He graduated from the University of Saskatchewan in 1943.

### VISITORS TO HEADQUARTERS

**J. M. Garton,** S.E.I.C., Imperial Oil Limited, Sarnia, Ont., on July 2nd.

**J. G. D'Aoust,** M.E.I.C., Vancouver, B.C., on July 6th.

**L.-P. Cousineau,** M.E.I.C., superintendent, Dufresne Engineering Company, Rivière-du-Loup, P.Q., on July 6th.

**Past-President G. J. Desbarats,** M.E.I.C., Ottawa, Ont., on July 6th.

**M. Fast,** S.E.I.C., Aluminum Company of Canada Limited, Shawinigan Falls, Que., on July 8th.

**Gilbert Proulx,** S.E.I.C., assistant to the superintendent, Saguenay Electric Company, Chicoutimi, Que., on July 8th.

**Robert J. G. Schofield,** Jr.E.I.C., chemist, Canadian Cottons Limited, Hamilton, Ont., on July 13th.

**A. R. Hannaford,** M.E.I.C., office and designing engineer, city of Hamilton, Hamilton, Ont., on July 14th, with Mrs. and Miss Hannaford.

**S. W. Gray,** M.E.I.C., assistant general manager, Dominion Steel & Coal Corporation, Sydney, N.S., on July 14th.

**A. R. Bonnell,** M.E.I.C., Sussex, N.B., on July 19th.

**J. R. Rettie,** M.E.I.C., Fraser Brace Company, La Tuque, Que., on July 21st.

**Lieut.-Colonel J. H. Edgar,** R.C.E., M.E.I.C., and Mrs. Edgar, Winnipeg, Man., on July 28th.

**A. A. Swinnerton,** M.E.I.C., chemical engineer, Fuel Research Laboratories, Mines Branch, Department of Mines, and secretary-treasurer of the Ottawa Branch of the Institute, on July 28th.

**Earle O. Turner,** M.E.I.C., professor of civil engineering, University of New Brunswick, Fredericton, N.B., and Mrs. Turner, on July 30th.

**Jas. R. B. Milne,** M.E.I.C., Sault Ste-Marie, Ont., on July 31st.

# Obituaries

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

**James Davidson Baker,** M.E.I.C., deputy minister of telephones and general manager of the Alberta Government Telephones, died suddenly at his home on July 10th, 1943. Born at Charlton, Kent, England, on February 20th, 1883, he came to Canada at an early age and received his education in Manitoba. He joined the Bell Telephone Company as an inspector in Winnipeg, in 1902, and a year later he was transferred to Calgary. From 1905 to 1907 he was chief inspector at Calgary.

He joined the Alberta Government Telephones in 1907 as construction foreman and the following year became local manager at Macleod. In 1910 he was appointed district plant manager at Calgary and in 1913 he was appointed assistant to the plant superintendent at Edmonton.

During the first great war he served overseas as a lieutenant in the Canadian Signals Corps. He was demobilized as a captain in 1919 and returned to the Alberta Government Telephones as construction engineer. In 1920, he was made plant superintendent a position which he occupied until 1929 when he became deputy minister of telephones and general manager of the Alberta Government Telephones.


George Silas Clark, M.E.I.C.


Philip Austin Fetterly, M.E.I.C.


John Hole, M.E.I.C.

Mr. Baker joined the Institute as a Member in 1935. He was president of the Association of Professional Engineers of Alberta in 1933.

**George Silas Clark,** M.E.I.C., died at the hospital in Montreal on June 29th, 1943. Born at Lachute, Que., on March 5th, 1898, he received his engineering education at McGill University, Montreal, where he graduated in 1922. He had served with the Canadian Forces during the first great war. Upon graduation, he joined the staff of Bailey Meter Company as sales and service engineer and a few months later in 1923, he went with the Newfoundland Power and Paper Company Limited as design and testing engineer. From 1926 to 1929 he was employed with Price Brothers & Company Limited and was responsible for design work in connection with mill alterations and extensions. From 1929 to 1931 he was in charge of the machinery installation for the new board mill of Donnacona Paper Company Limited, later becoming assistant mill superintendent. In 1931, he joined the staff of Molson's Brewery, at Montreal, as mechanical superintendent, later becoming chief engineer, a position he occupied until the time of his death.

During the last two years he had been on loan to the government devoting part of his time to the engineering department of Wartime Merchant Shipping at Montreal.

Mr. Clark joined the Institute as a Student in 1919, transferring to Junior in 1925. He transferred to Associate Member in 1931 and he became a Member in 1940.

**Philip Austin Fetterly,** M.E.I.C., died suddenly at Cardston, Alta., on June 20th, 1943. He was born at Aultsville, Ont., on February 16th, 1882, and graduated from McGill University as a bachelor of science in civil engineering in 1909. Upon graduation, he joined the Dominion Government Geological Survey and during 1909-1910 he was employed in survey work in British Columbia and Yukon. In 1911 he went with the Irrigation Department of the Canadian Pacific Railway, at Brooks, Alta. He served during the last war with the Royal Canadian Engineers. Since demobilization, in 1919, he had been employed by the Dominion Water & Power Bureau at Calgary.

In his position, Mr. Fetterly worked in collaboration with the engineers of the United States Geological Survey and, in paying tribute to his memory, the chief hydraulic engineer of the U.S. Geological Survey noted Mr. Fetterly's "good cheer and hearty co-operation which had been of inestimable value to the relations of both organizations."

Mr. Fetterly joined the Institute as a Junior in 1912 and was transferred to the class of Associate Member in 1913. He became a Member in 1940.

**John Hole,** M.E.I.C., mechanical superintendent of the Parks Department of the City of Toronto, died at his home, in Toronto, on April 30th, 1943. Born in London, England, on January 23rd, 1874, he received his education at Finsbury Technical College. From 1898 to 1907 he was engaged in construction of roads, sewers and buildings. He came to Canada in 1907 and worked with Darling & Pearson and Storey & Van Egmont, architects of Regina. Later he was engaged on drainage work for the Department of Public Works of Saskatchewan. From 1910 to 1912 he was employed by the Elias Rogers Coal Company of Toronto on remodelling of plant. He was with the Toronto Harbour Commissioners as assistant chief draughtsman, from 1916 to 1918, and as resident architect and engineer from 1920 to 1922. In the meantime, during the years 1918-1920 he was architect and engineer to the Toronto Housing Commission. In 1922 he went into private practice in Toronto as consulting engineer. In this capacity he was engaged by the Toronto Terminals Railway Company, the City of Toronto and the Canadian National Railways. He also designed and remodelled many buildings and industrial plants. In 1936 he was employed by the Parks Department of the City of Toronto as their mechanical superintendent, a position he held until his death.

His hobbies were music and poetry; several of his songs and a great many of his poems having been published.

Mr. Hole joined the Institute as an Associate Member in 1923 and he was transferred as Member in 1931.

George Wesley Howse, M.E.I.C

**George Wesley Howse,** M.E.I.C., district electrical inspector of the Hydro-Electric Power Commission of Ontario at Hamilton, died at his home in Port Nelson, on July 16th, 1943. Born at Beamsville, Ont., on June 29th, 1884, he was educated in the local schools and at Hamilton. He entered the power industry in 1906 with the Almonte Power Company, later being employed with W. C. Edwards & Company, Ottawa. From 1908 to 1910, he worked on construction with the Canadian General Electric Company. Joining the Hydro-Electric Power Commission of Ontario in 1910, he became chief operator at St. Thomas in 1911 and from 1914 to 1920 he was electrical inspector at St. Thomas. In 1920 he was appointed to the position of district electrical inspector at Hamilton, a position he held until his death.

Mr. Howse joined the Institute as a Member in 1941.

**Arthur John Matheson,** M.E.I.C., died at Toronto on July 3rd, 1943, after an illness of several months. Born at Ottawa, Ont., on March 17th, 1870, he attended the local model school and collegiate and in 1890 graduated with honours from the Royal Military College of Kingston.

After graduation from the Royal Military College he entered the Dominion Government where he was employed for forty years in various departments, including Railways and Canals, Public Works, Marine, Interior, Mines and Resources, and Transport. He was actively engaged in the construction of the Soulanges canal, Trent Valley canal, Georgian Bay ship canal survey and Upper Ottawa storage.

After a few years in private practice, in Vancouver, with his brother-in-law, C. E. Cartwright, as consulting engineer, he was appointed to the Montreal Water Level Commission, and later, became engaged, successively, with the Dominion Power Board, International Joint Commission, Kootenay River, Lake Superior, Niagara Falls, Massena, St. Croix River, and the Montreal Ship Canal Water-Levels Board.

He retired in 1937 and took up residence in Toronto.

Mr. Matheson joined the Institute as a Student in 1895 being transferred to Associate Member in 1899 and to Member in 1910. He was made a Life Member in 1938.

**Ernest Harold Pacy,** M.E.I.C., president of the Pittsburg Welding Corporation, died suddenly at his home in Allison Park, Pennsylvania, on June 22nd, 1943.

He was born at Montreal on July 18th, 1884, and received his education in local schools and by private tuition. In 1900 he joined the staff of the Dominion Bridge Company, Montreal, and from 1905 to 1908 he was employed by H. E. Vautelet, consulting engineer of Montreal, on inspection of fabrication of railway bridges. He joined the Canadian Pacific Railway in 1908 and in 1912 transferred to the Grand Trunk Pacific Railway being engaged on the inspection of railway bridges. During the construction of the Quebec Bridge he was employed as assistant engineer for the Board of Engineers of the Department of Railways and Canals of Canada. In 1918 he was employed with the American International Shipbuilding Corporation at Dayton, Ohio, and in 1919 he was with the Hamilton Bridge Company, Hamilton, Ont. In 1921, Mr. Pacy went to Pittsburg, Pa., where he became president and general manager of the Pittsburg Welding Corporation.

Mr. Pacy joined the Institute as a Student in 1907 and was transferred to Associate Member in 1917. He became a Member in 1940.

---

## CORRESPONDENCE

*(Continued from page 474)*

period of transition, not only from war to peace, but from the world as we knew it to the new world which is only now beginning to take shape in the hearts and imagination of the peoples. In carrying out the very great responsibilities which this transition period will place upon the shoulders of the engineering profession, it will be well for them to proceed not only in the knowledge of their own great powers but also of their own peculiar limitations. One hears much about the foundations of a new world and the presupposition that plans for such foundations can be drawn up and that they can be laid once and for all. But the new world will not be built in this engineering sense if it is to survive. The new world will be a society of free men and will be an organism rather than an inanimate engineering creation. It will be something that must grow and develop just as human life and human society has always grown and developed. This position has been soundly stated by Prime Minister Mackenzie King in his now famous words:

"Much is being said to-day about a new world order to take the place of the old world order when the war is at an end. If that new order is not already on its way before the war is over, we may look for it in vain. A new world order cannot be worked out, at some given moment, and reduced to writing at a conference table. It is not a matter of parchments and of seal. That was a part of the mistaken belief at the end of the last war. It is born, not made. It is something that lives and breathes; something much closer to the soul of man; something that needs to be worked out and prepared in the minds and the hearts of men. It expresses itself in brotherhood, in goodwill, and in mutual aid. It is the application, in all human relations, of the principle of service, and of helpfulness, that ennobles the work you are being asked to support."

E. R. Jacobsen, M.E.I.C.,
*Deputy Director General,*
*Commonwealth of Australia War Supplies Procurement.*

Washington, D.C.
June 14, 1943.

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## CALGARY BRANCH

K. W. Mitchell, M.E.I.C. - *Secretary-Treasurer*

At an open meeting of the Calgary Branch at the Pallister Hotel on June 14th, some 200 members and their friends from the welding industry were privileged to hear a most instructive and interesting paper by Mr. H. Thomasson, welding engineer for the Canadian Westinghouse Company, Hamilton, Ontario.

Mr. Thomasson's paper, **Salvage Conservation and Reclamation by Welding and Associated Processes, in Wartime,** dealt with conservation of stock material effected by application of joining metals in the manufacture of many standard items, particularly by the recently developed controlled atmosphere furnace brazing. This saving of vital materials by reduction of machining losses has contributed greatly to the war effort.

Mr. Thomasson illustrated this method by slides and samples and also described methods developed by his department in reclamation of costly machine tools. One was the thermal cycle treatment, involving preheating, welding, cooling and stress-relieving, at critical temperatures for each individual problem.

Mr. Thomasson has been closely associated with the Department of Munitions and Supply and his advice has produced many time, tool and vital material saving methods, that have contributed to Canada's outstanding war effort.

## EDMONTON BRANCH

F. R. Burfield, M.E.I.C. - *Secretary-Treasurer*
L. A. Thorssen, M.E.I.C. - *Branch News Editor*

A joint banquet of the Association of Professional Engineers of Alberta, the Northern Alberta Branch of the C.I.M. & M. and the Edmonton Branch of the Institute was held at the Macdonald Hotel, on Saturday evening, March 20th, at 7 p.m. This dinner, bringing together the members of the three societies and having as well many American engineers as visitors, was a real success.

The main feature of the evening was a talk by Mr. Richard Finnie on **Canada Moves North.** Mr. Finnie, a writer and photographer of the north, is presently engaged by the American Government as historian for the war emergency developments now underway in Canada's northern lands. Mr. Finnie using very excellent coloured movies, described in words and pictures the developments of the north and this presentation was very much enjoyed by all who attended.

* * *

The final meeting of the 1942-43 session of the Edmonton Branch was held as a dinner meeting in the Macdonald Hotel on April 29, 1943. Some forty American engineers joined our gathering and were, as always, very welcome visitors.

The main business of the evening was the election of officers for the coming year as listed on page 403.

The retiring chairman, D. Hutchison, said a few words in summarizing the work of the year and then, having thanked all those who aided him during the past year, turned the meeting over to the new chairman, C. W. Cary.

Mr. Cary then called upon L. A. Thorssen of the Department of Civil Engineering, University of Alberta, to give a talk on **The Shipshaw Development.** Mr. Thorssen outlined the magnitude of this project, discussed some of its construction problems and closed with a comparison to Boulder Dam.

Prof. I. F. Morrison moved a vote of thanks to Mr. Thorssen at the conclusion of a discussion period.

## NIAGARA PENINSULA BRANCH

J. H. Ings, M.E.I.C. - *Secretary-Treasurer*
J. W. Brooks, Jr.E.I.C. - *Branch News Editor*

Mr. Paul Ackerman, guest speaker at the Branch meeting on April 29, presented his much-discussed paper, **Industrial Democracy and Its Survival.**

By way of introduction, Mr. Ackerman compared his proposals to some of the perhaps more widely publicized plans for social security as evolved by economists, who base their theories on the assumption that full employment is a necessary prerequisite to the success of any plan. The speaker's research, however, indicated that such a condition could not endure, because full employment would result in our production being four times our normal consumption. This unbalanced equation, if global in its scope, must surely lead to economic disaster.

Mr. Ackerman therefore proposed that the situation be remedied by shortening the "producing period" of an individual. This might be achieved by reducing the hours of a working week, and by retirement at a relatively early age. A direct result of this would be a reduction in a man's earning power, and hence some provision must be made in

**Chairman C. G. Cline welcomes the president, *Left to right:* G. E. Griffiths, H. E. Bennett, President K. M. Cameron, C. G. Cline, L. Austin Wright.**

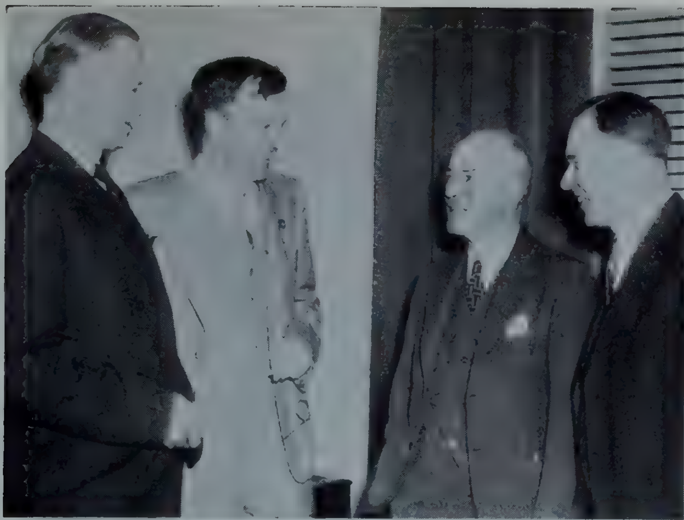
order that he might be financially independent after his years of production had come to an end. Mr. Ackerman suggested income taxation as the obvious solution, with a portion being set aside in a retirement fund. The taxation system would be worked out so that each individual would continue to receive his full salary after retirement.

Mr. Ackerman's paper is the result of eight years' research on the subject, and hence this brief summary can not hope to do justice to the speaker's excellent presentation. By way of conclusion, the writer believes it only fitting to observe that this particular meeting was spectacular in attendance, attention, and arguments.

---

The Niagara Peninsula Branch was honoured at its annual meeting on May 20th, 1943, by the visit of President K. M. Cameron, on the sixth stop of his tour to the twenty-five branches. An executive luncheon at the General Brock Hotel in Niagara Falls preceded the main dinner meeting, held at the Leonard Hotel in St. Catharines.

In his address, President Cameron spent a few moments reminiscing about his past in The Falls, for it was here that he obtained his first job, some forty years ago. The president then proceeded to outline the present activities of the Institute, and indicated many of the post-war problems it must face.



**General Secretary L. Austin Wright, Incoming Chairman G. E. Griffiths, President K. M. Cameron, Chairman C. G. Cline.**

The general secretary, Dr. L. Austin Wright, spoke briefly about some of the Institute's activities which are not so commonly well known. He gave special mention to the Committee on Collective Bargaining, which performed such a noble service for the profession through its accomplishments in connection with the recent labour legislation. Dr. Wright also referred to the Committee on the Engineer in the Services, which is under the very able chairmanship of Dean D. S. Ellis, Queen's University. Dean Ellis' committee has a real job ahead of it, and is approaching the problem from the standpoint of both national interests and engineers' interests.

Toward the close of the meeting, H. F. Bennett, of the London Branch, presented a brief, though eloquent, report on the progress of his Committee on the Training and Welfare of the Young Engineer.

### PETERBOROUGH BRANCH

A. J. Girwood, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, Jr.E.I.C. - *Branch News Editor*

Owing to travel restrictions the Annual Outing was held near Nassau on the Otonabee river. A shower delayed the start but the remainder of the afternoon was bright and a full programme of picnic games was run off.

Despite attempts to bolster up his soft ball team, G. R. Langley's married men were beaten by the single men captained by Gordon Ross. The winners were rewarded by a cigar and a package of Alka-Seltzer—intended for the benefit of anyone hardy enough to smoke the cigar. Brown and McHenry defeated Cameron and Malby in the horseshoe pitching, thereby entitling them to the prize of Yardley's soap and lotion. It was anticipated Gord McHenry could make particularly good use of this after an unfortunate accident sustained while pitching at softball. A volleyball team captained by Stan Shields and representing the C.G.E. Engineering Department came first by dint of considerable hard punching and reinforced by hard talking. A nail driving team consisting of Langley, Emery, Girdwood, Cameron, Muir and Brown won the nail driving contest in close competition with Stan Shields men, claiming the splendid clothes whisks offered as prizes.

The refreshment booth managed by Zeke Gray attracted more than a little custom and the hearty lunch arranged by Don Emery and committee was also a decided success. Activities ceased towards dusk when Don Emery held an impromptu auction to dispose of surplus provisions.

## THE PRESIDENT AT QUEBEC

**Head table, *left to right:* Past Vice-President Fred Newell, Past-President O. O. Lefebvre, President K. M. Cameron, Chairman René Dupuis.**

***Below:*** **Councillor R. E. Heartz, E. Drolet, Councillor E. D. Gray-Donald, Dr. Paul E. Gagnon and L. Beaudry.**

***Left to right:*** **Y. R. Tassé, L. Trudel, G. St. Jacques, G. E. Sarault and Léo Roy.**

***Below:*** **Councillor E. V. Gage, Past Vice-President G. B. Mitchell, A. O. Dufresne, A. Larivière and B. Grandmont.**

# PRESIDENTIAL VISIT TO THE SAGUENAY BRANCH

*Left to right:* **Chairman R. H. Rimmer, Gilbert Manseau, R. B. Brosseau and P. P. Lecointre.**

*Left to right:* **P. H. Morgan, H. V. Serson, G. Dufour, W. E. Cooper, Y. De Guise, G. St. Jacques, R. Lemieux.**

*In the foreground:* **A. C. Johnston, G. Proulx, B. Bowman, E. L. Miles and Past-President A. R. Décary.**

*Left to right:* **H. A. Estabrook, E. P. Muntz, Chas. Miller, F. Duffy and J. T. Nichols.**

## QUEBEC BRANCH

Paul Vincent, m.e.i.c. - *Secretary-Treasurer*

The president of the Institute, K. M. Cameron, and his party visited the Quebec Branch on June 19th, 1943. At 9.30 a.m. the Council of the Institute held a regional meeting at which past officers of the Institute in the province and members of the branch executive committee were invited. At noon, the president and his group met with the members of the branch at luncheon at the Château Frontenac. About sixty members were in attendance.

Chairman René Dupuis introduced Mr. Cameron to the meeting. The president first spoke in French paying tribute to his predecessor in the position of chief engineer of the Department of Public Works of Canada, Mr. Arthur Saint-Laurent, also a past president of the Institute. Mr. Cameron offered his congratulations to Past President Dr. A. R. Décary, who was made a member of the Order of the British Empire, last June, in recognition of his many years of faithful service with the department which is now headed by Mr. Cameron.

In the main part of his address, which was delivered in English, the president pointed to the important work accomplished by the members of our profession in the service of the various governments, municipal, provincial and federal. He stressed the need for continued co-operation between the government engineers and those members of the profession in the industry, particularly in the post-war period.

Dr. Décary thanked the president in the name of the members of the branch for his interesting address. Dr. O. O. Lefebvre, past president of the Institute, expressed his pleasure at being present at the meeting. The general secretary, Dr. L. Austin Wright, gave an exposé of the recent activities of the Institute in several new directions. He showed that our society is certainly keeping abreast with developments affecting the profession in this changing world.

Other visitors who were present included Past Vice-Presidents Fred Newell and E. P. Muntz, Past Councillor Bruno Grandmont, from Rimouski, Councillors E. V. Gage and R. E. Heartz from Montreal, Chairman R. S. Eadie of the Montreal Branch and Assistant General Secretary Louis Trudel.

During the branch meeting, Mrs. René Dupuis entertained at luncheon at the Garrison Club for the visiting ladies. In the afternoon, the president and his party were taken through the modernly equipped laboratories of the new engineering departments of the Faculty of Science, at Laval University.

## SAGUENAY BRANCH

A. T. Cairncross, m.e.i.c. - - *Secretary-Treasurer*

A dinner meeting of the Saguenay Branch was held in the Grill of the Saguenay Inn, Arvida, on June 21, 1943, when President Cameron and his party were visiting guests.

Following the dinner, the branch chairman, R. H. Rimmer, introduced President K. M. Cameron, chief engineer, Department of Public Works, Federal Government, as speaker of the evening.

The president thanked the Branch for the welcome extended to himself and his party. He spoke briefly in French and then gave his address in English on the subject, **Post-war Reconstruction.**

The president emphasized the need for the planning now of a post-war programme, in view of the fact that 900,000 men are employed in war industries, 650,000 are in the armed forces, and about 150,000 women are employed because of the war.

In the past, post-war planning has been left entirely to the Government. The Government during wartime is busy trying to win a victory on the fighting front, and there is little time to give consideration to things that may happen in the future. Because there were no post-war plans made by the Government in 1918 a great deal of dissatisfaction resulted.

Recently, in order to help the Government plan its post-war programme, a Government-appointed advisory committee was formed to study the problems and to gather

# THE PRESIDENT VISITS THE ST. MAURICE VALLEY BRANCH

**The president is greeted at Three Rivers by one of the oldest members of the Institute, F. X. T. Berlinguet. *On the left:* Viggo Jepsen.**

**_From left to right:_ W. A. E. McLeish, J. B. G. Auger, Morris Fast and J. Gilles Garceau.** →

← **Chairman Frégeau can tell a good story. *From left to right:* Past Vice-President H. O. Keay, President K. M. Cameron, Chairman J. H. Frégeau, Past-President A. R. Décary and General Secretary L. Austin Wright.**

← **_Clockwise:_ Jean Asselin, A. Trudel, Arthur Lacoursière, A. Landry, and E. Lavergne.**

all available information which would tend to help the men and women when they are demobilized from the armed forces and war industries. The committee, being outside the direct jurisdiction of the Government, has a free hand in its investigations, and its recommendations are sent directly to the Prime Minister. Years of concerted work and careful study lie ahead of this very important committee.

To aid this Government-appointed committee, the Institute also appointed a committee to act on post-war reconstruction problems. Mr. Cameron urged the Branch to form its own group and to report its findings to the Institute headquarters.

The president said that each member of the Institute should consider it his duty to help plan in advance the post-war reconstruction programmes and, thereby, advance the interests of all members.

The Chairman introduced Past-President A. R. Décary, Messrs. E. P. Muntz and Hector Cimon, who accompanied the president on his tour. They each expressed thanks for the hospitality shown them and they hoped that they would again be able to visit the Saguenay Branch.

Dr. Austin Wright, general secretary, was introduced, and he briefly outlined the important work being done by the Institute. Recently, five new committees had been formed to cover the following fields: (1) Post-war Problems, (2) Collective Bargaining, (3) Industrial Relations, (4) Engineers in the Civil Service, (5) Status of the Engineer in the Armed Forces.

Dr. Wright spoke about the proposed agreement between the Institute and the Professional Engineers of Quebec. He said that although no final agreement had yet been reached, progress was being made toward a successful conclusion.

The general secretary announced that a whole issue of the *Journal* was to be devoted to the Shipshaw project. The news was of particular interest to the members of this Branch for at that moment in full view of the meeting the setting sun could be seen displaying its varied colours on the Shipshaw forebay.

Mr. Louis Trudel, assistant general secretary, expressed his pleasure at being present at the meeting.

Questions, which included inquiries about Selective Service, were answered by Dr. Wright. Before the meeting adjourned at 9.30 p.m., Mr. Rimmer tendered the thanks of the Branch to Mr. Cameron and his associates.

## ST. MAURICE VALLEY BRANCH

David E. Ellis, M.E.I.C. - *Secretary-Treasurer*

A dinner meeting of the St. Maurice Valley Branch was held in the St. Maurice Hotel, Three Rivers, Que., on June 23rd last, to welcome Mr. K. M. Cameron, president of the Institute, to this district.

Mr. Cameron was accompanied from Quebec by Messrs. L. Austin Wright and Louis Trudel of the Institute staff as well as Messrs. A. R. Décary, René Dupuis, E. D. Gray-Donald, P. Vincent and Gustave St-Jacques of the neighbouring Quebec Branch.

Before dinner, a visit was made to the Three Rivers plant of the Canada Iron Foundries where all were impressed by the war work being carried on by this company.

A reception and dinner then followed, presided by Branch Chairman J. H. Frégeau, which was attended by 74 members and guests.

President Cameron later addressed the meeting speaking on The Engineer and Post-War Reconstruction, especially urging the engineer to take a greater interest in post-war problems.

Prof. H. O. Keay very suitably thanked Mr. Cameron for addressing the meeting. Mr. A. R. Décary, honorary chairman of the Quebec Branch, briefly addressed the meeting in French and English and conveyed the best wishes of his branch.

Mr. L. Austin Wright, general secretary, gave an interesting report on Institute affairs, after which a very satisfactory meeting was brought to a conclusion.

# Library Notes

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## THE FUTURE OF "NORTH OF 54°"

ROBERT F. LEGGET, M.E.I.C.
*Assistant Professor of Civil Engineering, University of Toronto, Toronto, Ont.*

**A book review together with general comments on the development of Canada's northern territory**

The Alaska Highway and the associated construction projects in Canada's far north-west have focussed public attention within recent months upon the Mackenzie River Valley and the forbidding terrain that separates it from the Pacific coast. Members of The Engineering Institute will recall the vivid description of this region given by Brigadier-General Sturdevant at the Annual Meeting of February, 1943. It is appropriate, therefore, that the pages of *The Engineering Journal* should contain adequate reference to the latest book dealing with the north-western part of the Dominion, a book of unusual significance if only because of the diverse opinions evoked upon its main thesis (1).

This is not the first time that Canada's Northland has received attention in these pages. In the June, 1940 issue of the *Journal* there was published a valuable paper by Dr. John A. Allan of the University of Alberta entitled "Mineral Development North of 54°." In this contribution the geology of the area adjacent to and included in the Mackenzie Valley was reviewed and a summary presented of the mining development that had taken place up to the end of 1939. In the July 1941 issue of this publication, there appeared a short paper by the present writer under the title "Construction North of 54°" in which were given general particulars of the small construction projects carried out, up to 1940, in the Mackenzie Basin.

It is with the Mackenzie Valley and the Arctic regions of Canada accessible from the Basin alone that Mr. Finnie's book is concerned, despite its promising title. In view of the certain importance of the northern part of the Province of Quebec, this restriction of area distinctly limits the value of the book. When it is mentioned that the names of the two eastern divisions of the Northwest Territories—Keewatin and Franklin—appear only once in the index, it will be realized that it is only a partial picture of northern Canada that is presented in this widely publicised volume. This is the more surprising since the author is well qualified to discuss more than the Mackenzie Valley and its environs. Born at Dawson in the Yukon, and son of a civil servant distinguished in the service of his country in the north, Richard ("Dick") Finnie has participated in eight expeditions which have covered a large part of the northern fringe of the Dominion. Despite the contrast which it suggests, note should perhaps be made that the reviewer has spent three months in the Mackenzie Basin but did not penetrate as far as the Arctic. He therefore knows at least a part of the area dealt with by Mr. Finnie; he has had the privilege of talking with men experienced in northern travel, including some mentioned in the book under review.

These personal notes are interjected since it is obvious that a number of those who have reviewed the book elsewhere know very little if anything of the area described and thus have been misled by the authoritative tone of Mr. Finnie's writing and by his photographic illustrations. The latter are magnificent. It is a pleasure to pay tribute to them. They are indeed so good that they will inevitably influence the impressions created in the minds of all but the most unemotional and critical reader! The authoritative tone of the writing is very largely due to repeated references to official publications, as though these were not available to the general public. The unquestioned experience of the author assists in this aspect of his style—one which contrasts so strangely and markedly with another phase which can only be described as that of a "smart aleck."

The title suggests the main thesis of the book. The author is in no doubt about the future. "Canada's destiny is a northern one. If Canada's population is to expand, it must expand northward." In developing the thesis Mr. Finnie proceeds to "debunk" what he regards as popular superstitions about the north of Canada, using as his whipping-boy the current Public School Geography of the Province of Ontario, this being "50 per cent wrong and 90 per cent misleading." In discussing cold, he says (p. 5) "I do not recall ever having been seriously inconvenienced there (in the Arctic and Northwest Territories) by cold weather and I have never been badly frost bitten." Such youthful exuberance is interesting, even entertaining, but it is unworthy of any serious consideration. Assuredly Canada will develop northward—but slowly, laboriously, and always in the face of climatic conditions as bad as are to be found in any comparable part of the world.

Engineers will know that the key to any such development is transportation—so has it always been; so must it be. Mr. Finnie has a chapter devoted to this vital topic—an interesting chapter too. It consists of 25 pages (pp. 88-112). Of these, 20 are devoted to a discussion of air travel. One page only treats of the amazing inland waterway provided by the Mackenzie River, and yet by this route probably 90 per cent of all the freight to the North is handled. Probably in no better way than by this contrast in the treatment of transportation methods can the superficial nature of Mr. Finnie's volume be illustrated. Aeroplane travel is, of course, fascinating to the individual; Mr. Finnie is an enthusiastic flier. It has been very largely responsible for the initiation of the mining developments "north of 54°". By means of aeroplanes, mapping of the area has been proceeding at a great rate. Admitting all this, however, and without in any way detracting from the manifest importance of air travel in the north, the slow travelling steamboats and Diesel-tugs must long remain the basic means of transport for Canada's Western Arctic, as it has been called, and much of the Mackenzie Valley. And the waterway down which they travel is open at best for only a third of each year.

This one fact alone necessarily places severe limits upon any ordinary development northward, at any rate for the immediate future. When, in addition, it is realised that the limiting draft upon the Mackenzie system is at times as low as two feet—due to shifting sandbars and low water—and that due to the geological character of the river this limitation cannot be removed, then the significance of transportation in all studies of northern development will be clear. Even in time of war, when all ordinary economic considerations can be shelved, the same controlling factor has determined the course of movement in the Mackenzie valley, as is well testified by the feverish activity in boat building that has been observable at Waterways, railhead on the Clearwater River, during the past two summers. When it is recalled that Waterways is still 1,600 miles from the Arctic Ocean, then the economics of northern transportation will at once be seen to be a prime determining factor in all considerations of the future of the area under review.

Engineers are by nature economists and thus appreciate instinctively the significance of economic factors. How easily they may be neglected is shown by the absence of any reference in Mr. Finnie's book to the economic aspects of any features of northern development. This may be due, in part at least, to the author's reliance upon Mr. Vilhjalmur Stefansson as the oracle of the Arctic. The frequently repeated adulation of Stefansson will be cloying to the average reader; to those who have studied the North, it is a good indicator of the value of many of Mr. Finnie's opinions. The author would have done well to have consulted some other authorities.

Road construction is forecast in a general way by Mr. Finnie and two of the projects which he touches upon have now been built. Since all recent developments in the vicinity of the Alaska highway and the Norman oil wells have been carried out in connection with the war, it would seem advisable to omit all reference to them in this review. Since Mr. Finnie's book was published before the Alaska highway was started, and as the route of the highway lies generally outside the area with which his book is concerned, this omission will not act as any undue restriction.

As it is only a few years since the glamour of mining developments diverted the public interest from the fur trade and associated missionary endeavours which have been the mainstay of the Mackenzie Valley since its discovery, these ventures naturally receive attention in "Canada Moves North." Mr. Finnie does not like missions and says so in no uncertain or guarded terms; in this place, however, his barbed criticisms of this branch of Christian work cannot be discussed. Correspondingly, his comments upon the fur trade are far from complimentary to the Hudson's Bay Company although a few grudging tributes to the remarkable work of this oldest of commercial undertakings are to be found in odd places throughout the book, as on page 170 where reference is made to the splendid service provided by the *S.S. Nascopie*.

The fur trade would appear to be far removed from the practice of engineering. No detailed discussion of this important branch of northern activity would therefore be fitting in these pages. But the Hudson's Bay Company has been very much more than a fur trader in the Mackenzie Valley. In order to service its own posts the company has been interested in transportation and consequently has operated for many years the only long-term regular transportation service on the Mackenzie system. To this service, and to its contribution to the development of the North, Mr. Finnie makes no direct reference. He does refer to a smaller competitive transportation service, organized a few years ago in connection with the Eldorado radium mine; the impression might even be gathered that this was the only river service. Competing river services in the far north present a seemingly ludicrous

(1) *Canada Moves North*, by Richard Finnie; ix — 227 pp., illustrated; Macmillan Co. of Canada, Toronto. $4.00.

picture! Strange as this may seem, the duplication of the portage road at Fort Smith (see pp. 91 and 92)—a road used for only four months of each year, and for a portion of each week of the four months—is an even graver reflection upon governmental administrations that allowed such waste to occur. For many years now the so-called monopolistic position of the Hudson's Bay Company has been challenged by competitors, principally small operators who have come to be known as "free traders." Close study will show that many of the abuses associated with the fur trade mentioned by Mr. Finnie are the result of such itinerant competition for, in this special case of the exploitation of a renewable natural resource, the only course for a "monopoly" to pursue is the wise one of conservative conservation. Nobody would suggest that the Hudson's Bay Company's record is perfect, but it is certainly immeasurably better than Mr. Finnie will admit.

What solution does Mr. Finnie suggest to the problems posed by all the features of mission-work, fur-trading and native life that he does not like? Apparently, complete governmental control despite the fact that he is caustically critical of some features of the Northwest Territories' administration of the immediate past. The dissolution of the Northwest Territories and Yukon Branch of the Department of the Interior by the Bennett Government in 1930 is very naturally castigated. But although Mr. Finnie suggests doubling the number of doctors in the North, and vast increases in governmental services, he has little more to say about the machinery of government except to relate some abuses that do not make pleasant reading. Even these pale into insignificance when compared with incidents not mentioned in this book such as the flying of 20 tons of coal from Great Bear lake to Coppermine in 1940, under government contract, when the coal could quite easily have been transported by water. It is small wonder, then, that Mr. Finnie waxes indignant in this part of his presentation. Unfortunately, he does not translate his indignation into suggestions for any positive action.

In another place (2), the present writer has called attention to the unbelievably cumbersome organization of the Department of Mines and Resources and has suggested that necessary preparatory planning should be initiated now for the complete reconstruction of this department as soon as the war is over. This suggestion was advanced in relation to the Geological Survey and the control of Canada's waters. How much more necessary is the reconstruction of the department when the north of Canada is considered. Difficult though it may be to believe, it yet remains a fact that the "N.W. Territories and Yukon Branch" of the Government of Canada is but one of four sections into which the Lands, Parks and Forests Branch of the Department of Mines and Resources is organised. And this for the completed administration and good government of an area of 1,463,563 sq. mi., almost half the total area of the Dominion. It is small wonder that all is not as it should be in the administration of this vast area; the surprising feature is that progress has been as good as it has.

It is the view of many with whom the writer has talked that a drastic reconstruction of northern administration is long overdue; Mr. Finnie would probably agree. Details of reorganisation need not be discussed here, but three essential principles may be suggested. Administration of this half of Canada must be the direct responsibility of a minister of the crown, and not merely *one* section of *one* branch of a vast department. Correspondingly, and in some appropriate way, safeguards against drastic changes in policy and personnel (such as the debacle of 1930) must be provided so that a reasonable degree of long-term planning may be assured. And arrangements should be made for reasonably close cooperation and interchange of information with the similar northern administrations of the United States (Alaska) and the Union of Soviet Socialist Republics, the only other countries with administrative tasks in any way comparable to that under review. Alaska is frequently mentioned by Mr. Finnie but the essential geographical and climatic differences between the two areas he is discussing are not, so that his comparisons tend to be misleading. He does mention modern Russia, in addition to quoting from an interesting report compiled by the Canadian Senate in 1887-88 in which Russia is considered. A quotation from "The Soviet Arctic" by W. O. Field, Jr., is included (pp. 156-157) but with no explanatory notes and no discussion. This is particularly to be regretted since, although parts of the Western Russian Arctic are strongly influenced by the Gulf Stream, the U.S.S.R. faces elsewhere identical problems to those presented by Canada's Northwest Territories and the Yukon, and apparently great strides have already been made in dealing with them. It is greatly to be hoped that somebody with suitable qualifications may undertake the task of interpreting this Soviet experience for the information of Canadians and the benefit of those in authority.

Until such a detailed comparison is made, it is impossible to be specific about the future of Canada's northern territory. Certainly Canada is not going to "move northward," as Mr. Finnie suggests. Equally certainly, the existing development will progress—slowly, in all probability, associated in large measure with mining ventures, necessarily linked closely with water transportation routes, intimately associated with the fur trade which must long be the staple industry, dependent upon engineering services for vital communications and all transport requirements, always beset by the rigours of long and hard winters—and yet activated by men who, even in this day and age, can properly be called pioneers.

(2) 'Reconstruction in Canada' (Ed. C. A. Ashley): see p. 88 in Water, Its use and Control by R. F. Legget, University of Toronto Press, 1943.

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**Basic Electricity for Communications:**
*William H. Timbie. N.Y., John Wiley and Sons, Inc., 1943. 5½ x 8½ in. $3.50.*

**Electronic Control of Resistance Welding:**
*George M. Chute. N.Y., McGraw-Hill Book Company, Inc., 1943. 6¼ x 9 in. $4.00.*

**Remedial Reading:**
*The diagnosis and correction of reading difficulties at the college level. Frances O. Triggs. Minneapolis, The University of Minnesota Press, 1943. 6 x 9¼ in. $2.50.*

**Bibliography of Structural Engineering and Architecture:**
*I. N. Koblentz and S. A. Rimsky-Korskoff. Moscow, 1941. This book—written in Russian—contains a list of Russian publications on structural materials and draughting, design of buildings, bridges, steel structures and architecture.*

**Statics of Structures:**
*I. M. Frenkel and P. M. Frenkel. Moscow, 1940. This volume—written in Russian—is a text book of statics for students of technical schools.*

### TRANSACTIONS, PROCEEDINGS

**The Society of Naval Architects and Marine Engineers:**
*Transactions volume 50, 1942.*

**The University of Toronto:**
*Transactions and Yearbook of the Engineering Society 1943.*

### REPORTS

**Metropolitan Water District of Southern California:**
*Fourth annual report, July, 1941, to June 30th, 1942*

**Ontario-Quebec Ottawa River Power Agreement:**
*Correspondence between Hon. C. D. Conant and Dr. T. H. Hogg including the report by Dr. Hogg.*

**Alberta, Department of Lands and Mines:**
*Annual report for the fiscal year ended March 31, 1942.*

**Quebec, Department of Mines:**
*The Mining Industry of the Province of Quebec in 1941. (This report will be sent in English or in French on request to the Deputy Minister of the Department of Mines, Quebec.)*

**University of California—Publications in Engineering:**
*Vol. 5, No. 1—The Conduction of heat in composite infinite solids. Vol. 5, No. 2—The Analytical prediction of superposed free and forced viscous convection in a vertical pipe.*

**University of Illinois—Engineering Experiment Station—Bulletins:**
*No. 340: Loss of head in flow of fluids through various types of one-and-one-half-inch valves. No. 341: Effect of cold drawing on mechanical properties of welded steel tubing. No. 342: Pressure losses in registers and stackheads in forced warm-air heating. No. 343: Tests of composite timber and concrete beams.*

**University of Illinois—Engineering Experiment Station—Reprint series:**
*No. 24: Ninth progress report of the joint investigation of fissures in railroad rails. No. 25: First progress report of the investigation of shelly spots in railroad rails. No. 26: First progress report of the investigation of fatigue failures in rail joint bars.*

**Iowa State College—Engineering Experiment Station—Bulletin:**
*No. 159: The Percentage stress-strain diagram as an index to the comparative behavior of materials under load.*

**Purdue University—Engineering Experiment Station—Bulletin:**
*No. 87: The formation, distribution and engineering characteristics of soils. A report of an investigation conducted by the Engineering Experiment Station and the State Highway Commission of Indiana.*

**The Asphalt Institute—Research Series:**
*No. 9: Flexible pavement reaction under field load bearing tests.*

**The Electrochemical Society—Preprints:**
*No. 83-19: A reversible oxygen electrode. No. 83-20: Conditions favoring the start of an arc discharge between cold activated electrodes at 50 cycles per second. No. 83-21: Prestite, improved method for molding electrical porcelain. No. 83-22: The electrochemist adopts automatic recording devices used in medical research. No. 83-23: Cathodic corrosion of cable sheaths.*

**American Welding Society:**
*Recommended practice for the spot and seam welding of low carbon steel, 1943.*

**Canadian Westinghouse Company, Ltd.:**

*Practical arc welding instructions in the interests of conservation of vital war materials.*

**Canada—Department of Mines and Resources—Mines and Geology Branch:**

*Prospectors guide for strategic minerals in Canada. 3rd ed. 1943.*

**Edison Electric Institute:**

*Turbine operating records for years 1940-1941. Publication No. K-5, May, 1943.*

**U. S. Bureau of Standards — Building Materials and Structures:**

*BMS 97—Experimental dry-wall construction with fiber insulating board.*

## BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters or may be sent direct to the publishers.**

### A.S.T.M. STANDARDS ON PLASTICS

*Sponsored by A.S.T.M. Committee D-20 on Plastics.*

*Specifications, Methods of Testing, Nomenclature, Definitions. May, 1943. American Society for Testing Materials, Phila., Pa. 375 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.00 (A.S.T.M. members, $1.50).*

The specifications, methods of test, recommended practices, nomenclature and definitions relating to plastics which have been approved by the Society are brought together in one volume for convenience.

### AIRCRAFT HYDRAULICS

*By H. W. Adams. McGraw-Hill Book Co., New York and London, 1943. 159 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $1.75.*

This text deals with the basic principles and general rules that govern the design of hydraulic systems for aircraft. The treatment is a practical one, aimed to enable the engineer to become a specialist in this field as quickly as possible. Although intended specifically for aircraft engineers, the book should be useful to designers of hydraulic systems for other purposes.

### AIRCRAFT MATHEMATICS

*By S. A. Walling and J. C. Hill, revised ed. The University Press, Cambridge, England; The Macmillan Co., New York, 1943. 186 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $1.75.*

A brief textbook covering the mathematics required for Air Training Corps cadets in Great Britain, adapted to American usage and terminology in this edition.

### AMERICA'S GREATEST INVENTORS

*By J. C. Patterson. Thomas Y. Crowell Co., New York, 1943. 240 pp., diagrs., 8½ x 5½ in., cloth, $2.00.*

This book tells briefly the lives and inventions of the eighteen men who were selected as America's greatest inventors in connection with the celebration, in 1940, of the sesquicentennial of the United States patent law. The list is an impressive one. The biographies are interesting, accurate, and popular in style.

### ANALYSIS OF CONTINUOUS FRAMES BY GRAPHICAL DISTRIBUTION OF MOMENTS

*By A. A. Eremin. Apply to author and publisher, A. A. Eremin, 1541, 37th St., Sacramento, Calif., 1943. 17 pp., diagrs., charts, tables, lithographic, 11 x 8½ in., paper, $2.00.*

This pamphlet presents a graphical method for the distribution of moments in continuous beams or rigid frames. The method is claimed to be as exact as algebraic methods and to be much less time-consuming. Numerous illustrative examples are given.

### BASIC ELECTRICITY FOR COMMUNICATIONS

*By W. H. Timbie. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 603 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.50.*

This is an introductory text for workers in communications and electronics. The book presents the elementary electrical principles that are needed in those fields and applies them to concrete practical problems that occur frequently. The text is intended as a course for workers and also as a foundation for advanced study.

### (The) CHEMICAL FORMULARY, Vol. 6, edited by H. Bennett

*Chemical Publishing Co., Brooklyn, N.Y., 1943. 636 pp., tables, 9 x 5½ in., cloth, $6.00.*

The sixth volume of this series contains several thousand new formulas for adhesives, beverages, cosmetics, emulsions, inks, food products, paints, varnishes, lubricants, pyrotechnics, polishes, etc.

### ENGINEERING DRAWING, Practice and Theory

*By I. N. Carter and H. L. Thompson. 2 ed. International Textbook Co., Scranton, Pa., 1943. 462 pp., illus., charts, tables, 11 x 8½ in., fabrikoid, $3.00.*

Descriptive geometry and practical engineering drawing are combined in this text, thus presenting theory and practice simultaneously. Duplication of classroom work is thus avoided, enabling the student to save time.

### ENGINEERING PROBLEMS ILLUSTRATING MATHEMATICS

*By J. W. Cell. McGraw-Hill Book Co., New York and London, 1943. 172 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $1.75.*

This text contains a collection of problems for students of college algebra, trigonometry, analytical geometry and differential and integral calculus. It is intended for use in junior and senior engineering courses, and aims to give students better understanding of the uses of mathematics than is obtained from purely formal exercises, by presenting practical problems of technological and industrial application. The work is a project of the Society for the Promotion of Engineering Education.

### FUEL TESTING, Laboratory Methods in Fuel Technology

*By G. W. Himus. Leonard Hill Limited, 17 Stratford Place, W. 1, London, 1942. 2 ed. 288 pp., illus., diagrs., charts, tables, 10 x 6 in., cloth, 21s.*

The methods of testing presented in this manual are those specified by the British Standards Institute, the Fuel Research Board and the Institute of Petroleum. The treatment, however, is far wider than a mere presentation of analytical methods. General principles are discussed at some length, and much general advice on the selection of fuels is included. While chief attention is given to coal, oil and gas are also treated.

### GEODETIC CONTROL SURVEYS

*By H. O. Sharp, 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 132 pp., illus., diagrs., charts, tables, 11½ x 8½ in., cloth, $3.50.*

The methods of surveying and the computations required in making precise control surveys and state plane coordinate systems are presented for use by engineers. Fundamental theory and practical applications are given.

### HEATING, VENTILATING, AIR CONDITIONING GUIDE, 1943, Vol. 21

*American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York, 1943. 1,160 pp. Roll of Membership, 90 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

The 1943 edition of this well-known reference book follows the form of preceding ones but has been carefully revised and, in part, rewritten. A chapter on abbreviations, symbols and standards has been added, and an appendix discusses emergency war practices now in use.

### INTRODUCTION TO ATOMIC PHYSICS

*By S. Tolansky with a foreword by Sir L. Bragg. Longmans, Green & Co., London, New York, Toronto, 1942. 343 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $4.50.*

The aim in this book is to supply a broad survey of the development of modern atomic physics for students who have completed a first year of college physics and are proceeding further. The treatment is descriptive and calls for little mathematical knowledge.

### MANUAL OF INDUSTRIAL HYGIENE AND MEDICAL SERVICE IN WAR INDUSTRIES issued under the Auspices of the Committee on Industrial Medicine of the Division of Medical Sciences of the National Research Council; prepared by the Division of Industrial Hygiene, National Institute of Health, United States Public Health Service; edited by W. M. Gafafer.

*W. B. Saunders Company, Philadelphia and London, 1943. 508 pp., charts, tables, 9½ x 6 in., cloth, $3.00.*

Military demands have withdrawn from industry many experienced industrial physicians, engineers and hygienists. This book is issued to assist physicians who must replace these losses and deal with the health problems of workers in war industries. It brings together in a single volume the essentials of the subject, covering the organization and operation of plant hygienic services, the prevention and control of disease in industry, and the problem of manpower in industry. The book is the work of a number of specialists and is issued under the auspices of the National Research Council.

### (The) MATHEMATICS OF PHYSICS AND CHEMISTRY

*By H. Margenau and G. M. Murphy. D. Van Nostrand Co., New York, 1943. 581 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $6.50.*

This book brings together within a single volume, those parts of advanced mathematics that form the tools of the modern worker in theoretical physics and chemistry. The subjects selected for treatment are those believed to be the most important for these workers, and the treatment of these subjects is full enough for practical purposes.

### NAVAL ARCHITECTURE AS ART AND SCIENCE

*By C. O. Liljegren. Cornell Maritime Press, New York, 1943. 212 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

This text starts with a simple presentation of the elementary principles of ship drafting and design. A second, more advanced section then analyzes the problems faced by the naval architect and the theories that apply to them. The third and most important section discusses the optimum form, proportions and dimensions of ships. New theories and formulas for resistance are developed, which differ from those commonly accepted.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

July 31st, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the September meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

## FOR ADMISSION

BICKNELL—A. BERTRAM, of Toronto, Ont. Born at Woodstock, Ont., April 24th, 1903; Educ.: B.A.Sc., Univ. of Toronto, 1927; with General Motors of Canada Ltd. as follows: 1927-28, dftsman, Oshawa, 1928-30, asst. mgr., standards dept., Regina, (plant closed) ,1930-31, dftsman., Oshawa; 1931 to date, engineer-purchasing agent, Canadian Gypsum Co. Ltd., Toronto, i/c of purchasing of all equipment and production materials for the six plants of the subject company.

References: W. H. M. Laughlin, H. S. Irwin, C. D. Carruthers, R. W. Angus, W. B. Dunbar, J. W. Falkner.

BRERETON—CHARLES HERBERT, of 306 Linwood St., Winnipeg, Man. Born at Carnduff, Sask., Aug. 25th, 1910; Educ.: B.Sc. (E.E.), Univ. of Man., 1934; 1934-37, radio technician, Canadian Airways Ltd.; 1937-38, technician, Trans-Canada Airlines; 1938-42, supt., communications, Canadian Airways Ltd.; 1942-43, supt., communications, Canadian Pacific Airlines; at present, radio engr., R.C.A. Victor Ltd., Winnipeg, Man.

References: E. P. Fetherstonhaugh, J. D. Peart, W. P. Brereton, G. H. Herriot.

BURMA—DAVID A., of 78 Grosvenor St., Toronto, Ont. Born at Montreal, Dec. 18th, 1914; Educ.: 1933-38, Montreal Technical Institute. Private study; 1933 to date, dftsman with the following companies: Canada and Dominion Sugar Refineries, Farand & Delorme, Pressure Pipe Ltd., Montreal, John T. Hepburn Co. Ltd., Toronto, Standard Steel Company, Welland, Foster Wheeler Ltd., St. Catharines, and at present, dftsman., designer and checker, Armstrong Wood & Company, Toronto. (Applying for admission as Affiliate).

References: D. S. Scrymgeour, W. T. Porter, L. P. Rundel, A. L. McPhail.

CARROLL—WILLIAM ERIC, of 155 Gainsborough Road, Toronto, Ont. Born at London, England, Nov. 30th, 1909; 1924-27, Ottawa Technical School; I.C.S. course in civil engrg. (uncompleted); 1927-28, power trans. lines, dams, retaining walls, surveying, levelling, dfting., etc., Gatineau Power Engineering Company; 1929, St. Lawrence Waterways project, Dept. of Rlys. & Canals; 1929-30, elec. designing and dfting., engrg. divn., Bell Telephone Co. of Canada; 1930-31, on sewers and watermains, James, Proctor & Redfern, civil and consltg. engrs., Toronto; 1931 to date, divn. of surveys, Ontario Dept. of Lands & Forests, present classification "senior dftsman," assting. the chief dftsman. and Ontario Land Surveyor (Asst. Inspr. of Surveys) in the checking of Crown land surveys, office administration, the administration of Crown lands, surveying, dfting., etc.

References: J. L. Morris, C. E. Bush, J. M. Gibson, F. H. Kitto, J. A. P. Marshall.

DOWELL—EUGENE HARRIS, of Halifax, N.S. Born at Shelburne, N.S., July 7th, 1920; Educ.: B. Eng., N.S. Tech. Coll., 1943; 1940-41 (summers), foreman, A. M. Smith & Co. Ltd., Halifax, and ironworker's helper, and refinery mtce. estimator, Imperial Oil Ltd.; 1941-42 (12 mos.), estimating and planning, Ottawa Car & Aircraft Ltd., Ottawa; at present, Pilot Officer, R.C.A.F., in training as Aeronautical Engrg. Officer.

References: H. A. Ripley, F. H. Sexton, K. E. Bentley.

McROBERTS—DONALD, of 366 Driveway, Ottawa, Ont. Born at Collingwood, Ont., Nov. 23rd, 1900; Educ.: 1917-23, 5 years' ap'ticeship, mech. engrg., Collingwood Shipyards Ltd.; I.C.S., mach. practice and design. R.P.E. of Ont.; 1923-27, chief mech. engr., Midland Shipbuilding Co. Ltd., Midland, Ont., i/c design and installn., supervn. of engines, boilers and mech. equipment; 1927-31, res. engr. of constrn. and designer, C. D. Howe Co. Ltd., Port Arthur; 1931-32, chief engr's. representative, reconstrn. west side docks, Saint John, N.B.; 1933-36, development engr., E. J. Fetherstonhaugh & Son, Patent Attorneys; 1936-40, western representative, C. D. Howe & Co. Ltd., Port Arthur; 1940-41, asst. chief engr., National Harbours Board, Vancouver Harbour; at present, engr. i/c of shipyards, Dept. of Munitions & Supply, Ottawa, Ont.

References: C. D. Howe, E. G. Cameron, J. M. Fleming, H. W. Frith, R. Yuill, J. B. Macdonald, R. Pybus, J. B. Stirling.

JULL—THOMAS ALFRED, of 51 Hazelton Ave., Toronto, Ont. Born at Toronto, June 28th, 1918; Educ.: B.A.Sc., Univ. of Toronto, 1943; 1936-39 (summers), mining and highway constrn.; 1940 (summer), aircraft assembly, National Steel Car Corpn., Malton, Ont.; 1941, millwright on mtce. with same company at Hamilton; 1942 (3 mos.), mtce. engrg., Imperial Oil Ltd., Sarnia; 1942 (3 mos.), field engr. i/c constrn., Canadian Dredge & Dock Co. Ltd., Toronto; at present, test engr., pump divn., John Inglis Co. Ltd., Toronto, Ont.

References: R. W. Angus, R. F. Legget, W. E. Bonn, C. R. Young, W. B. Dunbar

MACKENZIE—RAY ELLIOTT, of 351 California St., San Francisco, Calif., Born at Wilmington, N.C., Sept. 5th, 1898; Educ.: B.Eng. (Civil), North Carolina State College, 1920; (accredited curriculum); Post-graduate work in hydro-electric engrg.Member, A.S.C.E.; 1920-21, instr'man., U.S. Bureau of Reclamation; 1922, dftsman., N. C. Highway Commn.; 1922-23, junior engr., U.S. Bureau of Reclamation; 1924-25, junior engr., 1925-27, dist. engr. and asst. engr., U.S. Army Engineers; 1927-29, asst. engr., Aluminum Co. of America, Pittsburgh; 1929 to date, with the U.S. Army Engineers as follows: 1929-33, engr., 1933, associate engr., 1935-42, engr. and senior engr., and at present, principal engr. at San Francisco. On various projects and developments incl. planning, supervising and reviewing investigations, plans and specification for flood control, power, navigation, irrigation and multiple-purpose water-use investigations.

References: H. N. Macpherson, C. E. Webb, L. A. Campbell, F. E. Sterns, L. F. Harza, F. H. Cothran.

MacLEAN—DONALD WILBUR, of Black Point, N.B. Born at Black Point, June 13th, 1920; Educ.: B.Sc. (Forestry), Univ. of N.B., 1941; 1938-39 (summers), road constrn., N.B. Dept. of Public Works, compassman, block line survey, N.B. Forest Service; 1941 to date, transitman and instr'man., Air Services Branch, Dept. of Transport.

References: A. S. Donald, W. C. MacDonald, J. E. J. Patterson, J. J. Gorman, A. C. Golding, D. C. Bowlin.

RADLEY—PERCY EDWARD, of 1 Radin Road, Arvida, Que. Born at Lachute, Que., Dec. 28th, 1898; Educ.: B.Sc. (Chem.), McGill Univ., 1923; 1920-21-22 (summers), articled pupil to D.L.S. on topog'l. surveys; with Aluminum Co. of Canada as follows: 1923-26, chem. engr. on tech. control work, 1927-30, asst. supt., Shawinigan Works, 1931-39, aluminum plant supt., Arvida Works, 1940-42, works mgr., Shawinigan plant, 1942 to date, works mgr., Arvida Works.

References: R. H. Rimmer, A. W. Whitaker, Jr., C. Miller, H. G. Timmis, McN. DuBose.

SEMMENS—GRAHAM CORKILL, of Barrackpore, Trinidad, B.W.I. Born at Winnipeg, May 9th, 1908; Educ.: B.A., 1932, B.Sc. (Engrg.), Univ. of Alta., 1937; 1927, 1929, experimental work, Bituminous Sands Extraction Co.; 1930 (5 mos.), tank tester and weigher, Cons. Mining & Smelting Co.; 1937-38, South Crafty Tin Mines Ltd., Cornwall, England; with Trinidad Leaseholds Ltd. as follows: 1938-39, drilling at Forest Reserve, 1939, special study trip to U.S.A. to study and recommend on drilling equipment and technique, 1939-40, tech. asst. to gen. drilling supt., 1940-41, drilling engr. i/c cementation and casing operations at Forest Reserve Field, 1941-42, production engr., Forest Reserve, and 1942 to date, production supt. and engr. i/c production at Barrackpore.

References: R. S. L. Wilson, F. K. Beach, F. R. G. Wrigley, R. W. Emery, W. E. Cornish, R. M. Hardy.

WAITE—MATTHEW JOHN, of 10 Radin Road, Arvida, Que. Born at Haldimand Twp., Ont., August 22nd, 1904; Educ.: B.Sc., Queen's Univ., 1931; 1927 (6 mos.), master mechanic; 1928 (9 mos.), foreman mechanic in garage; 1929 (6 mos.), repair mechanic, inspection dept., General Motors of Canada; 1931-38, engrg. and servicing of sealing machines and equipment, Aluminum Co. of Canada Ltd., Toronto. Incl. development and design of new types of seals, sealing mediums, and sealing equipment, etc.; 1938-39, mtce. and management of all mining equipment of the Demerara Bauxite Company, British Guiana; 1939-40, mtce. engr. i/c mech. crews

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

MECHANICAL ENGINEER for the position of chief draughtsman, middle-aged person experienced in draughting office detail and capable of directing activities of 12 to 15 draughtsmen. Location Niagara Peninsula. Apply to Box No. 2644-V.

SALES ENGINEER experienced in building construction and possessing aptitude for sales work. Permanent position in Montreal, good opportunity. Bilingual preferred. Salary commensurate with ability. Apply to Box No. 2648-V.

PRODUCTION ENGINEER, Graduate, 40 years or over, with at least five years' experience in production processing and manufacture in heavy plate work, must be able to set up and direct operation of production control system. Knowledge of tool design and shop methods essential. Permanent. Salary commensurate with services. Apply to Box No. 2657-V.

PARTNER WANTED, graduate mechanical engineer wanted in small but successful manufacturing plant and machine shop in central Ontario city. Plant currently engaged on war work but with extensive peacetime programme definitely settled. Applicant must have executive and administrative ability, preferably with some production experience on machine tools. Moderate investment required. Apply to Box No. 2660-V.

### SITUATIONS WANTED

MECHANICAL ENGINEER, executive ability, desires permanent position with responsibility and future. Presently employed but war conditions necessitate change. Apply to Box No. 270-W.

GRADUATE ENGINEER, University of Toronto, with seven years experience along lines of general mechanical draughting and design with accent on electric motors, instruments and small tools. Also considerable experience in electric instrument laboratory. Due to re-organization of his present company, services are not being fully utilized. Apply to Box No. 1486-W.

CIVIL ENGINEER, B.A. Sc., Age 34, married. Experience covering heating, air-conditioning, mining. Design, construction and maintenance of sewers, waterworks, streets and highways, including surveying, location, estimating, inspection, drainage and soundings. Presently employed but desires advancement. Apply to Box No. 1859-W.

CIVIL ENGINEER, 36, graduate of the Royal Technical College, Copenhagen. Ten years' experience in all types of building construction and structural design in Canada as well as in Europe. Wants position with some responsibility. Apply to Box No. 2452-W.

GRADUATE ELECTRICAL ENGINEER, University of Manitoba (1933), skilled in design and layout work of power and lighting distribution for industrial plants and commercial buildings. Presently employed but services available where better opportunity afforded. Apply to Box No. 2099-W.

STRUCTURAL ENGINEER, M.E.I.C., modern methods reinforced concrete design, experienced on construction. Location immaterial. Preference for West. Excellent civil experience home and abroad. Apply to Box No. 2425-W.



in the field, 1940-42, master mechanic i/c machine shop, forge shop and foundry, and at present, asst. mech. supt., Aluminum Co. of Canada, Arvida, Que. I/c of all mech. operations not performed in the shops, incl. installn. of mech. equipment on constrn. projects.

References: M. G. Saunders, R. H. Rimmer, J. W. Ward, J. W. Thompson, C. Miller, A. W. Whitaker, Jr.

WILSON—JOHN TUZO, of Ottawa, Ont. Born at Ottawa, Oct. 24th, 1908; Educ.: B.A., Univ. of Toronto, 1930. B.A., M.A., Cambridge Univ., 1932. Ph.D. (Geol.), Princeton Univ., 1936; 1924-33 (summers), forestry, geology, geophysics, topography, mining and prospecting in Nova Scotia, Ontario, Quebec and Montana; 1934-36, original detailed geol. survey of part of Beartooth Mountains, Montana, for Ph.D. thesis; 1936-39, asst. geologist, Geol. Survey of Canada; Dec. 1939, granted leave of absence to join R.C.E. and proceeded overseas in Jan. 1940, holding following appointments: 2/Ltd., Field Survey Coy., Lieut., 12 Fd. Coy., Spec. Tunnelling Section, Lieut., Capt., and 2 i/c, 1 Cdn. Spec. Tunnelling Coy., 1941, A/Major and Sr. Instructor, School of Military Engrg (Royal Engrs), Cap. and G.S.O., III Engr., Liaison Officer, Candn. Mil. Hdqrs., 1941-43, Major and G.S.O., II Tech. Sec., G Branch, C.M.H.Q., and March 1943 to date, A/Lieut. Col. and G.S.O. I and 2 i/c Tech. Section, C.M.H.Q. Canadian Army Overseas.

References: A. G. L. McNaughton, C. S. L. Hertzberg, C. Camsell, F. C. C. Lynch, C. P. Edwards, J. A. Wilson.

#### FOR TRANSFER FROM STUDENT

DUCHASTEL—PIERRE ARTHUR, of Hull, Que. Born at Outremont, Que., Dec. 5th, 1915; Educ.: B.Eng., McGill Univ., 1938; 1938, engrg. office, 1939-41, field service and sales of transformers, meters, instruments, etc., for Ferranti Electric Ltd. Since Jan. 1942 on loan to National Research Council as junior research engineer. (St. 1937).

References: A. B. Cooper, C. V. Christie, O. O. Lefebvre, C. J. Mackenzie, B. G. Ballard.

FAST—MORRIS, of Shawinigan Falls, Que. Born at Blaine Lake, Sask., May 8th, 1917; Educ.: B. Eng., Univ. of Sask., 1942; 1937-38 and 1939 (summer), materials inspr., Northern Electric Co. Ltd., Montreal; 1939-40, aircraft production engr., Ottawa Car & Aircraft Co. Ltd.; 1940, mtce. Demerara Bauxite Co., British Guiana; 1940-41, Kingston works; May 1942 to date, production and mtce., Aluminum Co. of Canada, Shawinigan Falls, Que. (St. 1937).

References: C. J. Mackenzie, I. M. Fraser, R. A. Spencer, N. B. Hutcheon, W. M. Harvey.

McARTHUR—DONALD STEWART, of Whitehorse, Yukon Territory. Born at Edmonton, Alta., March 25th, 1915; Educ.: B.Sc. (Chem.), Univ. of Alta., 1939; 1939-40, asst. chemist, Calgary Refinery, British American Oil Co.; 1940-42, refinery operator, for six months, and then plant supervisor, Trinidad Leaseholds Ltd., Trinidad, B.W.I.; at present, progress engr., reporting on Whitehorse refinery project for J. Gordon Turnbull, Sverdrup & Parcel, Architects, Whitehorse, Y.T. (St. 1940).

References: R. S. L. Wilson, R. M. Hardy, W. E. Cornish, J. A. Allan, I. F. Morrison, L. A. Thorssen.

## APRIL AND JUNE JOURNALS REQUIRED

**There has been an unusual demand for extra copies of the April and June, 1943, issues of *The Engineering Journal* and it would be appreciated if members who do not retain their copies would return them to Headquarters, at 2050 Mansfield Street, Montreal, Que.**

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, SEPTEMBER 1943 | NUMBER 9

"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."

★ ★ ★

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.



# CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont.
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Arvida, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

### FINANCE
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

### LEGISLATION
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

### PAPERS
L. F. GRANT, *Chairman*

### LIBRARY AND HOUSE
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

### PUBLICATION
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

### BOARD OF EXAMINERS AND EDUCATION
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

### GZOWSKI MEDAL
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

### DUGGAN MEDAL AND PRIZE
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

### PLUMMER MEDAL
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

### LEONARD MEDAL
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

### JULIAN C. SMITH MEDAL
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

### MEMBERSHIP
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

### PROFESSIONAL INTERESTS
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

### STUDENTS' AND JUNIORS' PRIZES
**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

### INTERNATIONAL RELATIONS
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

### THE YOUNG ENGINEER
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

### POST-WAR PROBLEMS
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

### WESTERN WATER PROBLEMS
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

### ENGINEERING FEATURES OF CIVIL DEFENCE
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

### INDUSTRIAL RELATIONS
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. P. BRIERLEY
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
R. DUPUIS
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

### DETERIORATION OF CONCRETE STRUCTURES
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY A. H. PASK
A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR
H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY,
1614 Ontario Street,
Walkerville, Ont

**CALGARY**
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE
H. R. HAYES
A. HIGGINS
W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS
G. P. F. BOESE
H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL,
803-17th Ave. N.W.,
Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN,
60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN
J. W. JUDGE
E. D. ROBERTSON
J. D. A. MACDONALD
I. F. MORRISON
H. W. TYE
*(Ex-Officio),* D. HUTCHISON
E. NELSON
*Sec.-Treas.,* F. R. BURFIELD,
Water Resources Office,
Provincial Government,
Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE D. C. V. DUFF
G. J. CURRIE L. E. MITCHELL
J. D. FRASER P. A. LOVETT
J. W. MacDONALD
G. T. MEDFORTH
J. E. CLARKE
R. B. STEWART
K. L. DAWSON
*(Ex-Officio),* J. R. KAYE S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY,
Wartime Bureau of Technical
Personnel, 84 Hollis Street,
Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON
R. J. G. SCHOFIELD
NORMAN EAGER
A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID
STANLEY SHUPE
A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN,
91 Barnesdale Blvd.,
Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN
J. R. CARTER
J. D. LEE
*(Ex-Officio),* T. A. McGINNIS
L. F. GRANT A. JACKSON
*Sec. Treas.,* R. A. LOW,
Dept. of Civil Engineering,
Queen's University,
Kingston, Ont.

**LAKEHEAD**
*Chairman,* R. B. CHANDLER
*Vice-Chair.,* S. T. McCAVOUR
*Executive,* S. E. FLOOK
O. J. KOREEN
E. L. GOODALL
J. I. CARMICHAEL
W. H. SMALL
A. D. NORTON
E. A. KELLY
J. S. WILSON
*(Ex-Officio),* E. M. G. MacGILL
(Mrs. E. J. Soulsby)
E. J. DAVIES H. G. O'LEARY
*Sec.-Treas.,* W. C. BYERS,
c/o C. D. Howe Co. Ltd.,
Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON G. S. BROWN
N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE,
McKenzie Electric Ltd.,
706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT
W. C. MILLER
F. T. TAYLOR
F. C. BALL
V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN
J. A. VANCE
*Sec. Treas.,* H. G. STEAD,
60 Alexandra Street,
London, Ont.

**MONCTON**
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS H. W. HOLE
A. GORDON G. C. TORRENS
G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE
G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT,
Engrg. Dept., C.N.R.
Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE
R. C. FLITTON
G. D. HULME
G. E. GELINAS
K. G. CAMERON
G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD
J. E. ARMSTRONG
R. E. HEARTZ
W. G. HUNT
J. A. LALONDE
G. MacL. PITTS
E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL,
40 Kelvin Avenue,
Outremont, Que

**NIAGARA PENINSULA**
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR
C. G. MOON
G. F. VOLLMER
H. E. BARNETT
J. W. BROOKS
G. MORRISON
D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE
A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS,
2135 Culp Street,
Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY
G. A. LINDSAY
R. YUILL
W. H. B. BEVAN
J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY
K. M. CAMERON
N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON
Dept. of Mines & Resources,
Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN
A. L. MALBY
F. R. POPE
C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY
H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD,
308 Monaghan Road,
Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD G. ST-JACQUES
L. GAGNON A. E. PARÉ
G. W. WADDINGTON Y. R. TASSÉ
*(Ex-Officio),* H. CIMON
R. B. McDUNNOUGH
P. MÉTHÉ
L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT,
Colonization Department,
Room 333-A, Parliament Bldgs.,
Quebec, Que.

**SAGUENAY**
*Chairman,* CHAS. MILLER
*Vice-Chair.,* G. B. MOXON
*Executive,* J. FRISCH W. E. COOPER
F. T. BOUTILIER
*(Ex-Officio),* R. H. RIMMER J. W. WARD
ALEX. T. CAIRNCROSS
*Sec.-Treas.,* ALEX. T. CAIRNCROSS,
P.O. Box 33,
Arvida, Que.

**SAINT JOHN**
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN
C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH
J. P. MOONEY
D. R. SMITH
G. W. GRIFFIN
*Sec.-Treas.,* G. L. PHILLIPS,
Saint John Dry Dock &
Shipbldg. Co. Ltd.,
East Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vive-Chair.,* R. DORION
*Executive,* G. B. BAXTER
E. BUTLER
A. G. JACQUES
R. D. PACKARD M. EATON
E. T. BUCHANAN J. JOYAL
W. E. A. McLEISH H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN
H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS,
Shawinigan Water & Power
Company,
P.O. Box 190,
Three Rivers, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN
E. K. PHILLIPS
J. I. STRONG
F. C. DEMPSEY
N. B. HUTCHEON
J. G. SCHAEFFER
R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG,
P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK
C. R. MURDOCK
G. W. MacLEOD
K. G. ROSS
H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG
A. E. PICKERING
L. R. BROWN
*Sec. Treas.,* O. A. EVANS,
159 Upton Road.
Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR R. F. LEGGET
E. G. HEWSON A. H. HULL
C. F. MORRISON E. A. CROSS
*(Ex-Officio),* H. E. BRANDON W. S. WILSON
T. H. HOGG C. R. YOUNG
N. MacNICOL
J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. deJONG,
Dept. of Civil Engineering,
University of Toronto,
Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER H. P. ARCHIBALD
R. E. POTTER I. C. BARLTROP
E. S. JONES H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT
C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN,
2099 Beach Avenue,
Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD
A. N. ANDERSON
F. C. GREEN
J. H. BLAKE
*(Ex-Officio),* E. W. IZARD
A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING,
41 Gorge Road West,
Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING
N. M. HALL
B. B. HOGARTH
R. H. ROBINSON
R. A. SARA
*(Ex-Officio),* W. P. BRERETON
J. W. SANGER
D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY,
55 Princess Street,
Winnipeg, Man.

# STATISTICAL ANALYSIS OF INSPECTION RESULTS

H. H. FAIRFIELD
*Metallurgist, Metallic Minerals Division, Bureau of Mines, Mines and Geology Branch, Department of Mines and Resources, Ottawa, Ont.*

**SUMMARY—In the inspection of war materials great numbers of inspection tests are performed. Much useful information can be obtained by analysing large numbers of tests. This phase of industrial research has enabled inspection and production costs to be lowered and quality improvements to be made.**

**Unfortunately, many inspectors and manufacturers still do not know that statistical methods are available for the study of test results. The purpose of this article is to draw attention to the value of statistical methods.**

**Many contributions to a more efficient war effort can be made by applying the knowledge obtained from rational interpretation of large numbers of test results.**

**The methods described have been used successfully for many years. Examples of common problems in interpretation of industrial data are given.**

**A bibliography is attached.**

*NOTE—For obvious reasons, the examples given herein are for demonstration purposes only. The figures of these examples are not to be considered as from actual production observations.*

## Introduction

"No empirical knowledge is ever certain. From the cradle to the grave one must of necessity act on knowledge which is probable only."

—Lt.-Col. L. E. Simon, in "Engineers' Manual of Statistical Methods."

The production and inspection of the materials of war involve thousands of observations. Logical action is generally based on the interpretation of many observations. The success of such action depends upon the accuracy of the observations and the soundness of the interpretation placed upon them.

There are countless instances where the observer misses the significance of a group of observations, due either to faulty interpretation or failure to interpret the results. This condition is being partly corrected in the United Kingdom

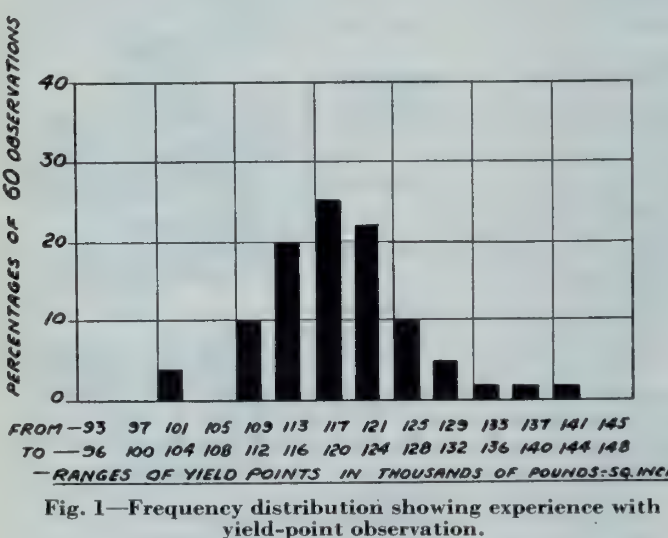
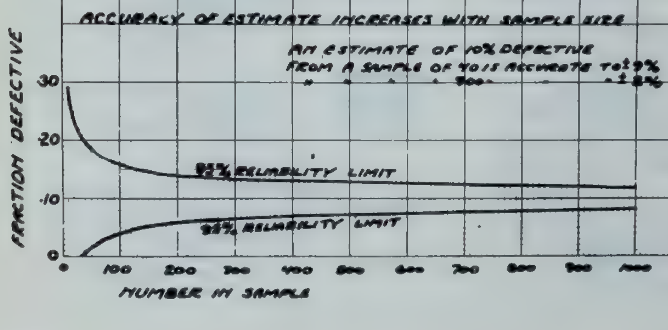



**Fig. 1—Frequency distribution showing experience with yield-point observation.**

**Fig. 2—Accuracy of estimate increases with sample size.**




and the United States* by the adoption of certain methods by inspecting officials. The term, "Quality Control," has been adopted to describe a system of studying and controlling industrial products by methods of handling observations.

In these pages an attempt is made to outline in a non-technical manner some of the ideas used in such a system. It must be noted that the authenticity of the observations determines the worth of any decisions based on them. The results of unreliable sampling can be of little practical value.

In some fields it is almost impossible to obtain observations free from bias. Let us suppose that observers of speed in miles per hour were available for judgment: (a) a bystander, (b) a motorcycle policeman, and (c) a motorist accused of speeding. The bystander might be unbiased but probably would be very inaccurate. The motorist is usually biased on the low side. The policeman is the only qualified observer and, if overzealous, he might be biased on the high side. *Conclusions drawn from large numbers of biased observations naturally would be of little value.*

The collection and study of a great number of observations will often bring out information that one person could not discover for himself in his lifetime. Early navigators of the globe could never know what winds to expect. By travelling one route through all seasons of the year, a captain would eventually get to know the prevailing wind for each season for that route only. It was an invalided British Navy man who, for a hobby, requested that vessels sailing to all corners of the globe report wind and weather conditions. From over six hundred log books he compiled a map of the trade winds on all the oceans. Thenceforward a captain could sail a strange course with some knowledge of the winds which would probably be encountered.

The same principle of using large numbers of observations is as applicable to industrial conditions to-day as it was to wind conditions two centuries ago. *Those with vision find an orderly pattern of relationship where others see a confusing welter of a thousand separate facts.* As early as 1924, K. H. Daeves** stated: "Statistical research is a logical method for the control of operations for the research engineer, the plant superintendent, and the production executive."

## One Hundred Per Cent Inspection Without Interpretation May Not Be Satisfactory

On destructive tests for projectiles, armour, etc., an estimate of the untested material must be made from the tests. If this is to be done scientifically, a statistical method should be used. *It is frequently stated that where 100 per cent inspection is used no statistical method is needed, since 100 per cent assurance is obtained that no defectives occur.* But even 100 per cent Go–NoGo type inspection does not predict the onset of defective material, as does the Quality Control system. The opinion of the Ordnance Division of the U.S. Army*** on this subject is as follows:

"But even where the necessary inspections are not destructive, *"inspection fatigue" steps in to prevent one hundred per cent inspections from providing one hundred per cent insurance of conformance to specification requirements.* If you have before you a hand truck containing 15,000 cartridges, and you are given the job of inspecting and gauging them visually one hundred per cent, they

*"Quality Control of Munitions"—G. D. Edwards, War Department, Washington, D.C. *Army Ordnance*, 1942.

**"The Utilization of Statistics," in *Testing*, March, 1924.

***"Quality Control of Munitions"—G. D. Edwards (loc. cit.).

probably will all look alike to you after you have examined about 9,000 of them, and you won't know whether the discoloration which evidences necessary shoulder anneal, for example, is there on the 9,001st cartridge or not. This is no insult to your intelligence; it is just a plain illustration of experience.

"So 100 or 200 or even 500 per cent manual inspections are not the answer where large quantities of material are involved, even if the resulting production delays could be tolerated. Mechanical gauging and photo-electric-cell gauging are being used in the inspection of ordnance material wherever possible to circumvent inspection fatigue, but even the best of these substitutes have their own margins of error. In other words, it must be recognized that the element of risk just can't be eliminated from quality considerations in mass production, and the real problem is how to reduce the chances which must be taken to a minimum without unduly impeding output. Quality control techniques are built around limiting such risks to a predetermined degree, and they are thus admirably adapted to the problem in hand."

On February 12th, 1943, inspection of materials was discussed at the annual meeting of the Engineering Institute of Canada, in Toronto. Mr. H. H. Vroom, Telephone Shop Superintendent for the Northern Electric Company of Canada, stated that after many investigations, extending over at least five years, they had determined that, on 100 per cent inspection, inspectors would pick out about 85 per cent of the defective material. This referred to experienced inspectors.

The experience of the Northern Electric Company is borne out by statements made by the inspectors in the Westinghouse Manufacturing Company and in the Picatinny Arsenal, U.S.A.

There is much evidence, therefore, to show that 100 per cent inspection does not give 100 per cent assurance that defective work is all detected. Statistical analysis of a number of tests can probably predict the occurrence of defective work more accurately than can be done by ordinary "100 per cent" inspection.

### 1.—The Significance of Observations Differing in Magnitude

Let us suppose that an ordnance inspector is examining test results which represent two lots of castings. One test bar is recorded at 110,000 lb. per sq. in. yield strength and the other at 126,000 lb. per sq. in. yield strength. What does this mean? Should the manufacturer be asked to take corrective action? Should the work be rejected? The following is a demonstration of how such an occurrence should be interpreted.

Without a background of experience, interpretation of observations is impossible. By experience we mean a collection of facts arranged in orderly manner so that some pattern of behaviour is evident. The facts may be retained mentally, or they may be recorded.

The inspector should first acquaint himself with the normal behaviour of the observation for the source being studied. The frequency distribution chart is a convenient graphic method of showing how observations have occurred. The vertical lines in Fig. 1 show the percentage of sixty observations on the yield point which fell within the limits 101,000—104,000, 109,000—112,000 and so on. For instance 20 per cent of the specimens showed yield points between 113,000 and 116,000 lb. per sq. in.; yield values have occurred around a central value of 117,000 to 120,000 lb. per sq. in. and over a range of 100,000 to 144,000 lb. per sq. in. If the process remains unchanged, what has happened before may be expected to happen again, and, as the figure shows, approximately 67 per cent of all results will probably fall within 113,000 to 124,000 lb. per sq. in., while approximately 87 per cent of all results will probably fall within 109,000 to 128,000 lb. per sq. in.

It is only common sense, therefore, to say that proof of departure from normal operation requires that an observation well outside the above limits be encountered. In fact the frequency distribution chart thus provides a background of experience with which the new observation can be compared.

*Judgment of an observation must be either that there is no indication of a change in the process or that the process has changed.* If the process has not changed, there is a question of whether the process itself is acceptable. This can best be answered by comparing frequency distributions of the observations taken in different industrial establishments known to be turning out a satisfactory product.

### 2.—Conclusions Drawn from a Sample

A sample is a small part or quantity of a product intended to be used as evidence of the quality of the whole. *A common mistake, made by many inspectors, is the assumption that the material is exactly like the sample.* This fallacy has been exposed by L. E. Simon.*

Common sense would indicate that the larger the sample taken the more sure is the estimate of quality. Simon proves that if a lot of material were actually 10 per cent defective and samples of ten items were taken at random; then

35 per cent of the samples would contain no defectives,
39 per cent of the samples would contain one defective, and
26 per cent of the samples would contain more than one defective.

Obviously, the material cannot then be exactly like the sample in 60 per cent of the cases.

The question then arises, how can a sample be interpreted if there is no certainty that the sample is like the material?

*"Engineer's Manual of Statistical Methods," by Lt.-Col. L. E. Simon, Ordnance Department U.S. Army, Assistant Director, The Ballistic Research Laboratory. Pub. by John Wiley & Sons, New York, 1941.

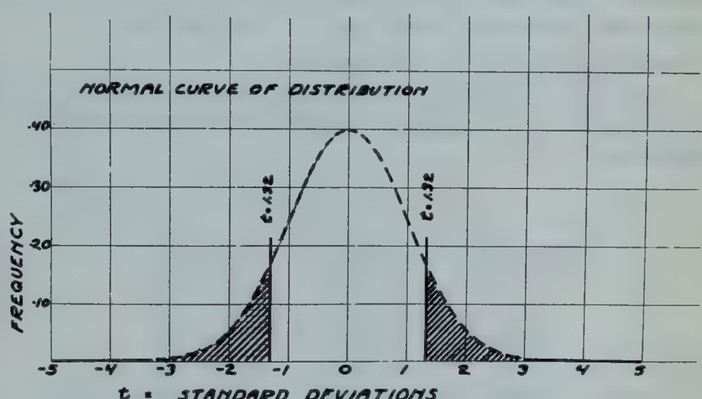
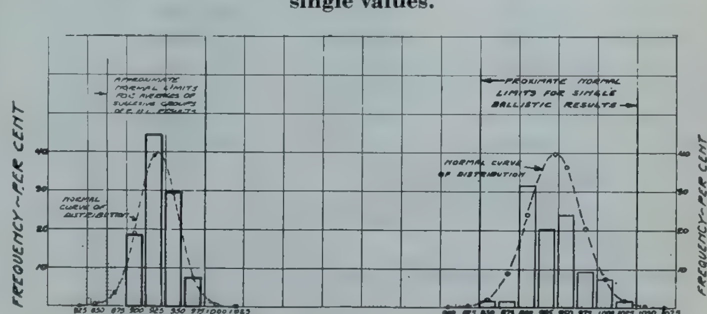



**Fig. 3—Normal curves of error of differences.**

**Fig. 4—Distribution of ballistic limit on groups of two and in single values.**



The answer is that, from the value obtained from a sample, the range within which the true value lies may be estimated. A value obtained from a sample is merely an estimate, the accuracy of which depends upon the number in the sample.

Figure 2 shows how the accuracy of a sample found to be 10 per cent defective increases with the size of the sample.

The accuracy of averages, percentages and deviations is also subject to the same effect of number in sample. For example, statistical organizations questioning individuals must obtain about one thousand observations at least, in order to state the attitude of the whole population within two per cent (assuming perfect sampling method).

Any report of properties of a lot of material should be qualified by stating the limits of accuracy of the estimate. The following example is offered in order to illustrate the calculations involved in assessing a sample:

*Example*—An estimate of izod impact strength of a steel from Company A is required. Ten values for successive heats were reported as follows:

Izod Impact Strength, in ft. lb.
(Number of observations = 10)

| | |
|---|---|
| 69 | Average is 61.3 |
| 61 | |
| 63 | |
| 73 | |
| 54 | |
| 54 | |
| 56 | |
| 58 | |
| 74 | |
| 51 | |
| 613 | |

The average value for the sample is 61.3 ft. lb. Values recorded in the sample range from a minimum of 61 ft. lb. to a maximum of 74 ft. lb. What is required is an idea of where the average izod for the process lies and the limits within which individual values are expected to fall. This requires that the standard deviation of the results be calculated.

The "standard deviation" for a number of observations is a number which is found by dividing the sum of the squares of the several deviations by the number of observations and taking the square root of the quotient.

STANDARD DEVIATION (LONG METHOD)

The term "sigma" and the symbol $\sigma$ are often used as abbreviations for standard deviation, which is given by the expression:

$$\sigma = \sqrt{\frac{\Sigma(\bar{X} - X)^2}{N}}$$

| *Observation* $X$ | *Deviation* $\bar{X} - X$ | *Deviations*$^2$ $(\bar{X} - X)^2$ |
|---|---|---|
| 69 | + 7.7 | 59.29 |
| 61 | − 0.3 | .09 |
| 63 | + 1.7 | 2.89 |
| 73 | +11.7 | 136.89 |
| 54 | − 7.3 | 53.29 |
| 54 | − 7.3 | 53.29 |
| 56 | − 5.3 | 28.09 |
| 58 | − 3.3 | 10.89 |
| 74 | +12.7 | 161.29 |
| 51 | −10.3 | 106.09 |
| 613 | 0 | 612.10 |

$X$ = An izod observation.

$\bar{X}$ = Arithmetical average izod. = 61.3.

$N$ = Number of observations. = 10.

$\Sigma$ = The sum of all.

$$\Sigma(\bar{X} - X)^2 = 612.10$$

$$\frac{\Sigma(\bar{X} - X)^2}{N} = 61.21$$

$$\sigma = \sqrt{\frac{\Sigma(\bar{X} - X)^2}{N}} = \sqrt{61.21}$$

$$\sigma = 7.8 \text{ (approx.)}$$

The average of the sample is 61.3 ft. lb. and the standard deviation is 7.8 ft. lb.

A shorter method of computing standard deviation is given later in section 4.

RELIABILITY OF AVERAGE

The sample serves as an estimate of the true average of the process. The reliability of the sample average depends upon the standard deviation of the sample and the number of observations in the sample. It is calculated as follows:

$$\left.\begin{array}{c}\text{Standard error}\\ \text{of average}\end{array}\right\} = \frac{\sigma}{\sqrt{N}} = \frac{7.8}{\sqrt{10}} = \frac{7.8}{3.16} = 2.5 \text{ approx.}$$

The standard error of the average, therefore, is 2.5 ft. lb.

The reliability of the average, 61.3 ft. lb., may now be stated as follows, the figures being based on the normal curve of distribution.*

The odds are 68 out of 100 that true average lies between $61.3 \pm 2.5$

the odds are 95 out of 100 that true average lies between $61.3 \pm 2$ times $2.5$ and

the odds are 99.7 out of 100 that true average lies between $61.3 \pm 3$ times $2.5$

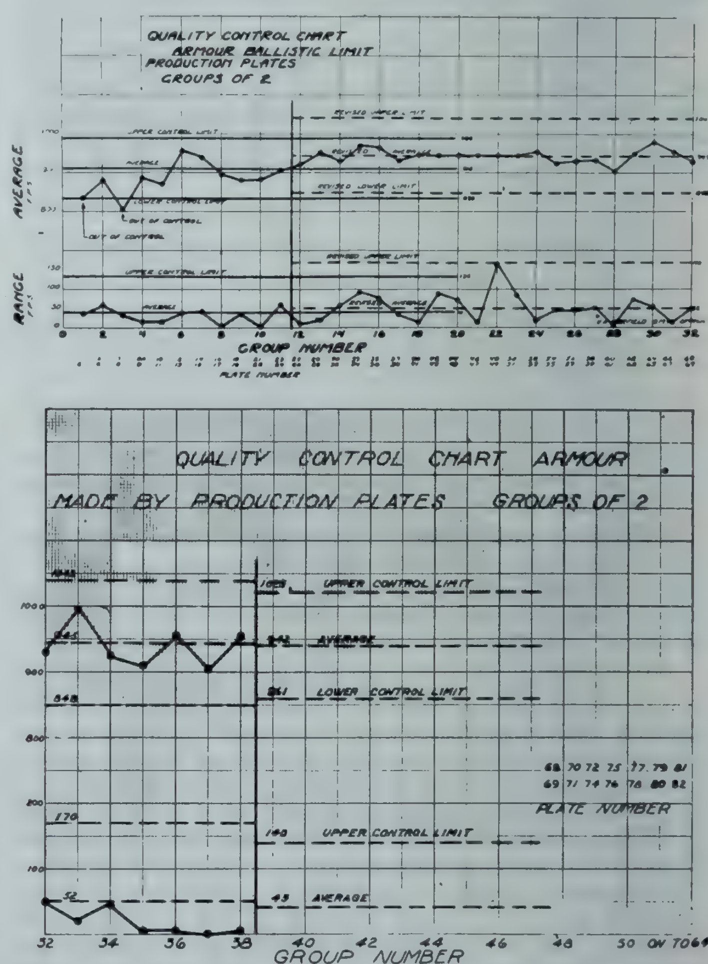



**Fig. 5—Control limits for ballistic limit and range of groups.**

*For the normal curve of distribution, see A.S.T.M. Manual on Presentation of Data, page 23.

The average of the process, therefore, lies somewhere between 53 and 69 ft. lb.

From the information given in the sample, individual results may be expected to fall within average $\pm$ 3 sigma.

$$61.3 \pm 3 \text{ times } 7.8,$$
$$38 \text{ to } 85 \text{ ft. lb.}$$

The accuracy of the standard deviation is expressed in the following:

Standard error of sigma = sigma divided by the square root of twice the number in the sample. In this case this equals

$$\frac{7.8}{\sqrt{20}} = 1.74 \text{ ft. lb.}$$

The standard deviations of samples of ten should therefore fall within:

$7.8 \pm 1.74$.................68 per cent of the time,
$7.8 \pm 2$ times 1.74....95 per cent of the time, and
$7.8 \pm 3$ times 1.74......97.8 per cent of the time.

Thus, from a sample of ten observations, general conclusions as to the nature of the behaviour of observations can be made. The accuracy of any statement is qualified by probabilities that will occur within a definite range. As the number of observations increases the accuracy of any estimate becomes greater.

The only calculation required for this type of work is that of standard deviation. For precise work the standard deviation of a sample should be corrected for sample size. This has been omitted here in order to prevent complicating calculations. For simple methods of handling data it is not necessary to make this correction. Students of statistical methods will follow this question in standard texts.

### 3.—The Significance of Difference Between Samples

Often it is necessary to compare two samples to determine whether they are from the same lot or from different lots, or an inspector wishes to determine by sample whether or not the process has changed. Many mistakes are made in comparing samples. Unless there is a sufficient background of experience, or statistical methods are used, faulty conclusions may be drawn. The significance of the difference between samples depends upon the reliability of the values determined from the samples.

For a full discussion of this problem the reader should refer to "Applied General Statistics" (by Croxton and Cowden). The following example is given here to show a practical problem.

*Example:*

Let us assume that a comparison of two types of tank track pins is to be made. One hundred and sixty-eight pins of type "A" and a like number of type "B" are placed in the tracks of a tank so that they will be subject to the same conditions. After a standard proving ground test has been carried out, it is found that five "A" and ten "B" pins have broken.

If the significance of the above difference was left to unaided human judgment, there would be a variety of opinions. Some would say that there was no difference; others would say that "A" pins were definitely superior. Errors in this type of judgment occur so frequently that it is considered worth while to explain the method of handling this problem.

*Given Data—*

| "A" pins | "B" pins |
|---|---|
| 5 failed. | 10 failed. |
| 168 tested. | 168 tested. |
| 2.975 per cent defective. | 5.95 per cent defective |
| .02975 fraction defective. | .0595 fraction defective. |

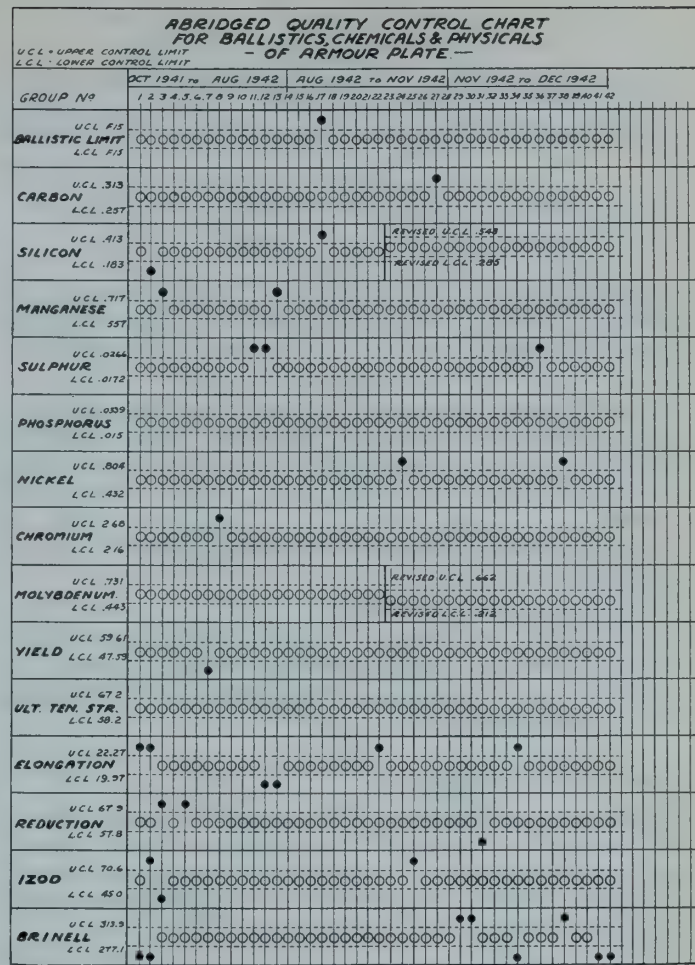


Fig. 6—Abridged quality control chart.

*Reliability of Given Data—*

Standard error of fraction defective = $\sigma_p$
Fraction defective = $p$
Fraction effective = $q$
Number tested = $N$

$$\sigma_p = \sqrt{\frac{p\,q}{N}}$$

For "A" pins, this becomes $\sigma_p = \sqrt{\frac{.0298 \times .9702}{168}}$

$$\sigma_p = .013$$

Now the reliability of the results of the test on "A" pins can be stated as follows:

There are odds of 95 out of 100 * that the true fraction of "A" pins which are defective lies between

$$p \pm 2\,\sigma_p$$
$$\text{or } .0298 \pm .026$$
$$\text{i.e. between } .0036 \text{ and } .0456$$

Expressed in terms of pins failing out of 168, the reliability of the test is such that from 0 to 8 failures may normally be expected.

Similarly analyzing the data on the "B" pins, the reliability of this test is such that from 4 to 16 failures may normally be expected.

It is obvious that no estimate can be made without qualifying the probable accuracy of the estimate. Now, if two estimates are so close together that their accuracy limits overlap, the significance of the difference may be small. Without statistical method the observer may draw erroneous conclusions. The following method is generally used for determining the significance rationally:

Let $t$ be the symbol used to represent significance, while
$p_A$ = fraction defective in group 'A' = .0298 and
$p_B$ = fraction defective in group 'B' = .0595 then
$p_A - p_B$ = difference between fractions = − .0297

* See "Handbook of Chemistry and Physics," Chemical Rubber Pub. Co.

Now $\sigma_{pA}$ = standard error of $p_A$ = .013 and
$\sigma_{pB}$ = standard error of $p_B$ = .0183.

The standard error of the difference between the fractions defective will then be $\sqrt{\sigma_{pA}^2 + \sigma_{pB}^2} = \sqrt{.013^2 + .0183^2} = .2245$ and

$$t = \frac{p_A - p_B}{\sqrt{\sigma_{pA}^2 + \sigma_{pB}^2}} = -\frac{.0297}{.02245} = -1.32$$

Practically speaking, if $t$ is less than 2.0 the difference in fractions observed is not significant. Thus in this example "A" pins have not proved definitely superior to "B" pins.

Actually $t$ refers to distances on the curve of normal error, measured in terms of standard deviation. Thus from the curve of normal distribution it is found that the fraction of total area under the curve from $t = 0$ to $t = 1.32$ is .4066

Significance then equals 2 × .4066 = .8132
or approximately 0.8.

This means that the odds are
8 out of 10 that "A" pins are the same as "B" pins, and
2 out of 10 that "A" pins are different from "B" pins.

There is only a slight chance therefore that "A" pins are different from "B" pins.

WHEN IS ACTION NEEDED ?

Mathematical methods will determine odds that a venture will be successful. These odds are based on test data which give only a small part of the general overall conditions. Therefore, judgment of intangible conditions should supplement the mathematical odds.

In the previous example, the odds are only 1 out of 5 that the "A" pins are superior to "B" pins. Let us suppose that there is reason to believe that the two tests differed and that "A" pins received a more severe test. Then, of course, one would be justified in disregarding the odds calculated from a number of failures.

Thus, in evaluating conditions, statistical methods serve to analyse the quantitative data. The intangible or qualitative data on the subject under consideration may outweigh the quantitative data. For example, a heat of steel may have an analysis which has proved satisfactory for a certain grade of steel castings. From the chemical analysis can we predict that the castings will be satisfactory? Suppose the foundryman notices that the steel is poured into a wet mould, then he can predict from this practical information that the casting will be defective.

There is no substitute for experience of past conditions and knowledge of current conditions.

Figure 3 shows the normal curve of error of differences. If "A" and "B" pins are actually the same, then differences greater than $t = 1.32$ will normally occur with the frequency shown in the shaded areas in Fig. 3. The area of the shaded portions is .1868 of the total area under the curve (from any mathematical handbook of tables). This means that 19 per cent of the time differences greater than the observed would occur due to chance.

Differences are usually considered to be definitely significant when the possibility that they are due to chance is reduced to odds of 5 out of 100 or less. Any risk value can be chosen, however.

The ideas involved when interpreting single observations and samples of observations have been incorporated into the quality control chart method, which relieves the engineer of a great amount of calculation. The section following shows an example of the quality control chart method as used for interpreting the meaning of production test results.

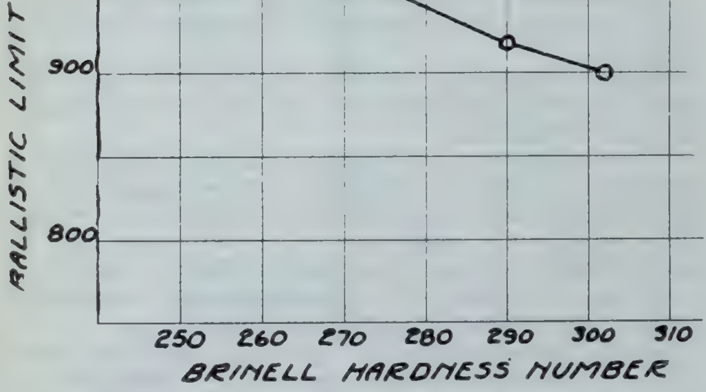


**Fig. 7—Three observations of ballistic limit and Brinell Hardness.**

## 4.—Significance of Variation in Observations During Production

Inspectors of ordnance are greatly concerned with the fluctuation of observations of ballistic limit, the velocity of projectiles, detonation time of fuzes, dimensions of metal parts, strength of metal, etc., etc. The quality control chart method is being used advantageously to study variations in many kinds of observations.

STANDARD DEVIATION, OR SIGMA (SHORT METHOD)

Some familiarity with sigma, or standard deviation, is needed in order to explain the quality control system. In Section 2 the standard deviation of ten izod observations was computed. A simpler method is used on the following example which deals with a group of elongation observations.

This shorter procedure is to take the average of the squares of the observations, deduct the square of the average of the observations, and take the square root of the difference.

Then using the same symbols as in Section 2, we have

$$\sigma = \sqrt{\frac{\Sigma (X^2)}{N} - \left(\frac{\Sigma X}{N}\right)^2}$$

In the example now considered there are ten observations of the percentage of elongation of test-pieces. The numbers found were as follows:

| $X$ | $X^2$ | |
|---|---|---|
| 20.5 | 420.25 | From these figures we get:— |
| 20.5 | 420.25 | |
| 22.0 | 484.00 | Average of squares of observations = 431.475 |
| 20.0 | 400.00 | |
| 23.0 | 529.00 | Average of observations = 20.75 |
| 20.5 | 420.25 | Square of average = 430.562 |
| 21.0 | 441.00 | |
| 20.0 | 400.00 | Difference = 431.475 − 430.562 = 0.913 |
| 20.0 | 400.00 | |

$\Sigma X = 207.5$ $\Sigma (X^2) = 4314.75$ Standard deviation $= \sqrt{0.913} = 0.956$

$\bar{X} = 20.75$

When the average and standard deviation of a group of test results are known, *the following is true if the process is under control:*

68 per cent of the results will be within average ± 1 sigma,
95 per cent of the results will be within average ± 2 sigma,
99.7 per cent of the results will be within average ± 3 sigma.

Even if the process is not under control, the following will hold (Tchebycheff's Theorem):

More than 75 per cent of the results will be within average ± 2 sigma,

More than 89 per cent of the results will be within average ± 3 sigma,

More than 94 per cent of the results will be within average ± 4 sigma.

The accuracy of the above statements, of course, is dependent upon the number of observations used to calculate sigma.

The reliability of the standard deviation is determined as follows:

The standard error of sigma is equal to sigma divided by the square root of twice the number of observations.*

In this case, then, the standard error is .956 divided by the root of 20, or approximately 0.2.

The reliability of the standard deviation, .9, is expressed as follows:

Based on the evidence supplied by the sample,
- the odds are 68 out of 100 that the true sigma lies between .9 ± 2,
- the odds are 95 out of 100 that the true sigma lies between .9 ± 2 times .2,
- the odds are 99.7 out of 100 that the true sigma lies between .9 ± 3 times .2.

The effect of a larger sample upon the reliability of a sample can readily be seen.

GROUPING

The use of sigma assumes that the distribution of observations is symmetrical about the average, that is, the normal curve of error prevails. However, this is not always the case. Hence, often the ± 3 sigma range based on individual observations may be in error. In order to avoid this type of error, the group system has been developed.

Figure 4 shows a frequency distribution for ballistic limits of armour plate. The ballistic limit is the striking velocity of a projectile which will just penetrate a plate. Above the ballistic limit penetration is expected; below the limit the projectile does not penetrate. In the right hand figure, single values have been classified into intervals of 25, etc., and the per cent falling into each class has been plotted. The observed frequency distribution does not follow the normal curve of error. In assuming the normal curve, therefore, we are taking too much for granted. Note that the normal curve calculated from the data of these results indicates a higher percentage of low results than is actually found.

Now, if each successive pair of results is averaged and these averages plotted in a similar way to the first frequency distribution, it will be found that this new distribution follows the normal curve quite closely as shown in the left hand figure. It has been proved both theoretically and practically that by grouping and averaging successive pairs of results the normal curve is approached. The number in the group determines how closely the averages will approach the normal curve, that is, the larger the group the closer to normal the distribution of the averages becomes. However, in industrial conditions we cannot wait to obtain a large group. We wish to obtain results at frequent intervals. Therefore, the practice of using groups of 2 to 10 in size has been widely adopted. The choice of a group of 2 in this case is merely to facilitate the interpretation. The technique of calculating normal control limits is employed in the following paragraphs, which deal with a set of observations of ballistic limits shown in Table I.

Table I gives observations arranged in the order of occurrence and placed in groups of two. For the quality control chart method the average and the three sigma limits are calculated. We are indebted to the A.S.T.M. Manual

*This ignores the correction for sigma of population.

TABLE I
QUALITY CONTROL CHART CALCULATION

| P. No. | B.L. | Av'ge. | Range | Group No. |
|---|---|---|---|---|
| 25<br>26 | 928<br>917 | 922 | 11 | 12 |
| 28<br>29 | 942<br>962 | 952 | 20 | 13 |
| 30<br>32 | 959<br>900 | 929 | 59 | 14 |
| 33<br>34 | 925<br>1016 | 970 | 91 | 15 |
| 35<br>36 | 927<br>1003 | 965 | 76 | 16 |
| 37<br>39 | 914<br>948 | 931 | 34 | 17 |
| 40<br>41 | 955<br>940 | 947 | 15 | 18 |
| 42<br>43 | 940<br>901 | 945 | 89 | 19 |
| 44<br>45 | 910<br>981 | 945 | 71 | 20 |
| 46<br>47 | 955<br>940 | 942 | 15 | 21 |
| 48<br>49 | 861<br>1025 | 943 | 164 | 22 |
| 50<br>51 | 899<br>985 | 942 | 86 | 23 |
| 52<br>53 | 965<br>944 | 954 | 21 | 24 |
| 54<br>55 | 900<br>947 | 923 | 47 | 25 |
| 56<br>57 | 910<br>952 | 931 | 42 | 26 |
| 58<br>59 | 958<br>906 | 932 | 52 | 27 |
| 60<br>61 | 905<br>903 | 904 | 2 | 28 |
| 62<br>63 | 914<br>986 | 950 | 72 | 29 |
| 64<br>65 | 955<br>1008 | 981 | 53 | 30 |
| 66<br>67 | 961<br>949 | 955 | 12 | 31 |
| 68<br>69 | 905<br>955 | 930 | 50 | 32 |
| 70<br>71 | 1002<br>983 | 992 | 19 | 33 |
| 72<br>74 | 949<br>903 | 926 | 46 | 34 |
| 75<br>76 | 912<br>907 | 909 | 5 | 35 |
| 77<br>78 | 955<br>951 | 953 | 4 | 36 |
| 79<br>80 | 903<br>902 | 902 | 1 | 37 |
| 81<br>82 | 952<br>954 | 953 | 2 | 38 |

on Presentation of Data for factors which enable these limits to be easily calculated using only the

$\overline{X}$ = Average of averages.
$N$ = Number of groups.
$\overline{R}$ = Average range.
$A_2$ = Factor for control limits for averages.
$D_3$ and $D_4$ = Factors for control limits for range.

The practical man will find that the mechanics of the method can be used without requiring acknowledge of the underlying theory. The student and research worker will want to study the origin of these factors.

$$\overline{\overline{X}} = \frac{\text{Sum of averages}}{\text{Number of groups}} = \text{Grand average.}$$

$$= \frac{1128}{27} = 42$$

$$\overline{R} = \frac{\text{Sum of ranges}}{\text{Number of groups}} = \text{Average range}$$

$$= \frac{1159}{27} = 43$$

Control Limits for Average

$$= \overline{\overline{X}} \pm A_2 \overline{R}$$
$$= 942 \pm 1.88 \times 43$$
$$= 942 \pm 81$$

Control Limits for Range

$D_3\overline{R}$ and $D_4\overline{R}$
$0 \times 43$ and $3.268 \times 43$
$0$ and $140$

Factors for Control Limits

THE MANUAL ON PRESENTATION OF DATA GIVES FACTORS FOR DIFFERENT SIZE GROUPS AS FOLLOWS:—

| Number in Group | $A_2$ | $D_3$ | $D_4$ |
|---|---|---|---|
| 2 | 1.880 | 0 | 3.268 |
| 3 | 1.023 | 0 | 2.574 |
| 4 | 0.729 | 0 | 2.282 |
| 5 | 0.577 | 0 | 2.114 |
| 6 | 0.483 | 0 | 2.004 |
| 7 | 0.419 | 0.076 | 1.924 |

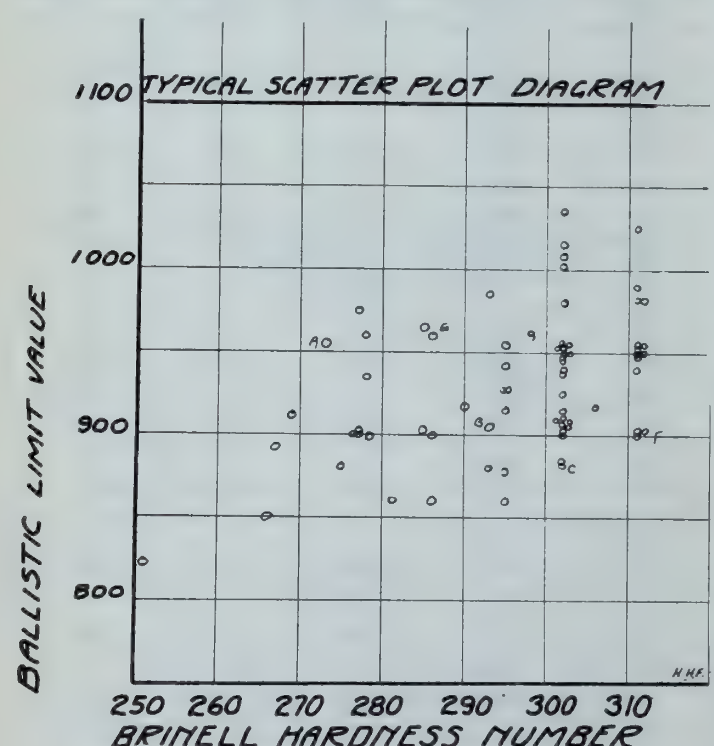


Fig. 8—Scatter plot diagram for 72 observations.

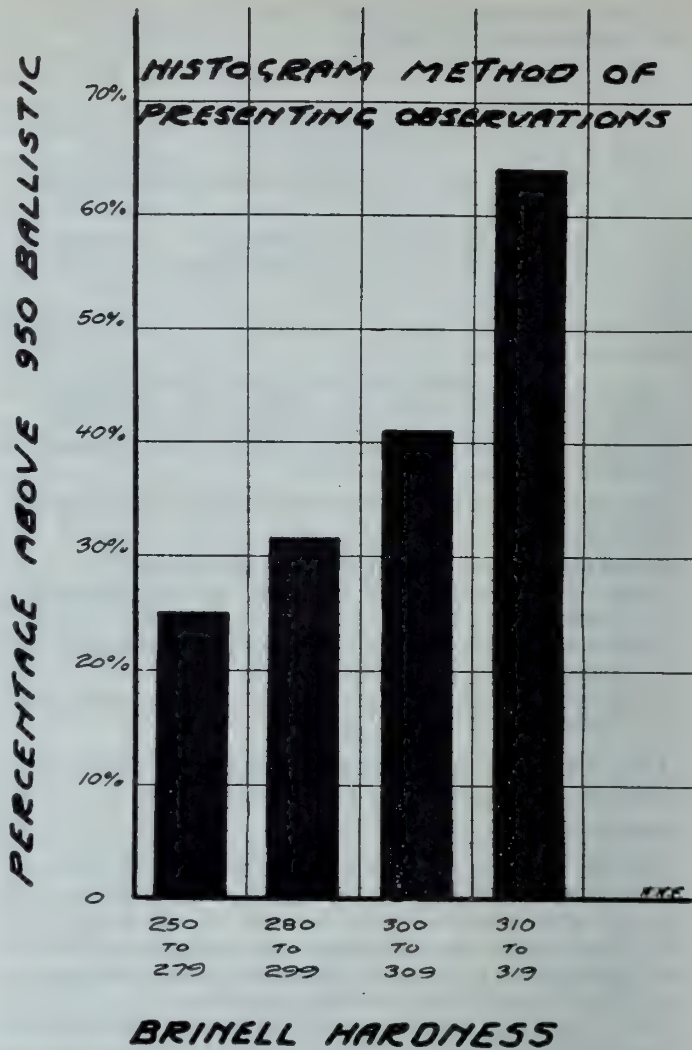


Fig. 9—Histogram presenting same observations.

Note on the charts which have been prepared (shown in Fig. 5) that the first control limits ran from 0 to 24 production plate number. The use of such a small amount of data is not generally recommended since the error in calculating three sigma limits is considerable. However, in this case it serves to give a vague outline of the characteristics of these ballistic limits. Starting at Group No. 10 a continual upward trend* was evident, hence revision was considered necessary at Group No. 12. The revised limits were based on No. 12 to No. 20 exclusive. The data most recently received completed up to Group No. 38. At this point new limits were calculated including data from Groups Nos. 12 to 38. This last calculated limit is more accurate than the previous ones since it is based on a greater number of observations. We may state, with a fair degree of certainty, that as long as the process remains under control, averages of successive groups of two observations will fall within 861 to 1023

*Trends toward change may be detected while the results are still within the control limits. The seven point rule is the safest from the mathematical viewpoint. However, the engineer constantly watching over the process may detect a trend towards change before seven points have been recorded. The seven point rule may be briefly stated as follows: If seven successive points fall on the same side of the average or form a continuous upward or downward path, then it may be fairly certain that a change is taking place in the process. The users of this type of control chart have found by practical experience that in nearly all cases where the control limits are exceeded this extreme variation is due to a definite assignable cause. Therefore, each time control limits are exceeded an immediate investigation should be made. Variations within the control limits are characteristic of the process. In most cases investigation into the cause of difference between any two such observations will be impractical. The cause of slight variations is found more accurately by the correlation or large number method which is described in Section 2.

ft. per sec. and the difference between two successive observations will not exceed 140 ft. per sec.

It is encouraging to note that the lower control limit has increased from 835 to 861 and the control limit for range has been narrowed. These are indications of an improvement in quality and a well controlled process.

#### PRODUCTION RECORD IN QUALITY CONTROL CHART FORM

If a large number of control charts are to be kept, an abbreviated form can be adopted. In Fig. 6 control charts are plotted covering fifteen of the requirements for armour plate. The white dot between the lines indicates "in control." The black dot either above or below the lines indicates "out of control."

This type of production quality record focuses attention on the trouble spots in the process. It also saves management and inspection a great deal of time in studying test records.

### 5.—Correlation Between Two Types of Observations

The idea of predicting the occurrence of an event from observations of phenomena in nature has engaged man's attention from earliest times. The phases of the moon, the positions of stars, flights of birds, and countless other omens were assumed to be definitely correlated with certain types of events. Palmistry and phrenology assume correlations between physical measurements and personal characteristics. The persistence of such theories with no foundation of factual evidence indicates how incapable are many individuals of rational judgment of observations. Instances of this irrational type of interpretation frequently occur even in industries equipped with every known device for making accurate observations but with no system of handling those observations for analysis.

The following examples deal in a simple way with the problem of finding the relationship between two types of observations on a product, as, for instance, ballistic limit and Brinell hardness. In this case would a sample of three sets give sufficient evidence on which to base the relationship indicated by the three points in Fig. 7 ?

Before attempting to judge data of this kind, a background of experience should be obtained. The normal fluctuation of observations should be known.

Figure 8 shows 72 pairs of observations of these two quantities, and indicates that for any given hardness, ballistic limit results vary over a considerable range. Evidently the points selected in Fig. 7 do not represent the true relationship.

The larger the number of data the more accurately will the relationship be portrayed.

#### METHODS OF DETERMINING RELATIONSHIPS BETWEEN TWO TYPES OF OBSERVATIONS

In Fig. 8 a scatter plot diagram for the 72 pairs of observations has been made. From this it is apparent that some relationship exists between the two types of observations. However, to attempt to draw a line through these dots would be only a conjecture. A simple method of analysis is the following: divide the plotted points into groups by vertical lines; select a ballistic limit value near the average of all the observations; determine the percentage of points above the average ballistic in each group; and plot as in Fig. 9.

Such a chart is called a histogram. Before accepting it as definite information the reliability of the results should be calculated. This is done as follows:*

The standard error of percentage is given by the expression,

$$\sigma_p = \sqrt{\frac{P-(1.00-P)}{N}}$$

where $\sigma_p$ = standard deviation of the percentage.
$P$ = percentage.
$N$ = No. of results.

Hence it can be seen that the smaller the number in a group the less accurate is the value obtained.

*See Applied General Statistics, by Croxton and Cowden.

*Example:*

In Fig. 8, in the Brinell range 250-279, three out of a total of 12 observations are above 950 ballistic. That is, 25 per cent are above 950. How reliable is this ? The standard error of the average of the 12 observations.

$$\sigma_p = \sqrt{\frac{P\ (1.00-P)}{N}} = \sqrt{\frac{25 \times .75}{12}} = \sqrt{.01565} = 0.1251.$$

Since the standard error of this average is 0.125, the reliability of the percentage 25 per cent may be expressed as follows:

The odds are 68 out of 100 that the true value lies between .25 ± .125;

The odds are 95 out of 100 that the true value lies between =25 ± 2 x .125;

and so on.

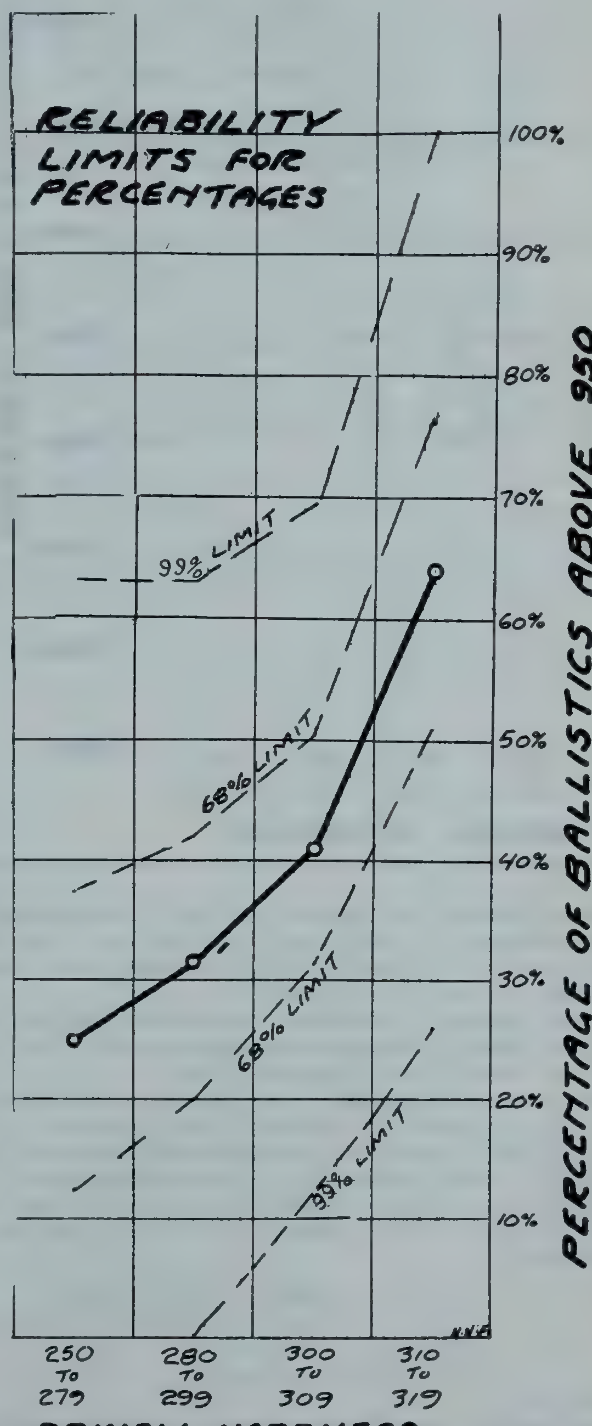



**Fig. 10—Reliability limits for percentages for observations shown on histogram.**

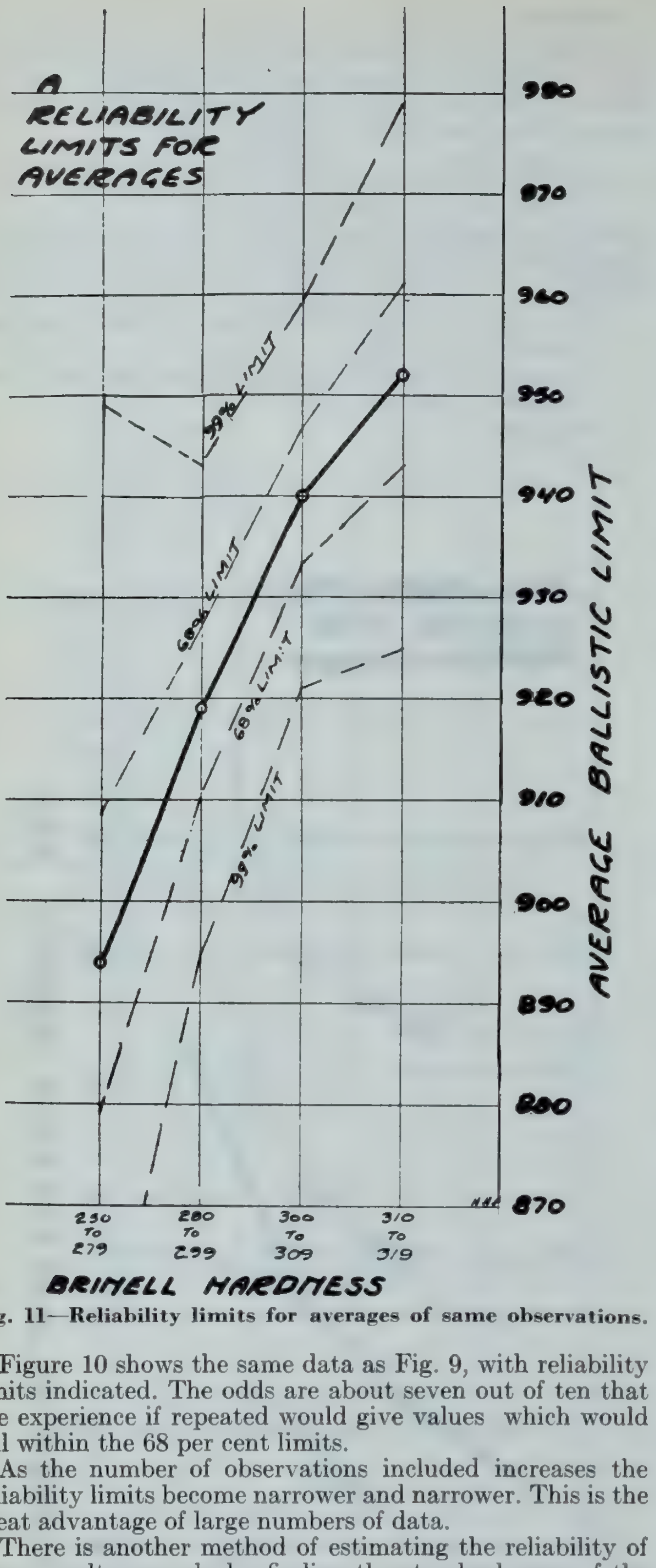



**Fig. 11—Reliability limits for averages of same observations.**

Figure 10 shows the same data as Fig. 9, with reliability limits indicated. The odds are about seven out of ten that the experience if repeated would give values which would fall within the 68 per cent limits.

As the number of observations included increases the reliability limits become narrower and narrower. This is the great advantage of large numbers of data.

There is another method of estimating the reliability of these results, namely by finding the standard error of the averages. Fig. 11 shows the average ballistic value for each group of hardness observations. The standard error of an average is equal to the standard deviation of the observations divided by the square root of the number of observations.*

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{N}}$$

$\sigma_{\bar{x}}$ = Standard error of average.
$\sigma$ = Standard deviation of the observations.
$N$ = No. of results.

*Example:*

The average ballistic limit of material between 250-279 Brinell hardness is 906. Standard deviation is 43.3.

*Ignoring certain corrections for sigma of population.

How reliable is this average?

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{N}}$$

$$\sigma_{\bar{x}} = \frac{43.3}{\sqrt{12}} = 12.5$$

$\bar{\sigma}$ = Standard deviation of all observations. This is actually unknown; the standard deviation of the sample serves as a rough approximation.
$\sigma_{\bar{x}}$ = Standard error of the average.
$N$ = No. of results.

The standard error of this average is therefore 12.5.

The method of using averages appears to be more accurate than the percentage method. Here again larger numbers of observations would give narrower reliability limits. In Fig. 12 the hardness of the samples above 940 ballistic has been plotted as in frequency distribution. The hardness of samples below 940 has also been plotted. Note that if ballistics above 940 are desirable, then it would appear that Brinell hardness from 300 to 319 is more desirable than Brinell hardness from 250 to 299.

There are other methods of determining correlation which involve a considerable amount of calculation. They may be obtained from standard statistical tests.

### 6.—Rational Judgment of Statistical Data

In this matter the practical man familiar with a process has a great advantage over the most precise theorist. He may have a wide background of experience in the light of which he can interpret the importance of a set of observations. The statistician may be in error through biased observations, poor sampling, and also the fact that factors of major significance were not considered.

In judging correlation between two types of observations one of the following general interpretations may be made:

1. A cause-and-effect relationship may exist. Usually, the cause-and-effect relationship should not be inferred unless there is sound engineering evidence to support this theory.

2. The apparent relationship may be due to a third and unknown variable which controls both of the observed variables. For example, quenching speed controls both tensile and hardness properties of steel.

3. There may be other correlations of much greater significance and therefore observed correlation is of only secondary importance.

4. The relationship observed may be only a transient one, that is, existing for a short period of time. As lots of raw material vary, the relationship between properties may vary. Properties of malleable iron vary with different lots of pig iron.

5. Two values may have no connection with each other and the relationships observed may be due only to chance.

6. The relationship is not necessarily a general one. It may hold only for the source of the data.

It is obvious that interpretation can best be made by engineers *thoroughly familiar with the process and with the methods and with the properties of the material.*

A correlation between Brinell hardness and tensile strength is normally expected and considered to be a true cause-and-effect relationship. A correlation between silicon and tensile strength would generally be considered by the metallurgist to be either accidental or transient. The statistician unfamiliar with the process may frequently select observations for correlation which are of little significance when compared to other major controlling variables in the process. However, it is often of interest to study apparently unrelated observations, for important discoveries have been made along this line of investigation.

The best proof of reliability is the fact that the same relationship occurs during several successive intervals of time. It has been found that, in the tests referred to, the relationship between Brinell hardness and ballistic limit has remained the same over four successive six-months periods. From this we are able to state that the relationship is of a permanent nature. We still do not have sufficient proof to state whether it is a cause-and-effect relationship or whether a third and unknown factor controls both Brinell and ballistic observations.

### Conclusions

A question frequently asked is how can war material be improved?

This article has shown one way in which industrial products can be improved. The steps are:

Make tests and observations during manufacture.
Record performance of the material.
Study the observations and their fluctuation.
Find correlation between types of observations.
Apply information so gained.

Unaided human judgment is frequently biased or in error. In handling large numbers of observations, some use should be made of the science of statistics to aid in judging the relationships between test data and variation of observations.

This article serves merely to introduce the subject. Those who intend to utilise statistical methods should refer to standard texts.

As man-power and materials become scarcer, it is of greater importance that industrial processes and inspection of materials become more efficient. When observations are interpreted rationally and statistical methods are used, inspection becomes an engineering science.

A great many of the larger manufacturers in Britain and the United States are using scientific inspection methods. Reports from users of scientific inspection state that rejects are decreased and at the same time man-hours of inspection are reduced by from 25 to 50 per cent of pre-scientific inspection period. These savings can be a valuable contribution to the war effort.

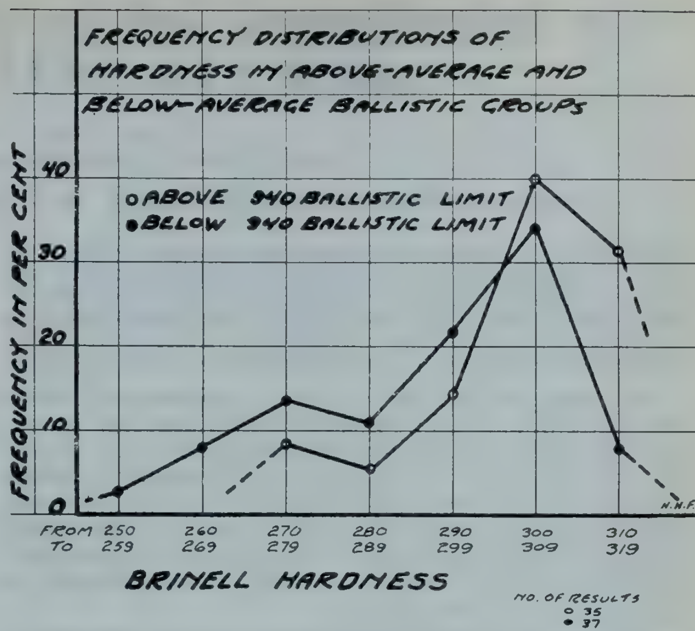



Fig. 12—Frequency distribution of hardness in above average and ballistic groups.

### Bibliography

A.S.T.M. Manual on Presentation of Data—American Society for Testing Materials.

Quality Control Chart Method—American Standards Association.

Applied General Statistics, by F. E. Croxton and D. J. Cowden, Prentice-Hall, Inc., New York, 1940.

Engineer's Manual of Statistical Methods, by Col. L. E. Simon, United States Ordnance, John Wiley & Sons, New York, 1941.

Economic Control of Quality of Manufactured Product—by W. A. Shewhart; D. Van Nostrand Co., New York, 1939.

Quality Control of Munitions—G. D. Edwards, War Department, Washington, D.C., *Army Ordnance*, 1942.

# AN ENGINEERING STUDY OF GLACIAL DRIFT FOR AN EARTH DAM, NEAR FERGUS, ONTARIO

ROBERT F. LEGGET, M.E.I.C.
*Assistant Professor of Civil Engineering, University of Toronto, Toronto, Ont.*

**Reprinted from *Economic Geology*, Vol. xxxvii, No. 7, November, 1942, with the kind permission of the publishers**

**ABSTRACT—The following record of some of the mechanical properties of glacial drift near Fergus, Ontario, is based on soil testing carried out during construction of the Shand Dam. Mechanical testing of samples permitted the conclusion that the "clay-sized soil particles" behave as granular material. Minerological examination could be utilized to corroborate this.**

The Grand River is one of the major streams of southwestern Ontario. It has a drainage area of about 2,600 square miles; the cities of Kitchener, Waterloo, Galt, Paris, Brantford and Guelph are the main centres of population in this important section of Canada (Fig. 1). In recent years, the flow of the Grand River has caused severe flooding during spring seasons and has been correspondingly low during later months of the year, thus constituting a menace alike to property and to public health.

After a long period of discussion, the Grand River Conservation Commission was set up in 1938 to carry out remedial works in order to conserve the river flow. Dr. H. G. Acres was appointed chief engineer, and on the basis of his studies and report, construction was started in July, 1939, of the Shand Dam (located three miles north of Fergus) as the main regulating structure for the river. The dam consists of a central concrete section, supporting four steel sluice gates, flanked by earth embankments which constitute the major part of the structure, containing about 500,000 cu. yd. of earth. These two embankments vary up to 75 ft. in height: they were constructed by the rolled-fill method, in accordance with currently accepted practice. Based on modern soil mechanics studies, this practice requires a close control over the quality of earth used for fill, and over its moisture content, throughout all stages of construction.


**Fig. 1—The Grand River and main tributaries.**

Preliminary information about the soils available at the dam site was therefore necessary, to enable Dr. Acres and his staff to proceed with their designs and contract documents for the dam construction. Accordingly, in April, 1939, Professor C. R. Young, head of the Department of Civil Engineering of the University of Toronto, was commissioned to undertake the necessary field and laboratory soil testing preliminary to the start of regular soil testing during construction. Professor W. L. Sagar and the writer assisted Professor Young and carried out the necessary laboratory work; the digging of test pits at the site was carried out by a local contractor.

All the unconsolidated material in the vicinity of the dam site is of glacial origin. For the soil investigations 70 test pits were dug, and sampled down to maximum depths of about twenty feet, the pits being carefully located, generally within a radius of one mile from the centre of the dam. The resulting test results therefore constitute a reasonably intensive local study of glacial drift. There appears to have been very little published about the mechanical properties of the drift and so this paper has been prepared in order to make this information generally available. Results of the tests provided the basis on which the selection of material for use in the dam was made, and upon which designs were prepared, but with these aspects of the work this paper is not concerned.[1] Results of mechanical tests on samples of the drift are included, however, since they suggest certain conclusions about the nature of the finer soil particles in the drift.

## Geology of the Dam Site

The following notes by Dr. J. F. Caley of the Geological Survey of Canada are presented as describing the general geology of the area in which the Shand Dam is located.

> The following remarks refer to an area of about 150 sq. mi. which includes the site of the Shand Dam: it is traversed diagonally in a southwest-northeast direction by the Grand River and by its major tributary, Irvine Creek. The entire area is underlain by Palæozoic sedimentary rocks of which two formations are represented; these are the Guelph dolomite and the overlying Salina calcareous muds and dolomites. The rocks have suffered no major deformation and their present attitude is a fairly uniform dip averaging between 20 and 30 ft. per mile in a general southwesterly direction.
>
> With the exception of a narrow strip at the southwest corner of the area which is underlain by Salina strata the Guelph dolomite constitutes the uppermost bedrock throughout the entire region. The contact between the two formations forms a northwest-southeast trending line which crosses the Grand River about one mile northeast of Pilkington. Guelph rocks are exposed in the bed and banks of Grand River about one mile above the village of Belwood, and almost continuously from Shand Dam to about two miles below Elora. Small isolated outcrops also occur at Invernaugh and at several localities on Swan and Cox Creeks. At Elora, where Irvine Creek joins Grand River, both streams have cut a gorge exposing nearly 90 ft. of the formation. In addition, exposures have been made by quarrying at both Fergus and Elora.

[1] For engineering details see McQueen, A. W. F., and McMordie, R. C.: Soil mechanics at the Shand Dam. Engin. Jour. 23: 161, Montreal, April, 1940.

The Guelph rocks are light gray, buff, and brownish coloured, finely crystalline to dense and granular textured gray weathering dolomites with a small bituminous content commonly in the lower few feet of the formation. The bedding varies from a few inches to upward of 3 ft. in thickness with commonly even bedding planes which may be quite smooth or rough and irregular. Some exposures show thin dark gray and greenish calcaro-argillaceous partings along irregular bedding surfaces. The chemical composition is remarkably uniform throughout most of the formation. Some exposures show irregular vertical jointing but this is not a conspicuous feature wherever these rocks have been seen. Small solution cavities, many lined with minute dolomite or pyrite crystals are common and in many places circulating waters have dissolved out the material filling whorls of gastropods and other fossils.

The rocks of the Salina formation underlie but a narrow strip at the southwest part of the area. Only the lower few feet of the Salina are present and since nowhere in the area are these rocks exposed, their presence is known only from test borings. As seen at the outcrop elsewhere in Southwestern Ontario and in samples taken from borings for natural gas, the Salina consists of dark gray and greenish thinly bedded and hackley weathering limy shales or argillocalcareous mud rocks with interbeds and alternating zones of brownish and gray, slaty, dense, dolomite. In the Niagara peninsula, small quantities of gypsum occur throughout the formation while farther west considerable thicknesses of Salt are present.

The entire region has been glaciated and is covered with a mantle of unconsolidated material which attains a maximum thickness of about 175 ft. As seen along the stream valleys and road cuts this overburden consists of sand, silt, gravel and boulder clay with sand and gravel probably constituting the major portion of the total. In the immediate vicinity of Shand Dam the bedrock on the left side of the river is immediately overlain by at least 40 ft. of clay and boulder clay although irregular gravel and sandy lenses seem also to be present. On the right side a similar general condition prevails but with more gravel and boulders with some sand overlying the bedrock and succeeded by clay. It should be remembered that the general retreat of a glacier is in detail composed of a number of minor oscillations or advances and retreats and that such a movement may result in extreme heterogeneity of the unconsolidated deposits. This feature of glacial deposits was clearly indicated by the records obtained from the test pits dug at the Shand Dam site.

### Methods of Obtaining Samples

Figure 2 shows the area in which the dam is located and the positions of the test pits dug in connection with the soil testing herein described. Pits were in general about 5 ft. by 5 ft. in cross-section, and were sunk wherever possible to depths of between 15 and 20 ft. All excavation was by hand, the use of picks being necessary in practically all pits except those in sand. Little timbering was required, due to the unusually compact nature of the material. One pit required the use of a steel casing, and the presence of water caused delays in a number of other cases; as the work was carried out just as the snow was disappearing, this was to be expected. Excavation amounted to 712 cu. yd. requiring 1,982 man-hours of work for its execution. All pits were backfilled after inspection and sampling.

Samples, each weighing about 30 lb., were taken at intervals of about 5 ft. from all uniform material. Additional samples were taken at all noticeable changes in the soil profile of each pit. All samples were shipped to the Soil Mechanics Laboratory of the University of Toronto where the soil testing was carried out. In addition to these disturbed samples, relatively "undisturbed" samples were also obtained and shipped to Toronto. These were obtained by smoothing off the bottom of a test pit and placing thereon an inverted cylindrical steel can (10 in. in diameter and 12 in. high). With a trowel, the soil around the circumference of the can was gradually removed, the can being steadily pushed down and encasing the cylinder of soil thus shaped. Cutting away of the soil continued after the can was full, to such a depth that the cylinder of soil could be cut off well below the lower edge of the can. After the can had been inverted, the soil was trimmed off flush with the edge of the can, the lid secured and bound up with special waterproof sealing tape. All these undisturbed samples arrived safely at the Laboratory. Careful checks showed the moisture contents of the samples when opened up several weeks (and sometimes months) later to agree very closely with corresponding moisture contents for samples tested in the field office immediately on removal from the pits. These "undisturbed" samples were used principally for investigating the shearing strength of the material which was to be left in place under the dam as part of foundation strata.

### Mechanical Analysis of Samples

On arrival at the testing laboratory, samples were air dried and thereafter broken up for sieving. This was carried out in the usual way through 3, 1½, ¾, ⅜ in. sieves in the first instance, and thereafter through Tyler No. 3, 4 and 8 sieves. In order to save time, analysis by hydrometer followed. Fifty grams of that part of each sample which passed through the No. 8 sieve were taken and soaked in distilled water. This material was then used for the now standard method of hydrometer analysis.[2] Hydrometer readings were taken at intervals up to two hours from the time at

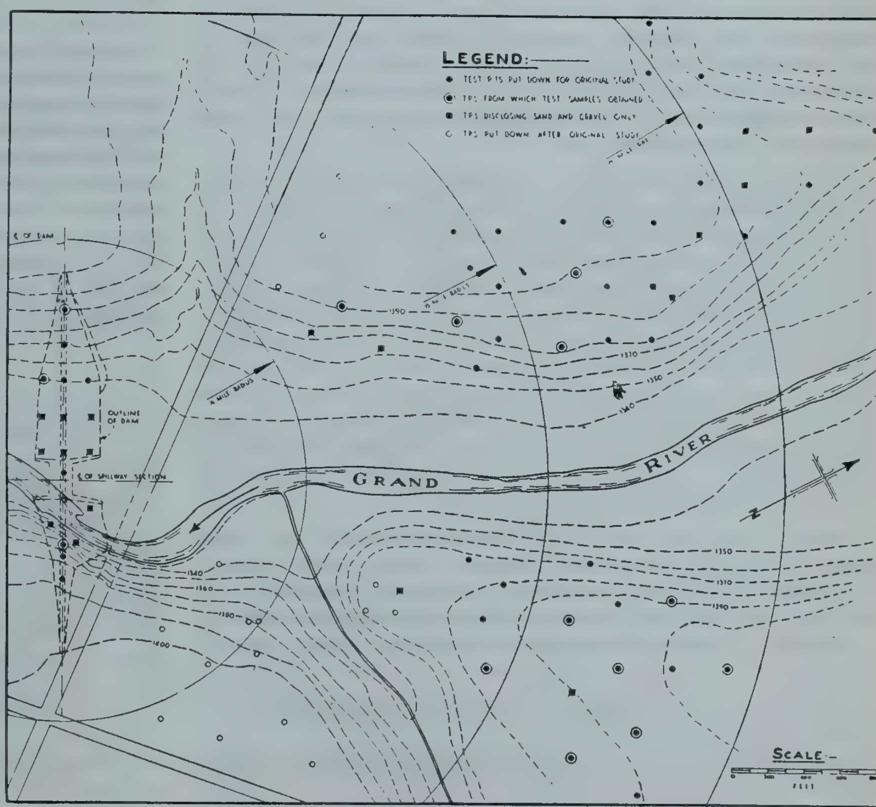



**Fig. 2—Plan of the Shand Dam site, showing location of exploratory test pits.**

[2] See, for example, Tentative method of mechanical analysis of soils. Proc. Am. Soc. Testing Materials 35: Pt. 1, p. 953, 1935.

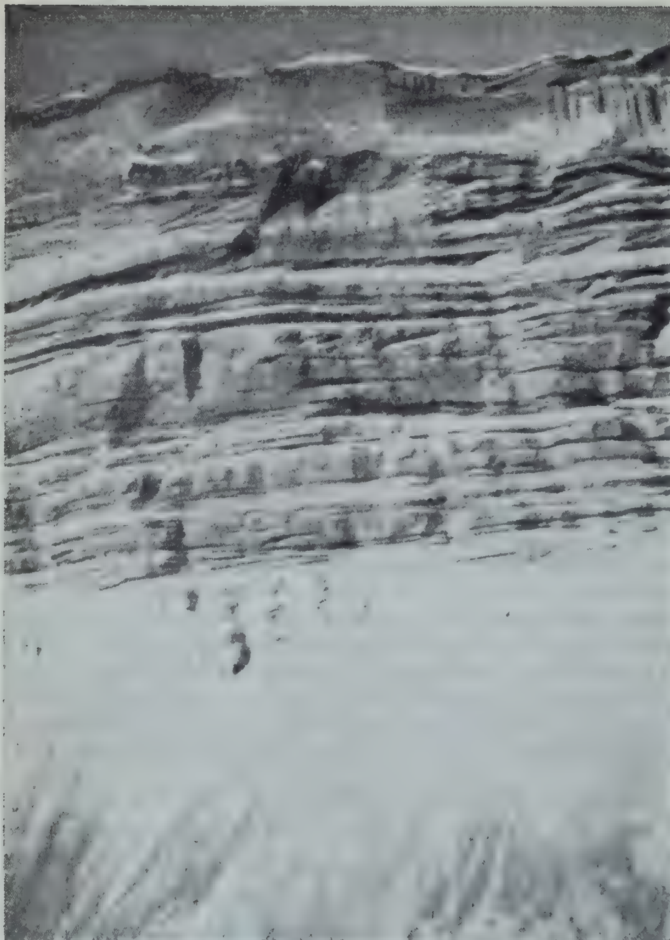


**Fig. 3—Photograph of stratified sand and gravel.**

which shaking of the mixture was stopped, and in this way grain sizes down to the equivalent of a diameter of about 0.005 mm, from an equivalent diameter of about 0.060 mm, were determined. The material was then carefully washed out onto a No. 200 sieve; that part which was retained was dried and analyzed by being sieved through No. 14, 28, 48 and 100 sieves. The results of this analysis were then plotted on a standard form of semi-logarithmic paper, one form being used for each test pit.

Of the 70 pits studied, 18 revealed sand and gravel as the predominant materials in the soil profile. Of these 18, 9 were adjacent to the dam site, and were clearly in alluvial material. The remaining 9 were located in higher ground, and from the stratified appearance of the sand and gravel in them, it is reasonably certain that they disclosed water-sorted glacial material. One of these pits (R) disclosed such excellent sand that the area around it was later stripped of overburden, and developed as the source of supply of fine sand used to improve the pit-run gravel concrete aggregate. An accompanying photograph (Fig. 3) shows the stratification. Some of the gravel thus revealed was used in the pervious section of the dam structure.

From all the test pits, 225 individual samples were obtained. Towards the end of the soil testing work, after it had been found that, in general, individual samples from the same test pit gave very similar analyses, it was decided to combine the several samples obtained from each pit and to prepare from the resulting mixture a "composite pit sample." Due account was taken of all noticeable variations in the soil profiles by weighing the respective amounts of the individual samples, when necessary. The object of this operation was to save time, in view of the pending start of construction, and this it did by reducing the number of samples to be analyzed to 139.

Of these 139 samples, 41 consisted of sand and/or gravel from the 18 pits already mentioned. The remaining 98 samples were all of material that was classed in the field as either "sandy clay" or "silty clay," being typical of the hard soil mixture that is generally known as "boulder clay." The uniformity of this material is shown by Fig. 4 for the analysis curves given by 79 of the 98 samples (44 individual samples and 35 composite pit samples) come within the limits shown on the chart. The chart shows, in addition to the two limiting curves, a number of typical analysis records.

There has been included also a graphical record of the average mechanical analysis of till or boulder clay from the Boston, Mass., district given by Prof. W. O. Crosby in one of the first, if not the first paper in English upon the composition of glacial drift.[3] It is interesting to note the close agreement of the two sets of analyses.

The uniform shape of the analysis record curves is also worthy of note. All those shown are slightly concave downwards. Of the analysis curves not shown (132 in number) only 17 did not conform generally to this shape. These exceptions were all from the pits that were excavated in sand and gravel; they displayed the usual steeply graded analysis curve in the sand range of particle sizes. This downward concavity is a marked feature of practically all other analysis record curves for glacial drift which the writer has examined; typical are the diagrams reproduced in Professor W. C. Krumbein's study of glacial till from the southern end of Lake Michigan.[4] It has been suggested that the shape of the curves shown in Fig. 4 is typical for residual soils and that if the concavity is reversed, a better graded soil mixture is denoted, typical of water-sorted soil mixtures.[5] The coincidence of analysis curves for glacial materials with the type curve for residual soils is a fact of some interest.

## Physical Characteristics

SPECIFIC GRAVITY OF SOIL SOLIDS. Concurrently with the prosecution of mechanical analyses, typical soil samples were selected and the specific gravity of the soil particles was determined by means of a Le Chatelier flask, using a 50-gram sample. Air was exhausted from the soil and distilled water, the vacuum obtained approximating to 29 in. of mercury. Values so determined for the specific gravity varied only between 2.77 and 2.78. So uniform were the results obtained that after eleven typical samples had been treated in this way, from pits well distributed over the area being studied, testing of this soil property was discontinued.

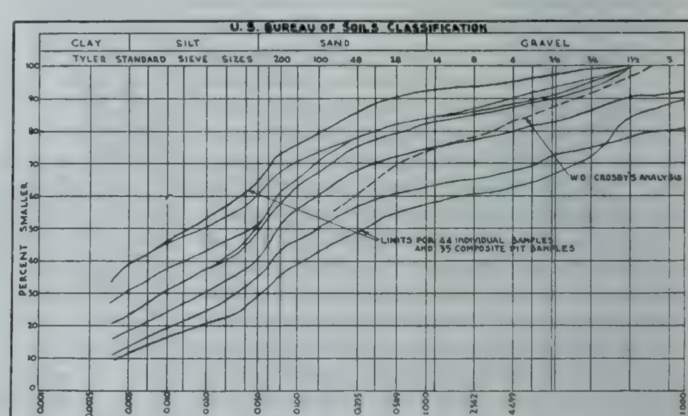



**Fig. 4—Mechanical analysis record curves.**

---

[3] Crosby, W. O.: Composition of the till or boulder-clay. Proc. Boston Soc. Nat. Hist. 25: 115-140, 1892.

[4] Krumbein, W. C.: Textural and lithological variations in glacial till. Jour. Geol. XLI: 382-408, 1933.

[5] See, for example, Lee, C. H.: Selection of materials for rolled-fill earth dams. Proc. Am. Soc. Civil Engin. 103: 1-61, 1938 (and accompanying discussion).

COMPACTION AND OPTIMUM MOISTURE TESTS. The work of Kelso in Australia,[6] and Proctor in the United States,[7] has demonstrated the importance, in earth dam construction, of the degree of compaction to which the soil is subjected and the moisture content of the soil when it is compacted. It is found that, when compacted under identical conditions, a soil mixture will steadily increase in weight as the moisture content increases until a certain maximum, or optimum, point is reached. If the moisture content is increased still further, the weight of the soil will decrease. The change in weight is explained by the action of the added water which first fills the voids between solid soil particles, displacing air as it does so, during which process the weight of the soil will obviously increase. Once all the voids are filled with water, the addition of more water serves to separate the soil particles, the additional water acting as a lubricant, and the weight decreases. A little consideration will show that in an earth dam, part of which will be saturated with water, it is desirable that the earth, when tamped in position in the dam, shall have a moisture content as close as possible to this optimum value so that, as water percolates through the dam, the volume of the saturated soil shall not change.

For the determination of this optimum moisture content in the laboratory, a technique has been developed by R. R. Proctor.[7] Sixteen typical composite pit samples from the Shand Dam site were selected and subjected to this testing procedure. Analysis record curves for the sixteen samples are given in Fig. 5, and it will be seen that they include two that do not conform closely to the general type, those for samples O and U. These soils were all tested by the Proctor method, which consists essentially in compacting a portion of the soil mixed up with a known percentage of water in a cylinder of known volume by means of which the unit weight of the compacted soil can be determined; compaction is standardized by the use of a ram of known size and weight (5½ lb.) dropped 25 times on to the sample placed in three successive layers, from a height of 18 in.

The resulting compaction curves are shown in Fig. 6. The varying shape of these curves may be explained by the uneven distribution of observed results, but it will be seen that they all show clearly a maximum value for the soil moisture content. In addition, the right hand sections of all the curves come relatively close to, and are roughly parallel to the line marked "Zero Void Line." This line shows the theoretical weight of a material having a specific gravity of 2.75 having no intergranular voids other than those represented by the appropriate percentage of water present. The gap between the record curves obtained for the Shand sam-

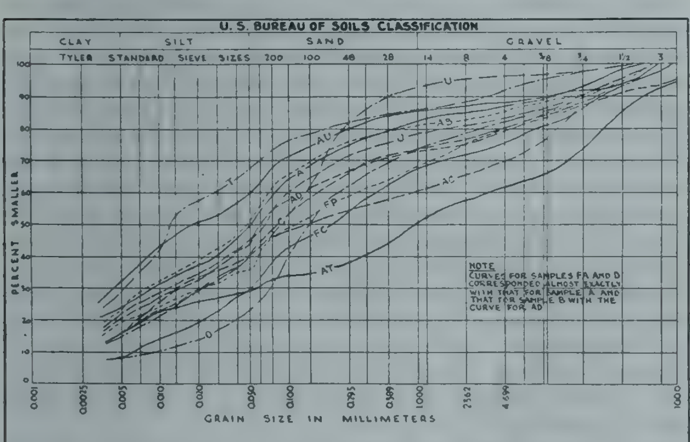



**Fig. 5—Analysis record curves for sixteen special test samples.**

[6] Kelso, A. E.: The construction of the Silvan dam, Melbourne water-supply. Min. Proc. Inst. Civil Engin. 239: 403-446, London, 1936.

[7] Proctor, R. R.: Fundamental principles of soil compaction. Engin. News Rec. 111: 245, 286, 348, 372, 1933.

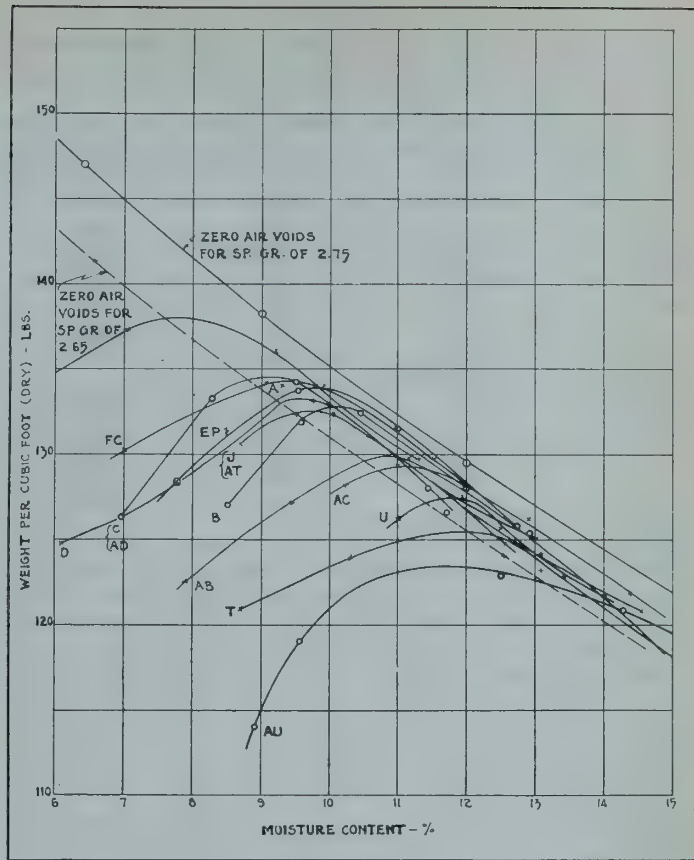



**Fig. 6—Compaction curves for sixteen special samples.**

ples and this line is accounted for by the fact that under the conditions of the Proctor test, which represent field conditions on a small scale, it is impossible to remove all the air from the voids in the soil, the gap thus representing percentage of air still retained in the soil at the conclusion of the test.

PERCOLATION OF WATER THROUGH SOILS. Another important soil property, in relation to the design of an earth dam, is the rate at which water will percolate through the soil of which the dam is to be made. This characteristic of the Shand soil samples was determined by testing specimens 3 in. thick, contained in an 8-in. diameter cylinder, and compressed between porous plates each 1 in. thick by a load equivalent to about 20 ft. of soil. The test conditions were therefore equivalent to an average position of the soil in the dam structure. The test load was maintained by means of a heavy spring device, which enabled the test cylinder to be moved about in the laboratory. By means of sensitive micrometers the amount by which the soil samples were compressed by the test load was determined in each case.

In order to maintain uniform conditions of test, all soil samples were tamped in place, by a uniform number of equal blows from a standard rammer, after having been mixed up with the respective optimum moisture content. After compression of a sample had stopped, the test cylinder was connected to a column of water by a suitable connection which led the water to the bottom of the soil sample, through which it percolated upwards, thus driving out entrapped air. When steady flow had been attained, readings were taken at the top of the water column to determine the rate of flow. This rate was surprisingly low; most of the samples required a head of water of 40 ft. before water would even pass through them within a reasonable period. Table I gives a summary of the results, and from this may be seen the uniformly low percolation rate. To facilitate interpretation of the rates given, it may be noted that the lower rates of flow correspond to a few cubic inches of water passing through the 3-in. sample, under a head of 40 ft. in 24 hrs.

TABLE I

Percolation Coefficients and Consolidation of Soil Samples in Percolation Test Cylinders

| Sample | Total Consolidation of 3-inch Sample (inches) | Consolidating Load (lbs sq. inch) | Percolation Rate (cu. ft/sq. ft/year at unit gradient) |
|---|---|---|---|
| A | 0.0951 | 20 | 0.074 |
| C | 0.0959 | Do. | 0.0319 |
| D | 0.0779 | Do. | 0.0156 |
| J | 0.1068 | Do. | 0.1060 |
| O | 0.0468 | Do. | 0.234 |
| T | 0.0897 | Do. | 0.052 |
| U | 0.0839 | Do. | 0.024 |
| AB | 0.0843 | Do. | 0.0196 |
| AC | Not obtained | | |
| AD | 0.0740 | Do. | 0.0124 |
| AT | 0.1093 | Do. | 0.018 |
| AU | 0.0857 | Do. | 0.091 |
| CH | 0.0909 | Do. | 0.0161 |
| FA | 0.0953 | Do. | 0.0089 |
| FC | 0.0574 | Do. | 0.224 |
| FP | Not obtained | | |

Naturally, these results were very satisfactory when considered in relation to the design of the Shand Dam.

Soil shear tests. The concluding series of tests, carried out on 16 selected samples, consisted of determinations of the shearing strength of the soil. If thought is given to the structural action of the material of which an earth dam is made, it is clear that tensile stresses will not be of any significance since the material of which the dam is built possesses negligible tensile strength. Compressive stresses will not be of a high order. Shear stresses, however, may be relatively high and consequently govern the design. The purpose of the laboratory tests was to determine the shearing strength of the soil samples, with varying moisture contents, so that the design calculations for the cross-section of the dam might be based on actual rather than on assumed soil shear strengths.

The tests were carried out in a shear testing machine, constructed at the University of Toronto. The shear box, in which the sample is placed, consists of two similar rectangular brass frames, enclosing an area of 240 sq. cm, and each

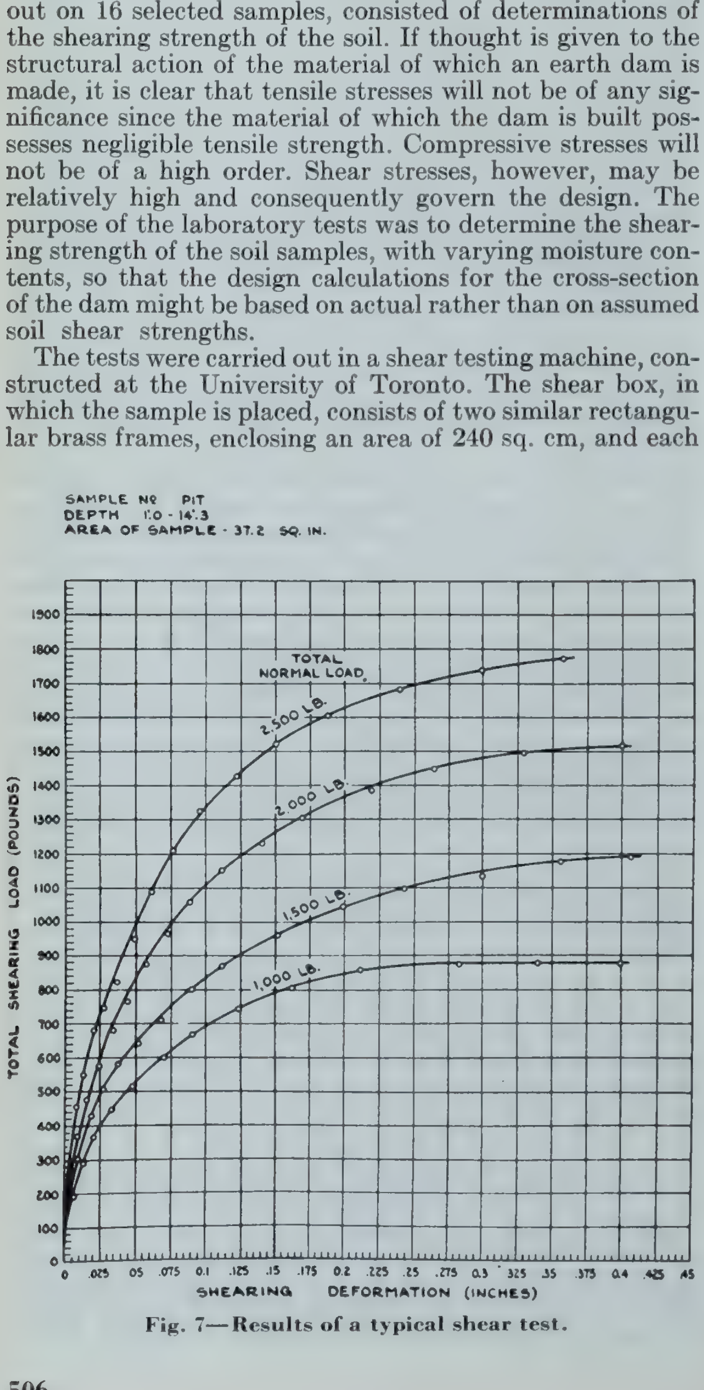



**Fig. 7—Results of a typical shear test.**

about 4 cm high. When one is placed vertically over the other, they form the box into which the sample is placed. Serrated brass plates, fitting snugly into the box, grip the top and bottom of the soil sample, and a heavy brass plate of the same size forms a movable top. A constant vertical load can be applied to this top plate, through a spherical seat, and so any desired normal load can be applied to the soil sample. After this load is applied, the top section of the shear box can be separated slightly from the bottom section, by means of lifting screws, and secured in this position, the only connection between top and bottom sections being then provided by the soil sample which has been so placed in the box that this division of the box occurs along its longitudinal centre plane. By means of a jacking device, the bottom of the box is then slowly pulled away from the top of the box, in a horizontal direction, and the resulting shear resistance developed by the soil is measured by a suitable load-measuring device. Movements of the box during test are measured by means of sensitive micrometer dials.

Figure 7 presents the results of a typical test in graphical form. It will be seen that as the horizontal deformation increases, the shear resistance also increases but at a gradually decreasing rate, finally becoming constant. The relation between these maximum values of shear resistance and the corresponding normal loads on the samples is shown in Fig. 8. From this it will be seen that a straight-line relationship exists. The angle of inclination of the line with the horizontal is known as the angle of internal friction, and the intercept with the vertical axis gives the value of the apparent "cohesion" of the soil particles. These two factors determine the shear strength as required for design purposes. Figure 8 is typical of the results obtained for all 16 samples.

Since the soil was to be placed in the dam mixed with its optimum moisture content, tests were first conducted on samples of soil mixed up with the requisite amounts of water, and tamped into place in the shear box to approximately the same degree of compaction used for the Proctor compaction tests. In order to investigate the effect of variations in the quantity of water present upon the test results, an extensive series of tests was conducted upon sample AB, under the conditions already described (1) and also as follows:

(2) Soil at optimum moisture content plus one per cent, compacted in the shear box, and left under full normal load for a period of 12 hrs. or more before being tested;

(3) Soil mixed up with water in the shear box to the consistency of fluid mud, left under the full normal load for 12 hrs or more, and then tested.

The second condition was investigated to take into account probable variations in the soil moisture contents obtained under field conditions. The third condition was analogous to the state in which the soil might be held to be when the dam is in use, and water has permeated through the lower part of the "impervious" part of its cross section. It was possible to carry out the test under the conditions described by having the shear box surrounded by a water bath, the water in which completely covered the sample, to which it had access through holes in the bottom of the shear box and through the porous plates which were substituted for the serrated plates used in the "dry" tests. Submerged tests were conducted on many samples other than AB, and in every case the soil sample removed from the box after the test was in the form of a solid state of compact soil even though at the start of the test the mixture was so fluid that it could have been "poured" into place from a container.

It was found that, within the limits of experimental error and allowing for the possible variations in the individual samples used, there was no appreciable difference between the results obtained under the three sets of conditions. This agreement was naturally welcome in relation to design work. It enabled all further shear tests to be carried out on samples in the first condition only.

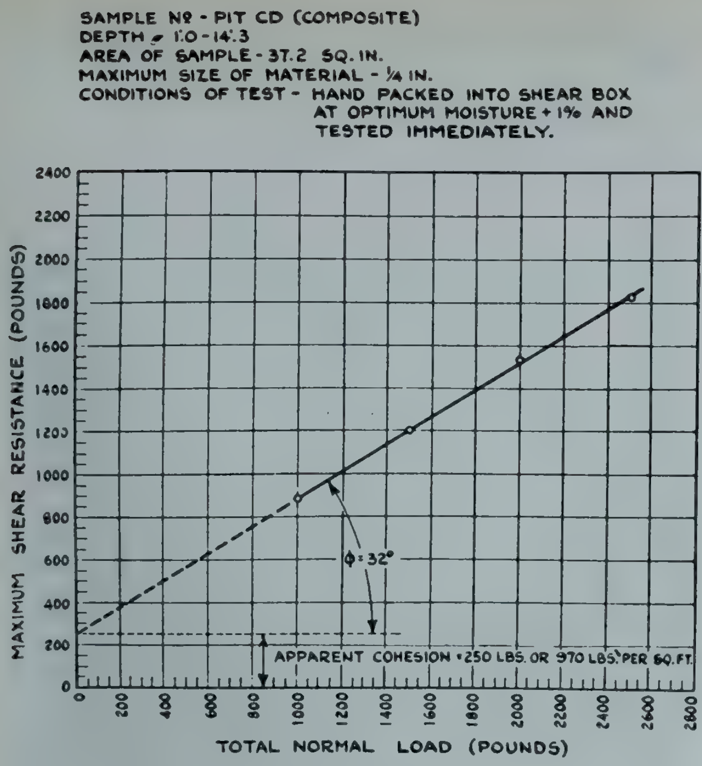



**Fig. 8—Typical relation between normal and shear loads.**

## Review of Mechanical Test Results

The foregoing account describes briefly the testing procedure that was followed in connection with the soil investigations for the Shand Dam. In view of the urgency with which results were required, it was not possible to review carefully the results obtained until some time after the conclusion of the regular testing programme. Three aspects of the results seemed to call for attention and are discussed below.

UNIFORMITY OF MECHANICAL ANALYSES. When comparing the mechanical analysis record curves, the general uniformity of the shape of all the curves obtained for soils other than those which were clearly predominantly sandy attracted attention. This feature is demonstrated, to some extent, by the group of typical curves shown in Fig. 4. Consideration was therefore given to other ways of plotting these analysis results in the hope that this uniformity might be better displayed, and so be more useful.

The most satisfactory arrangement was found to be given by plotting the proportions of the sand, gravel and clay sized particles on a tri-linear chart. Fig. 9 shows the appearance of the completed chart. The percentages shown have been calculated by considering all material in each sample below one millimeter in effective diameter as 100 per cent, and then subdividing this into sand (0.050 mm to 1.00 mm), silt (0.005 mm to 0.050 mm) and clay (below 0.005 mm) sized particles.

The chart shows clearly a definite "grouping" of points, apart from those denoting the sandy soils that were analyzed. Fifty-three per cent of the points representing clayey samples are located within the inner triangular limit marked on the chart, and 87 per cent within the outer limit indicated. Since variation in the quantity of particles larger than 1.00 mm in effective diameter, the gravel content of the glacial clay, does not affect the mechanical properties of the soil mixture (provided, of course, that the total quantity of gravel remains the minor constituent) it would appear that the use of this tri-linear "guide-chart" may prove to be a useful aid in the interpretation of the results of the mechanical analysis of glacial clays considered for use in engineering work. Mechanical analysis can never be more than a general guide in the selection of soils for engineering purposes, and so the saving of time which can be effected by the use of such a chart as Fig. 9, as compared with plotting the full semi-logarithmic analysis record curve, would seem to be of some importance.

ATTEMPTED CORRELATION OF TEST RESULTS. During the conduct of the tests it was noticed that one or two samples (O and FC, for example) usually occupied a position in the summarized test results adjacent to one end of the list adopted. The attempt was therefore made to see if any general correlation existed between the various sets of test results for the complete series of samples. Figure 10 is a typical result of this enquiry. From an examination of this chart it can be said that, in general, no such correlation appears to exist.

NATURE OF CLAY-SIZED SOIL PARTICLES. The fact that the soils being tested were known to be of glacial origin naturally suggested that the finest soil particles would be rock flour. It is interesting to note how the results of the mechanical tests would have led to this conclusion, irrespective of this prior knowledge.

The high specific gravity of the soil solids presented the first unusual feature. An average figure used as the specific gravity of soil particles is 2.65. This corresponds to the known specific gravities of the commoner type of clay-minerals (*e.g.* kaolinite 2.60). In view of the great accuracy required in carrying out specific gravity determinations, it might be thought that the value of 2.77 was unduly high because of experimental error. Reference to Fig. 6 shows that this uncertainty is unwarranted. It has already been pointed out that all the compaction curves approach closely the Zero Air Voids line, for a specific gravity of 2.75. As a matter of convenience, the Zero Air Voids line for a specific gravity of 2.65 has been added to the diagram, as a broken line. It will be seen to intersect all the compaction curves. This is an obvious physical impossibility, and so the specific gravity of approximately 2.77 is confirmed. This value suggests, if it does not prove the presence of some fresh minerals in the finest soil particles.

Final proof of this is afforded by the comparative shear tests made on sample AB and, indeed, by the shear test results generally. Fine grained clay soils develop their shearing strength primarily from their cohesive character, cohesion being an intramolecular attraction as yet imperfectly understood but known to be related to particle shape and size. It may be considered as a combination of "true cohesion" and "apparent cohesion," the latter being dependent upon capillary attraction developed by the small quantities of water that fill the voids between soil particles. Apparent cohesion is demonstrated by the fact that damp

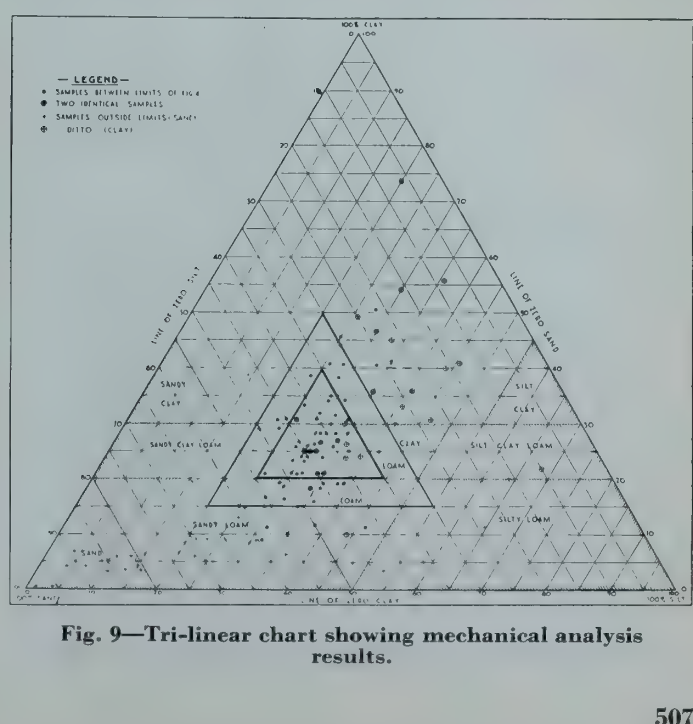



**Fig. 9—Tri-linear chart showing mechanical analysis results.**

sand can be moulded, to a limited extent, whereas the same sand when dried will not bind together at all. The other variable in the Coulomb expression for shear strength, the angle of internal friction, is known to be in the vicinity of 30 deg. for granular materials such as sands and silts; its value for fine grained soils such as clays is not known with the same degree of certainty, but is generally understood to be lower, relatively, than for granular materials.

All the test results for the shearing strength of the Shand soil samples showed an angle of internal friction of 30 deg. or more, and a low value for cohesion or more correctly apparent cohesion. Furthermore, the comparative tests on sample AB, as well as the other comparative tests on saturated soil and the same soil at optimum moisture content, gave practically identical shear strength irrespective of the initial moisture content of the soil. These results correspond with the behaviour to be expected from granular soils; they do not correspond with the results to be expected from soils containing an appreciable percentage of clay, as the "clay-sized particles" revealed by hydrometer analysis.

Considered together, these suggestions lead to the conclusion that these "clay-sized particles" correspond with the material properly known as clay in size only but are of such a nature that they behave as granular material. This they would do if they were finely ground fresh minerals, generally described as "rock flour" and produced by the mechanical action of glacial flow. Mineralogical examination might be utilized to corroborate this conclusion; it is hoped that this possibility can be studied at some future time.

## Conclusion

This paper is essentially a record of some of the mechanical properties of glacial drift from a location near Fergus, Ontario, which were determined during the course of an extensive programme of soil testing carried out in connection with the construction of the Shand Dam of the Grand River Conservation Commission. It may therefore be described as a by-product of the Commission's work, and appreciation of the action of the Commission in allowing this paper to be published is here recorded.

The work was carried out to the instructions of H. G. Acres and Co. Ltd., consulting engineers to the Commission, and thanks are due to Dr. H. G. Acres and Mr. A. W. F. McQueen, hydraulic engineer, for their agreement with publication of these soil test results and their interest in the aspects of the soil testing herein described.

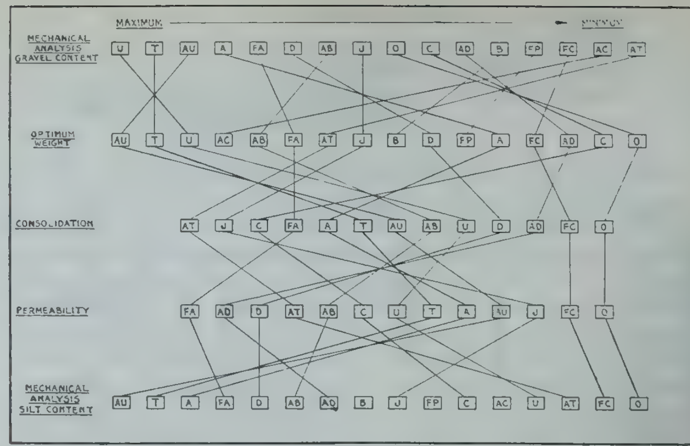



**Fig. 10—Attempted correlation of physical tests.**

# VIBRATION ABSORPTION WITH STRUCTURAL RUBBER

J. W. DEVORSS
*Mechanical Goods Division, United States Rubber Company, New York*

**Paper presented before the Montreal Branch of The Engineering Institute of Canada, January 28th, 1943**

The subject of this paper is the application of structural rubber, that is, load supporting rubber used as a mechanical building material, to the insulation of objectionable mechanical vibration. This is a very specialized field of rubber technology and represents only a small section of the rubber industry. Of the several thousand rubber compounds used by the United States Rubber Company, only five or six are considered as standard for use as structural materials; data on the structural qualities of these are quite complete.

The principal uses of structural rubber are to reduce the transmission of (1) vibration, (2) impact shock, and (3) noise. Of these, its use to reduce the transmission of vibration is the most important.

In order to apply rubber to vibration insulation, the mechanical fundamentals must be known. Vibration transferred from a mechanism can be reduced by (1) supporting the entire mechanism on resilient mountings of the proper flexibility and proper design, (2) by securing the mechanism to a heavy foundation, or (3) by the use of counter-vibrators. The resilient suspension of a machine is generally the most practical and economical method and, therefore, is the most extensively used.

The mechanical fundamentals of vibration absorption are readily demonstrated with a chain of rubber bands and a weight. Consider the weight suspended from one end of the chain of rubber bands; the other end held in the hand. Now, if the hand is moved rapidly up and down, it will be noticed that the weight stands practically still. In other words, the vibration is not transmitted through the rubber bands. Now, if the chain is shortened and the experiment repeated, the weight moves with a larger amplitude than before. It can also be shown that if the hand is moved more slowly, more vibration will be transferred to the weight.

A resiliently suspended mechanism acts just like the weight suspended from the rubber bands. The rubber bands are a type of spring.

When a weight is suspended on a spring, the spring elongates. This is called the *static deflection* and is generally measured in inches. The spring rate (sometimes called spring coefficient) of a spring is defined as the number of pounds required to deflect the spring one inch statically; a spring rate of ten pounds means that a ten-pound load placed on the spring will deflect it statically one inch.

If the weight on a spring is pulled downward and suddenly released, it will oscillate up and down. The number of oscillations per minute is called the *natural frequency* of the spring system. The natural frequency is a function of the static deflection, which in turn is determined by the stiffness of the spring and the weight of the sprung load. With given conditions, therefore, the natural frequency is fixed and cannot be changed. An example of this fact is the well-known tuning fork.

Figure 1 shows that where the static deflection is small the natural frequency is high. Where the static deflection is large, the natural frequency is low. The natural frequency of a mounting suspension can be found from this chart if the static deflection of the mountings is known.

Ordinarily a mechanism is forced (by electricity or other power) to operate, and if it vibrates, its vibration is known as *forced vibration.* Some small part of the mechanism may be forced to move rapidly up and down. This reciprocating action usually forces the entire mechanism to vibrate in a smaller amplitude but at the same frequency, and in the same direction as the reciprocating small part. Usually the frequency of this reciprocating movement is known or can be easily determined. If one cycle of movement takes

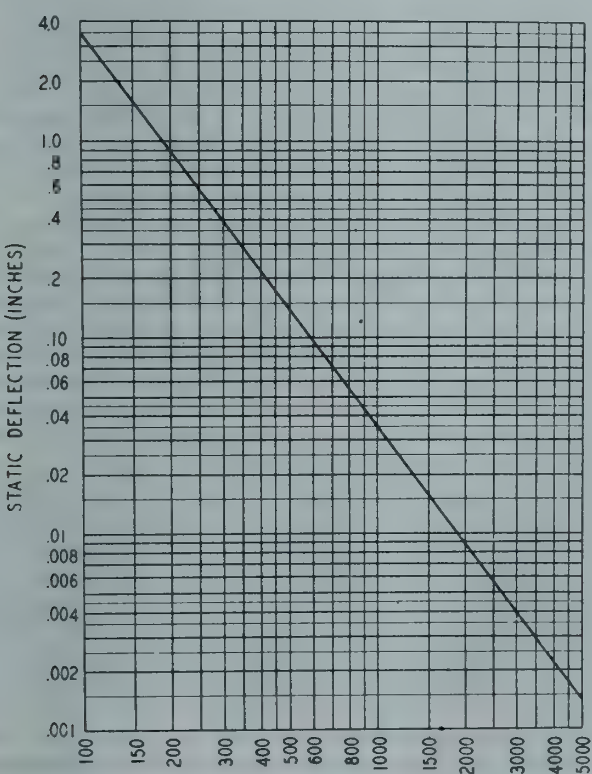



**Fig. 1—Relationship between static deflection and natural frequency of spring system**

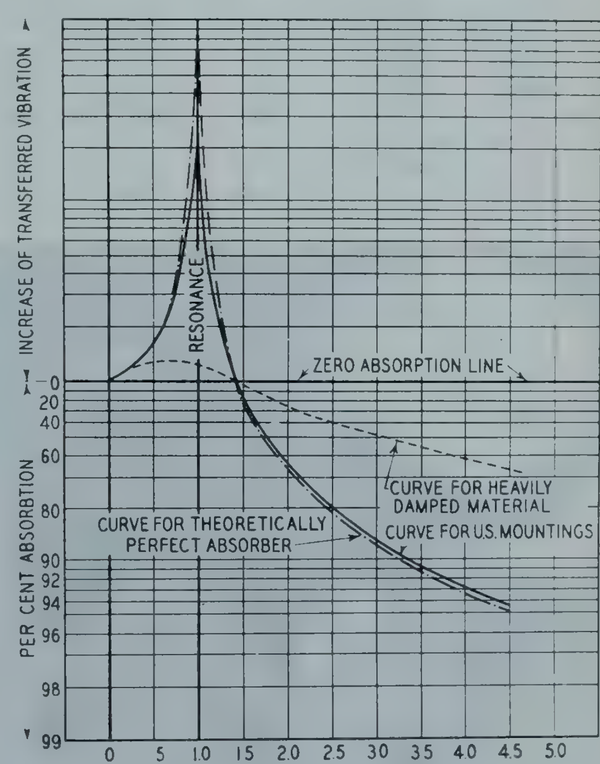



**Fig. 2—Chart showing the efficiency of rubber mountings for vibration insulation**

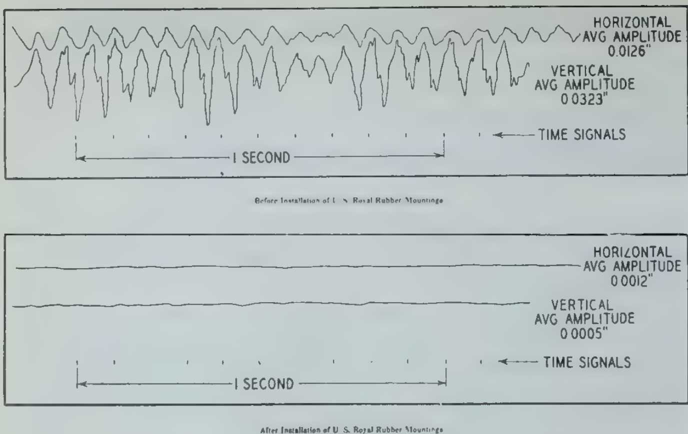



**Fig. 3—Photographic record of actual results accomplished in vibration insulation using rubber mountings.**

place for every revolution of a shaft, then the frequency per minute is the same as the r.p.m. of the shaft. Note that if there are *two* equally-spaced reciprocating movements for each shaft revolution, then the forced frequency per minute is *twice* the shaft r.p.m., and so on.

If a mechanism is supported on resilient mountings arranged so that its natural frequency on the mountings is considerably lower than the forced frequency of vibration, then a considerable portion of the vibration of the mechanism will be isolated by the mountings.

A measure of the effectiveness of a resilient mounting installation is given by the *insulation ratio* i.e., the quotient of forced frequency by natural frequency. Figure 2 shows the actual effectiveness of rubber mountings.

| | Insulation ratio | % of vibration insulated by mountings |
|---|---|---|
| Where forced frequency is 4 times natural frequency | 4 | 93 (Excellent) |
| Where forced frequency is 3 times natural frequency | 3 | 87.5 (Very good) |
| Where forced frequency is 2.5 times natural frequency.................. | 2.5 | 81 (Good) |
| Where forced frequency is 2 times natural frequency | 2 | 66.6 (Fair) |
| Where forced frequency is 1.5 times natural frequency.................. | 1.5 | 20 (Very bad) |
| Where forced frequency is 1.4 times natural frequency.................. | 1.4 | None |

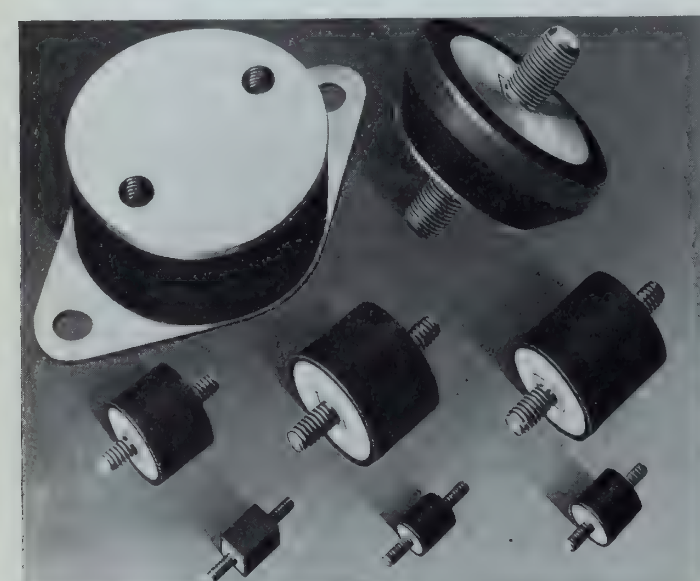


**Fig. 4—Cylindrical type rubber mountings.**

When forced frequency equals natural frequency, the result is worse than if no mountings were used. This condition is known as *resonance*. Satisfactory results are usually obtained when the ratio of forced to natural frequency is 2.5 or slightly greater.

A photographic record of a vibration is shown in Fig. 3. The equipment when bolted rigidly to the floor vibrated as shown in the top records, which indicate the horizontal and vertical vibration. After the proper installation of mountings underneath the equipment, the vibration from the floor to the equipment was reduced as shown in the lower group of records, which indicate the reduction in amplitude of movement. The actual reduction of vibration transmission was in the neighbourhood of 64 to 1. The record indicates that vibration very seldom, if ever, occurs linearly. The vibration in the stationary parts of reciprocating and rotating machines is generally in a plane at right angles to the crank shaft. Depending upon the structure, the plane may occur tilted at some angle to the horizontal,

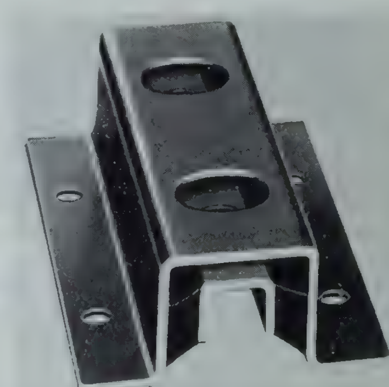


**Fig. 5—Channel type safety mounting.**

hence components of the vibration exist along all three principal axes. In order to absorb vibration of this type properly, it is necessary that the direction of vibration be considered and that the spring rate of the resilient supports be properly calculated along all three principal axes.

Structural rubber is generally made to adhere to steel to facilitate its application as a mounting for mechanisms. Standard rubber mountings are shown in Fig. 4 and 5. Figure 4 shows the simplest type of mounting, consisting of a column of rubber with steel studs affixed to each end. This type of mounting can be used to absorb relatively low impressed frequencies in three directions. Figure 5 shows what is generally known as a channel type mounting. This design will absorb relatively low frequencies in two directions, or in a plane which is determined by the longitudinal and vertical axes. In the channel type mounting illustrated, the load of the resiliently sprung unit is carried on the inside smaller channel by means of a spacer which extends through a large clearance hole in the outside channel. It can be seen that should the rubber be burnt or accidentally destroyed, the supported unit would not be released, for the inner channel would interlock with the outer.

Standard types of mountings are used for many purposes in industry. Figure 6 illustrates the use of channel mountings to reduce the vibration and noise transmitted from ventilating equipment to a building structure. The flexible connection should be noted particularly. Resiliently supported equipment must be provided with flexible connections for piping, conduits, control rods, and the like. The stiffness of these connections adds to the stiffness of the supporting springs.

In order to design mountings employing structural rubber, it is necessary to have complete data on the physical characteristics of the material. One of the most important characteristics of the rubber is its incompressibility; rubber is less compressible than water.

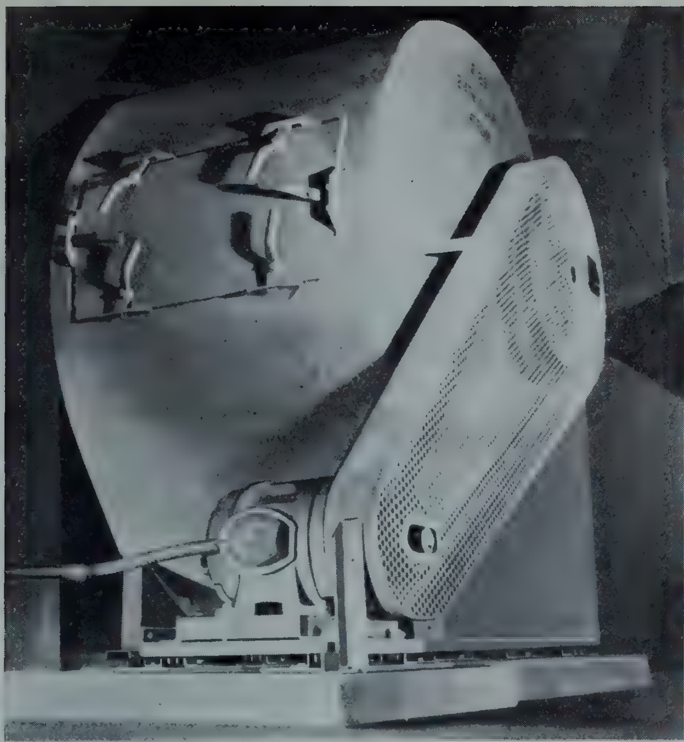


**Fig. 6—Channel type mountings under motor and fan of modern air conditioning system.**

Rubber can be used in compression, in shear, in flexure, in torsion, and in tension. It is primarily used in shear and in compression. By compression is meant subjecting the rubber to a load which tends to squeeze it. The deflection of rubber in compression for different slabs which are not dimensionally proportional can be related by a ratio called the *area ratio*. This ratio is determined by dividing the load-bearing area of the slab by what is termed the bulge area, i.e., the unrestricted area of the slab which is free to bulge. As an example, a slab one inch thick and four inches square would have a load-bearing area of sixteen square inches and a bulge area of sixteen square inches. The area ratio determined as above would be one. A slab one inch thick and two inches square would have a load-bearing area of four square inches and a bulge area of eight square inches. The area ratio is 0.5. Referring to the curves shown in Fig. 7, it will be seen that the deflections of these two slabs with different area ratios, although subjected to the same load in pounds per square inch, are different. It is possible to determine the load deflection characteristics of any rubber slab, not attached to metal plates, from Fig. 7, provided the area ratio of the slab is calculated as above. It should be noted that in the higher area ratios, the positions of the curves are not consistent. The data are given exactly as determined experimentally from tests on hundreds of samples. It is believed that a certain slippage exists between the pressure faces of the slabs, accounting for the irregularity. Actually rubber used structurally is bonded to metal to facilitate its application. When rubber is used in this manner, slippage does not occur between the pressure faces, and a nomograph as shown in Fig. 8 has been designed to facilitate the determination of deflection characteristics of rubber in this condition. The nomograph can also be used for designs which are not rectangular in shape by determining the equivalent rectangular shape for whatever design is under consideration.

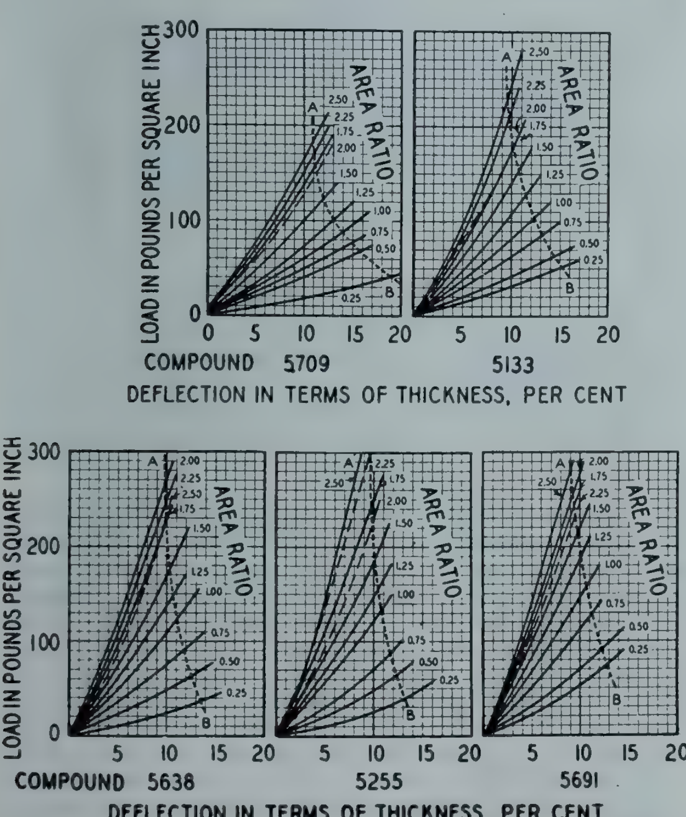



**Fig. 7—Load deflection characteristics for five structural rubber compounds not adhered to metal.**

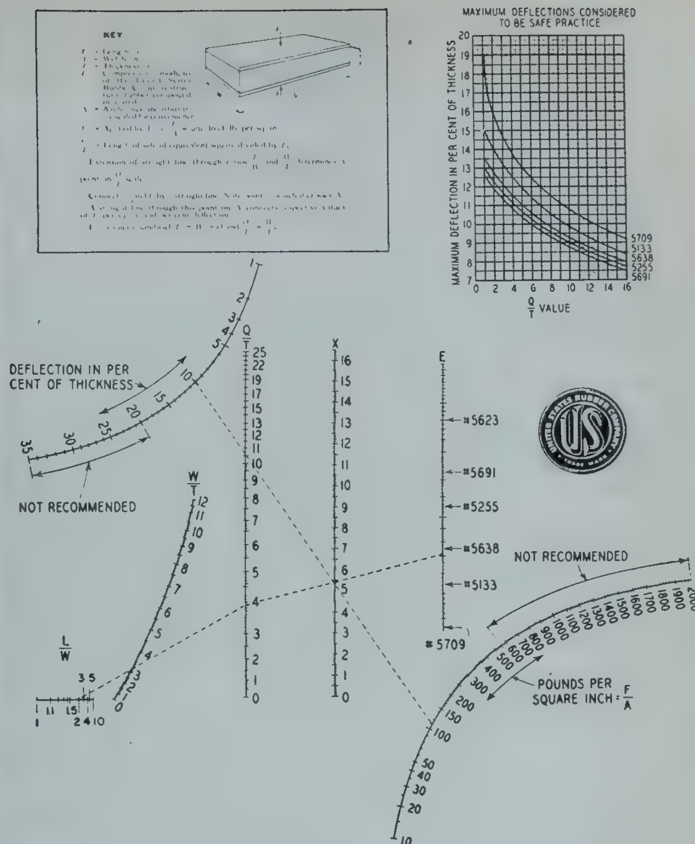



**Fig. 8—Nomograph for determining deflections of rubber adhered between parallel metal plates and stressed in compression.**

The use of rubber in shear is illustrated by the shear "sandwich" in Fig. 9. By sandwich it is meant that the rubber is bonded between two steel plates, or as shown in the illustration, two layers of rubber are bonded between three steel plates; here the load is applied to the centre plate and the two outside plates are held by a suitable support. The shear modulus of various rubber compounds can be determined as can be done for steel. The shear moduli of structural rubbers, however, run between 50 and 150 lb. per sq. in. The shear moduli of five structural rubber compounds are shown in Table I, along with other physical

## Table I

PHYSICAL PROPERTIES OF SIX STANDARD STRUCTURAL RUBBERS

Temperature of Rubber, 70° F.

| U.S. Structural Rubber Number | 5709 | 5133 | 5638 | 5255 | 5691 | 5623 |
|---|---|---|---|---|---|---|
| Shear modulus, lb. per sq. in........ | 50 | 70 | 95 | 140 | 195 | .... |
| *Logarithmic decrement of amplitude (Referred to base 10)............ | .041 | .055 | .14 | .23 | .35 | .47 |
| *Successive amplitude ratio........... | .91 | .88 | .72 | .59 | .45 | .34 |
| Per cent energy loss due to hysteresis, per cycle of vibration............ | 17 | 22 | 47 | 65 | 80 | 89 |
| Specific heat....... | .47 | .43 | .40 | .38 | .35 | .33 |
| Thermal conductivity in B.T.U., per sq. ft. per hour for a temp. gradient of 1° F. per in. thickness.. | 0.97 | 1.04 | 1.08 | 1.15 | 1.26 | 1.33 |
| Velocity of sound in rubber rods, feet per sec......... | 115 | 165 | 210 | 345 | 750 | .... |

*The logarithmic decrement given here represents the negative of the power to which 10 must be raised in order to obtain the ratio of any two consecutive amplitudes (on the same side of zero deflection) as unexcited vibration dies out. For instance, if the logarithmic decrement is 0.2 the ratio of one amplitude to the preceding one is,

$$10^{-0.2} = \frac{1}{10^{0.2}} = \frac{1}{1.585} = 0.631 = \text{Successive Amplitude Ratio}$$

(Ordinarily logarithmic decrement is referred to Naperian log base $e$ and if such values are required, they would be 2.30 times the values given here.)

characteristics. Of particular interest are the figures on velocity of sound in rubber rods, the logarithmic decrement, and energy loss due to hysteresis.

We have spoken primarily of the static properties of rubber. It should be mentioned that the natural frequency of a rubber spring system does not always follow the calculations made from the static deflection. Figure 10 shows the factor by which the calculated natural frequency should be multiplied in order to obtain the actual dynamic frequency. In most calculations, however, this refinement can be neglected, particularly when dealing with the softer rubbers on general industrial applications.

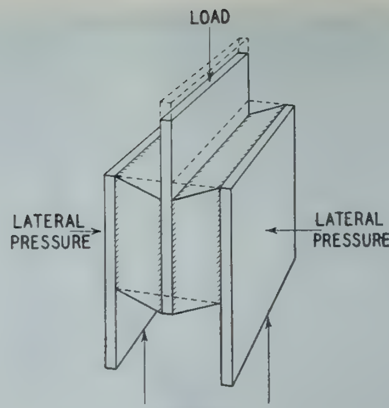
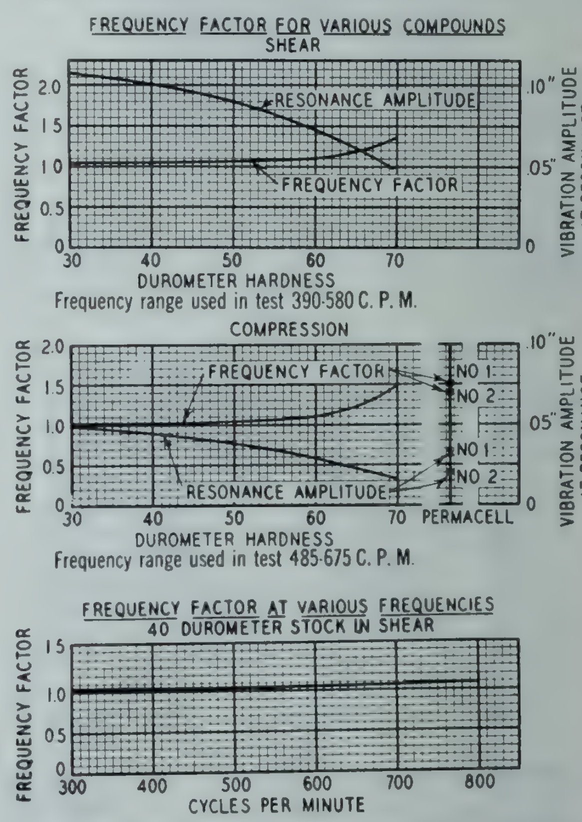



**Fig. 9—Simple shear sandwich.**

The use of structural rubber in shear and in compression has been described above. It should be noted that it is undesirable to stress rubber in tension and also that its use in flexure is limited. Its use in torsion, of course, is related to the discussion given for shear.

It is generally advisable when special applications are to be made to consult some authoritative source to obtain their experience as related to the individual problem.




"Frequency Factor" is factor by which calculated resonance frequency must be multiplied to determine actual resonance frequency

**Fig. 10—Charts used for determination of factors by which calculated resonance frequency must be multiplied to determine actual resonance frequency.**

# THE POSITION OF MANUFACTURING AND CONSTRUCTION IN OUR NATIONAL ECONOMY

G. R. LANGLEY, M.E.I.C.
*Works Engineer, Canadian General Electric Company, Peterborough, Ont.*

**Paper presented before the Peterborough Branch of The Engineering Institute of Canada, on April 8th, 1943.**

The February 1, 1943 issue of Maclean's magazine contains an editorial entitled "Is Industry Getting a last Chance." This article reads in part:

"The war has given private enterprise what may be its last chance to prove itself.

"If private enterprise fails when the crisis comes, and that will be after the war, it will be replaced.

"Replaced by what? Nobody knows. Bureaucracy, governmental control and ownership, confusion and chaos seem likely answers.

"Realizing that this crisis lies ahead is driving the leading businesses of the United States into a brand-new field of economics, post-war planning.

"So important do these corporations regard the field of post-war planning that some of them are assigning vice-presidents and other officials to research on this task as a full-time job.

"The researchers are faced with stupendous problems. They must get business away from its too individualistic past. They must prepare to assume leadership and co-ordination of effort on major questions. They must see to it that private enterprise has a broader conception of its duties to the community.

"They know that they cannot dream of returning to the 30 or 40 per cent production which pertained in the 1930's. To do so would mean the destruction of private enterprise and whatever political party is in power.

"They will be faced with a post-war demand for full-time production. They will have millions of young men and women trained along industrial lines, who must be put to work. Their post-war production itself will be full of problems, replacement of dies and tools; use of new materials; re-establishment of dislocated distribution systems."

Dr. F. Cyril James on December 4, 1942, stated: "We have to confront a picture in which roughly one-third of all the people who now have jobs will need new jobs . . . We cannot rely for this purpose on the immediate reorganization of industry with a view to producing peace time consumer goods. With the best will in the world, it takes considerable time for an industry to switch over from war time to peace time activity . . . In other industries there will be time consumed in the retooling or the rehabilitation of industrial plants so that even if there is an immediate demand for consumer goods, industry will not be able, in many cases, to absorb *at once*, large quantities of labour in the production of consumer goods."

Dr. O. J. Firestone in a paper presented at the annual meeting of The Engineering Institute of Canada, on February 12, 1943, stated: "We can only find a solution of our problem how to achieve full employment in the post-war economy by a policy of increasing production in this country. Since the war has shown us that a considerable increase of production was possible, the question arises, why should this high level of production not be carried on after the conclusion of the war, for the purpose of providing consumers with the goods they require? Since it is contemplated to produce more after the war than there was produced previous to the war the result will be a raised standard of living and increased opportunity for employment."

The broad tendency of these and many other editorials and speeches is to leave the main burden of providing a smooth operating economy on the door step of industry, saying in effect that it is up to *industry* to do something to avoid a repetition of our past troubles, and do it much better than it has ever been done before. Industry clearly has a very heavy responsibility but it would be dangerous to overlook the probability that equal or greater responsibility rests elsewhere. It is possible that the most constructive steps that can be taken may be outside the field of industry.

Dr. Firestone's statement quoted above would be correct if the producers of the additional goods were also the consumers. These producers are actually a minority of the employable consumers. *Purchasing power must be expanded to agree with any increased production of goods,* and to accomplish this, employment in "*services*" must clearly be increased in *greater* degree than employment in production and this paper has been prepared mainly to call attention to the general loose thinking on this point which is apparent.

In the olden days, man's unaided labour could never produce enough, and economic panics were more likely to be caused by sun-spots than by man's sins of omission or commission. The advent of steam and electric power changed this and gave us means for over-production. It is fundamental that our present-day economic dislocations originate in the overproduction of goods. It is true that a better distribution of purchasing power would make over-production less likely, but *production and demand must still be matched.* This means in effect that no industry can risk, both for its own sake and the national good, the creation of employment through production of unwanted goods. Due to the steadily increasing use of power and labour saving devices, the trend in industry is to produce more and more goods with less and less labour. This means either that an increasing portion of employment must be provided outside of industry, or that industry must shorten its working hours;—or a combination of these two means must be used.

If we attacked the problem by the usual engineering method we should start by writing a specification describing the objective, but should first attempt to define just what is meant by the term "industry." A typical dictionary definition is "any productive occupation, especially one in which a considerable number of people are employed." The term "productive occupation" we assume, means an occupation producing or processing raw materials. Although agriculture comes within the terms of this definition, none of the articles referred to appear to have it in mind, so rightly or wrongly we are going to divide the gainfully employed—between:

(A) "Industry," comprising—Manufacturing
- Construction
- Mining
- Fishing
- Hunting
- Logging
- Electric power.

(B) All other occupations comprising—
- Agriculture
- Wholesale and retail trade
- Defence
- Transportation and communications.

Miscellaneous services comprising—

Government, including civil services
Law enforcement
Educational
Health
Recreational — e.g., drama, music, art, outdoor
Personal—e.g., servants, barbers
Clerical
Press
Conservation
Religious
Finance and insurance
Warehouse and storage, etc.

The author offers following specification for criticism and as basis for his further remarks.

"There must be sufficient useful employment (for all persons of the ages 16-65 inclusive who are willing, and mentally and physically capable of doing work) to produce sufficient goods *and provide sufficient services*, and distribute purchasing power, so that a high minimum standard of living will be attained and maintained. Industry, agriculture *and the services* share the responsibility for providing this employment, and they must co-operate to ascertain what portion of this employment *is the responsibility of each.*"

The output of goods per man-day varies greatly in different industries, due to the varying degrees to which the workers' own efforts are supplemented by machines and power. This makes the use of dollar value of output confusing and misleading, if we use it when surveying employment possibilities. We therefore suggest the use of statistics with "employees" rather than "dollars" as the unit.

According to the 1931 census, almost exactly 60 per cent of our population fell in the age group 16-65. If we apply the same percentage to the final 1941 census figures we obtain, for this age group:

3,521,000 men
3,383,000 women

The 1931 census shows an average of 4.55 persons per household. If we use 4.5 for 1941, it gives 2,555,866 households. If we assume that 90 per cent of these households require one woman as housekeeper, we obtain a figure of 2,300,000 housekeepers. If we assume that there will be an average of about 35,000 men and 25,000 women confined in penitentiaries and mental hospitals, and an average of 75,000 men and 75,000 women in other hospitals or incapacitated, and use all these assumptions for deductions from the 16-65 age group, we arrive at a figure of 4,400,000 employables (3,400,000 men, 1,000,000 women). Dr. James has mentioned an approximate figure of 4,500,000 persons gainfully occupied a few months ago. This figure includes 600,000 in the armed forces and 900,000 in war industry. Dr. Firestone has mentioned a figure of 4,200,000 employed (exclusive of the armed forces). When it is considered that under present emergency conditions, many persons under 16 and over 65 are working, also housewives who in peace time would be tending their houses, our figure of 4,400,000 for post-war conditions may not be far out.

The results of any attempt to break down this figure of 4,400,000 employables for the period, say two years after the end of the war, are thought-provoking and emphasize rather strongly the author's earlier suggestion that the major employment responsibility lies outside the field of industry. The assumed proportions given below could be changed quite materially and yet point to the same conclusion.

| | | |
|---|---|---|
| INDUSTRY | | |
| MANUFACTURING | | 800,000 |
| Total = 1929 employment + 5% with 1,000,000 munitions workers extra. | | |
| The total, broken down per 1931 proportions, shows as follows: | | |
| Metal products | 245,000 | |
| Textiles | 138,000 | |
| Lumber and wood products | 130,000 | |
| Foods | 63,000 | |
| Leather goods | 37,000 | |
| Printing and publishing | 37,000 | |
| Miscellaneous | 50,000 | |
| Munitions | 100,000 | |
| CONSTRUCTION (1941) | | 220,000 |
| MINING (1940+) | | 110,000 |
| FISHING AND HUNTING (1931+) | | 50,000 |
| ELECTRIC POWER | | 20,000 |
| TOTAL OF INDUSTRY | | 1,200,000 |
| EMPLOYMENT OTHER THAN INDUSTRY | | |
| AGRICULTURE | | 1,140,000 |
| The total is the estimated 940,000 now employed plus 200,000 assumed to be in the armed forces now. | | |
| TRANSPORTATION (RAIL) AND COMMUNICATIONS | | 175,000 |
| (Approximate 1940 figures) | | |
| WHOLESALE AND RETAIL TRADE | | 350,000 |
| (Figures for 1930 plus) | | |
| ARMY, NAVY, AIR FORCE (pure guess) | | 150,000 |
| TOTAL | | 1,815,000 |
| The balance to be absorbed by the various other services is | | 1,385,000 |

The census shows that the three largest service groups are:

(A) Labourers.
(B) Clerks.
(C) Servants (including domestics, cooks, waiters).

One suspects that the census figures are misleading in that many of those listed as clerks or labourers are actually employed in industry or agriculture.

There is a widely held hope that inventive genius will provide some device that will create new employment on a scale similar to that created by the automobile. No such device is in sight and none of the active developments such as aircraft, plastics, electronics show likelihood of appreciably increasing the ratio of employment in production of goods to employment in production of services. The growing backlog of public and private construction is very comforting, but it can only affect the ratio temporarily, whereas, on the other hand, the steadily increasing use of electric power tends to decrease the ratio permanently. This all adds up in the fact that, if we are to attain permanent full employment, we have the choices:

(A) Decrease the output of goods per available man-day through decreasing working hours and a shorter span of working years.

(B) Increase employment in useful services. (This new employment would of course automatically give increased demand for goods and corresponding increased employment in industry).

(C) Combination of A and B.

We are far from saturation in employment in useful services. Our economy could, for instance, easily support radically increased expenditures in the field of:

1. Health.
2. Conservation of national resources.
3. Recreation (exclusive of the theatre).

The author has been unable to locate any satisfactory statistics on present employment in these three services, but doubts if the total exceeds 75,000. This could certainly be multiplied several times with beneficial results on the national standard of living, and at the same time be a logical and permanent step in the direction of full employ-

(*Continued on page 523*)

# THE CIVIC MORALS OF SCIENCE

CLEMENT C. WILLIAMS
*President, Lehigh University, Bethlehem, Pa.*

**Reprinted from the *Journal of Engineering Education*, March, 1942, with the kind permission of the publishers**

So frequently do statements appear to the effect that education in science and technology must have an infusion or leavening of the liberal arts in order to be beneficent rather than malevolent influences in civic morals that I am moved to inquire concerning the validity of the premises on which the statements are founded. Are they merely ghostly reverberations of Aristotle's disdain for manual skills still haunting the relics of the trivium and quadrivium? Are they rearguard actions of the battle waged in academia in the last century when science sought entrance at classic portals? Or are they actually footed on the natural effects of learning on human character? Without wishing to derogate any branch of knowledge, or to seem controversial, I should like to focus the inquiry on a few typical areas where the moral values of learning may be expected to be manifest in order to discern whether humanistic studies have actually a more beneficent effect than sciences on civic conduct. Does the one branch of learning produce better citizens than the other?

That much of the present world confusion results from a disparity of progress in science and in human relations would be generally admitted, and the exigencies of war have thrown that disparity into high relief. Within recent years, George Bernard Shaw, Rabindranath Tagore and the Reverend Dean Inge have charged technology with responsibility for disturbing world equilibrium and have even expressed a desire for a holiday in scientific discovery. In a recent letter, an eminent publicist asked whether, in my opinion, it would have been better if the airplane and certain other machines had not been invented, apparently wishing the race to live in a sheltered Eden out of reach of knives and other devices with which it might harm itself rather than to be developed through their use. Numerous voices have advocated a partial replacement of science with humanities in the curricula of engineering colleges in a belief that the hiatus between technology and ethical attainment in human relations might be closed from one side only. Some humanists have labored a tenuous distinction between "education" and "training" ascribing the former to letters and the latter to science, as if the disciplines of the one had properties of transferability not possessed by the other. As the argument runs, technology is supposed to be related to things and in consequence to have mineral morals while the liberal arts pertain to ideas and to life, and hence to be endowed with human and social values. One writer labels these two end products as "knowledge and wisdom, or in other words, science and values." This view apparently is based on the tacit assumption that language is not an acquired but a naturally inherited characteristic. There seems to be a vague superstition about its hidden origin through the breath from within the body which links language with the soul. Are words of air formed by the carnal mouth more divine and less man-made things than are tools of steel made by the hands? Both are implements. Both represent ideas but neither is an idea. An idea may embody sound judgment even if unexpressed verbally; it may be expressed by practical execution. A holiday in the production of verbiage would be fully as serviceable as one in the invention of devices toward locating the source of social confusion, which indeed results chiefly from the babel of academic voices attempting explanations.

Any implication that the motives of a scientist, even if diabolical, might somehow be transmitted to his inventions and thus influence their moral effects does not call for serious argument. The laws of nature are too immutable to partake of the personality of the one who reveals them. A monk of the church was reputedly the first maker of gunpowder, and Nobel, the engineer who invented high explosive, was a pacifist who gave the resultant fortune to promote peace and the arts of peace. The inventors of the airplane, sons of a clergyman, were the mildest of men; politicians, not the inventors, determine whether mail or bombs shall be the cargo. Of the responsible statesmen of recent years who have been unable to find a way out of international rivalries except through "blood, sweat and tears," none were suckled by the wolf of science. The most humane president ever to occupy the White House was an engineer. The engineer-statesman, Cavour, preferred diplomacy to war as a national policy. Da Vinci, engineer-artist of his time, in his famous letter to the Duke of Milan, offered to build engines of war and works of industry for a livelihood, but he painted that masterpiece of feeling, The Last Supper, from choice. Inventions are functions of nature's law and hence are independent of the inventor's character except as he himself employs them.

Fidelity to duty does not result to a less degree from the accuracy and objectivity of the sciences than from the subjective and a priori dialectic of the humanities. A few years ago, a colleague of mine on the faculty of a state university was employed to do some engineering work at the state prison. Being in need of an assistant after arriving, he sought an engineer among the prisoners. Not one was on the prison roster, although lawyers, bankers, teachers, preachers, and other respresentatives of humanistic callings were available aplenty. My curiosity being aroused, I made inquiry and learned that a similar situation prevailed at the penitentiaries of the neighboring states. The corps of army engineers, who have had charge of most of the construction operations for the Federal government for over a century, cherish the proud record of no defalcations in that entire period, notwithstanding the immensity of their financial responsibilities. These instances illustrate the observation that a betrayal of trust has been comparatively rare among scientists and engineers.

The precisions and rationalities of science yield a sense of moral direction quite as definite as do the emotional vagaries of literature. The recent brutal aggressions of dictator nations are recrudescences of the tribal barbarities and perfidies depicted in the Iliad, the Aeneid, Caesar's Commentaries, the Book of Judges, the Nibelungenlied and other classics which have been standard texts in arts courses for centuries. Language can be employed to deceive, to incite to crime, and otherwise misused quite as destructively as can nitrocellulose and the airplane. Perhaps the chief lag in social instrumentalities is language. It does not afford a vehicle for conveying thought unequivocally even between co-linguists. Indeed through striving for overtones and picturesqueness, language seems to be losing rather than gaining in exactitude. The use of words as sonic notes to produce impressionistic effects, premitting the appended ideas to dangle into a tangle, after the fashion of a modern school of writers, is a disservice to understanding. Grace of expression does not validate the sentiment contained. On the contrary, where correctness and precision are subordinated to felicity of phrasing, fallacies may be rendered less apparent by the lulling effect of a lingering assemblage of words. How many faulty maxims of life are treasured because of their euphony! How many speciosities have persisted because some superficial poet chanced to sing them! As exemplars of life patterns, the malodors of Shelly, Keats, De Quincy, Wagner, Poe and others compare unfavorably with the Spartan rectitude of the great scientists. Michael Faraday's ingenuous love letter to Sarah Bernhardt which closed, "As I ponder and think on you, chlorides, trials, oil, Davy, steel, miscellanea, mercury and fifty other professional fancies swim before me and drive me further and further into the quandary of stupidities," won him a devoted wife until "death did them part," while Byron's magniloquent epistle closing "My destiny rests with you" won him a mistress for only two years, when he deserted for other destinies. Linguistic facility may supply more abundant and varicolored verbal wrappings for a kernel of idea, but the "yea" or "nay" or decision is not of the wrappings. Learning, either liberal or scientific, can afford ethical standards only at the level of character, conscience and conviction.

Does one find an ethical or civic guidance in the methodology of the social studies superior to that inculcated by the systematic observing and testing of the scientific method? At the outset, confidence in the guidance of the former is undermined somewhat by two circumstances, viz., their conclusions are usually qualified instead of definite, and, secondly, scholars of equal standing in the field hold antipodal opinions relative to identical issues. Because circumstances are never repeated, history is only suggestive of possible outcomes of future events—evidence but not proof. Von Treitschke and Mommsen as historians arrived at the thesis of a super-race through the same egoistic predilections which led the psychopathic Nietzsche to the tenet "that the strongest and highest will to life does not find expression in a miserable struggle for existence, but in a Will to War, a Will to Power, a Will to Overpower." Across the Channel, historian Froude allowed his anticlerical prejudices to distort his judgments beyond trustworthiness. One reads volumes of history without a sentence which signifies discrimination in moral values. Political sway and military conquests are the crowning glories recognized for rulers and nations by the awards of written history. "The Great" is attached to Alexander, Catherine, Frederick and other predatory tyrants while "The Good" is applied to Charles, Phillip, and similar unimpressive sovereigns, and to them chiefly because of private kindnesses rather than political virtues. The realistic debunkers have sought to erase the peaks of individual inspiration and to level the narrative to a drab average humanity. Changes in fashion in historical viewpoint have been too frequent to impart a sense of established morals. Philosophies of history have been an adaptation of the biological theory of struggle and survival of the fittest with "the fittest" undefined except as the most viable. Their authors have overlooked the great biological principles of symbiosis and co-operation as factors in social and political development as well as the dynamics of a controlled psychology in national behavior. History's look is backward, while civic morals require a forward view. Was the treaty of Versailles overladen with historic hates? Would it have been more enduring if it had envisioned a future world of unexplored frontiers in scientific discovery where rich and limitless areas in human welfare await colonization? Will the ensuing treaty of World War II again only attempt to put new wine in old bottles? While we may be encouraged by the tendency of modern historians to devote more attention to the forests of common quests and advances of the race and less to the trees of nationalistic exploits, we are compelled to conclude that history has not attained complete clarity of ethical direction.

The claims for formal courses in politics and government as specific preparation for good citizenship are not supported by exhibits of products. The subject matter offered generally pertains to governmental structure and is seldom applicable to the issues to be marked in the voting booth. It does not offer a control of extra-legal cliques and pressure groups. Fluency in discussion of political affairs which rises from a knowledge of historical precedents must not be mistaken for good citizenship, for it may not even be its label. Tailor-made courses in citizenship usually are little else than indoctrination. Political academism, by emphasizing popular participation in governmental processes at the expense of efficiency, has contributed to the lag of progress from ruralism and isolationism into an urbanized society and an integrated world economy. Its idolatry of political processes, oblivious of human limitations, has loaded government with detail functions which transcend the potentialities of governmental machinery. The design approach of technical education, which stresses practicalities, constitutes a proper balance to these ill-advised tendencies.

Does the "transcendental knowing" of philosophy or metaphysics afford a more definite and reliable comprehension of public affairs than does the observational approach of the scientific method? In philosophy, a layman discerns no cumulative attainment toward a firmament of truth whereas science does yield a consciousness of certainty in its peculiar realms of knowledge. Philosophy seems to the laity too much a pendulum swinging back and forth to afford an awareness of established direction. The philosophers of the ancient world ranged the gamut of theories of social and political organization and their successors have chiefly devoted themselves to an inconclusive elaboration of intermediate themes. Herbert Spencer, an engineer turned philosopher, in keeping with his time, viewed social ethics from the standpoint of materialism, but the fashion swung to mysticism and idealism when materialistic atheism was found to be an intellectual and spiritual cul de sac. Nietzsche's doctrine that might is truth and right and James' pragmatism that whatever works well is truth equally eliminate from the scheme of things a concept of ultimate right and truth. Both would justify Hitlerism if it works well, although James would have denied this. To use Will Durant's phrase ("Story of Philosophy") Philosophies so cancel each other into zero" that they do not gather directional momentum.

In contrast, science advancing from one foothold of certainty to another is conducive to a positive faith in an ultimate truth that is more stabilizing and constructive than the cynicism which is so frequently the product of *actionless thinking and untested dogma.*

Is there any reason to suppose that speculating on the nature of man and society, perhaps the most disordered phenomena of all creation, will inspire a more just ethic than does observing the constancies of the physical universe? Does emotional human caprice yield a nobler freedom than does harmony with fixed natural law? If one were permitted a generalization, it would be that education in the humanities finds its motif in the free development of the natural individual to the neglect of order in society, while education in science is of the essence of system and organization. These two vital principles in education, liberty and order, are inherently opposed to each other, but they are not necessarily incompatible, since liberty may stop short of anarchy and order may not reach regimentation. They are, however, the specific characteristics of these respective educational methodologies, the one relying on intuitive reactions, the other on factual ratiocination. Too much emphasis on self-expression without self-discipline may militate against social accommodation. Liberals and radicals gravitate to the one group while conservatives predominate in the other. The humanities emphasize individual freedom in education, ignoring its corollary confusion, even though competence and efficiency in government are the painfully obvious needs. Exaggerated attention to initiative of leadership may overlook the virtues of discriminating followership, which indeed may be the actual stepping stone to leadership. The voice of order must be heard in counterpart to the voice of freedom if good citizenship is to be of a nature to yield the social stability which we call civilization.

Good citizenship, like charity, begins locally, and has as many aspects as there are interests of men. Suffrage is only one of its many obligations. The college bred may be assumed to know its fundamentals. The growth in urbanization introduces into civic morals those physical instrumentalities of the technical realm which promote community health and social intercourse. Good administration, which

*(Continued on page 536)*

# WARTIME BUREAU OF TECHNICAL PERSONNEL

## Annual Report—Year Ending March 31st, 1943

### Organization

On March 31, 1943, the Wartime Bureau of Technical Personnel completed the second full fiscal year of its existence. Established in February, 1941, the Bureau was at first occupied largely with tasks of organization and planning. By August, 1941, sufficient progress had been made to lay down broad principles of operation, registration was in progress, and definite service was already being rendered along a number of lines with the general object of promoting efficient use of the country's technical man-power resources.

During the latter part of the fiscal year 1941-42 much time and study was devoted to working out a system of man-power controls with respect to engineers and scientists which would make for efficient utilization of this group of citizens. As these Technical Personnel Regulations (P.C. 638 of 1942) became effective on March 23, 1942, the year under review in the present report commenced with the assignment to the Bureau of its first administrative function. At the same time, the first Director of the Bureau, Mr. E. M. Little, was appointed Director of National Selective Service, and two of the Assistant Directors, Messrs. L. E. Westman and L. Austin Wright, accompanied him to this new field of activity. At a meeting of the Advisory Board in April, 1942, Mr. H. W. Lea was appointed to succeed Mr. Little as Director of the Bureau. The necessary rearrangement of duties, together with steady expansion in all phases of the Bureau's work, has necessitated a corresponding increase in the staff.

### Regional Offices

A year ago there were three single regional representatives stationed at Montreal, Toronto and Hamilton. At present there are also single officers at Halifax, Winnipeg and Vancouver, the number at Toronto has been increased to three and at Montreal to two. In addition, there is an honorary representative at Quebec and two honorary representatives act in the maritime provinces, where matters require attention outside of Halifax.

### Demand for Technical Personnel

During the year the Bureau received 1,078 inquiries for technical personnel, each inquiry covering an average of somewhat more than two openings. Individual records totalling 8,301 were referred to prospective employers in connection with these inquiries, resulting in 899 placements. In the interests of efficiency, inquiries are constantly checked so that those which have been filled or have lapsed are removed from active files. Nevertheless, there has been throughout the year an average of 240 open inquiries on file representing at least 500 individual vacancies. Suitable candidates for these openings may sometimes be found among those whose services are reported as being available, but in many cases a search must be made of the records to find suitable qualified men who may be made available.

In addition to the above demands which deal with openings in civilian activities, the Bureau keeps constantly in the foreground the needs of the armed forces for engineers and scientists as technical officers. While it was not until August, 1942, that such needs could be dealt with systematically (it was then that a suitable officer was seconded from the Department of National Defence), 155 candidates referred by the Bureau have been accepted for technical appointments in the armed forces during the year.

Generally speaking, since the creation of the Bureau the demand for technical personnel has been in excess of the visible supply. The armed forces alone require this year for technical appointments a number somewhat greater than the total of physically fit science students who will graduate from Canadian universities. In addition, there are the legitimate needs of war industry and essential civilian services to be considered and, of course, there is the normal annual wastage due to death, disability or other causes. The deficit in supply can be met to some extent by diversion to more essential undertakings of technical personnel already employed, but a large proportion of the shortage will still have to be overcome by more efficient use of those at present employed.

### Registration

Considerable progress was made during the year in checking of alumni records of Canadian universities with the Bureau file. This was supplementary to the work previously done on membership lists of professional engineering and scientific organizations, and has resulted in a substantial increase in the registration. At the same time, complete registration was secured of those who, upon graduation in the spring of 1943, become technical personnel.

### Technical Personnel Regulations

Order-in-Council P.C. 638 (1942)

Later, Part III of Order-in-Council P.C. 246 (1943)

Broadly speaking, these regulations give the Minister of Labour the power to control changes of employment so far as technical personnel is concerned. In the general field of man-power, control is exercised through National Selective Service by means of a system under which an individual is granted a permit to seek work and a permit to take specific employment. But, under the requirements of the Technical Personnel Regulations, it is the employer who must secure, through the Bureau, a permit to engage an employee.

A total of 3,869 permits were issued to employers during the year and in each case the following matters had to be investigated: (a) Whether notification had been received of the post to be filled. (b) Whether priority of the proposed work warranted the use of the particular technical person it was proposed to employ. (c) Whether the prospective employee was registered with the Bureau and came under the Technical Personnel Regulations. (d) Whether the prospective employee's services were available.

Final approval of an application is not given until the Bureau is satisfied on all these four points and it follows that in some cases approval is withheld altogether.

Through the Bureau, the evils of useless turnover have been greatly curtailed. Taking the number of permits issued as a fair measure of the new contracts of employment and deducting the number of those who, on graduation, entered employment for the first time, it will be found that the monthly turnover during the past year is something under one per cent. Moreover, it should be borne in mind that part of this one per cent represents transfers from less essential to more essential activities and part of it can be traced to various shifts of emphasis that have taken place during the year in the country's war production position.

### University Science Students' Regulations

Originally P.C. 9566 (1942)

Now part III of P.C. 246 (1943)

As the main source of new supply of technical personnel is the output of the engineering and science faculties of Canadian universities, the Bureau from the start has been definitely interested in such matters as the numbers and methods of training of students in science courses. The first tangible result of this interest was indicated by a series of resolutions adopted during a Universities Conference held in Ottawa on May 11, 1942.

At this conference, the departments of National Defence, Munitions and Supply, National War Services, and Labour, as well as the National Research Council and the Inspection Board of the United Kingdom and Canada, were represented, along with all the universities in the country. After intensive discussions in special committees and before the whole conference, a number of recommendations for government action received unanimous support. Authority having been given to prepare plans for implementation of the recommendations, numerous consultations were held with representatives of the three branches of the armed forces and of the Department of Munitions and Supply, which resulted in a series of regulations controlling the activities of university science students.

In administering the regulations, the Bureau first had to secure from the armed forces, from government departments and from war industries, a statement of their needs for 1943 graduates. It soon developed that the number required was in excess of the supply and in certain courses the demand was double the number registered. This pointed to the need for consideration, for some of the available openings, of students whose specific training had not been definitely along the lines asked for. Progress has already been made in encouraging both the armed forces and civilian industries to use recent graduates on the basis of their general scientific training where adequate numbers are not available with the specific training desired.

### Financial Support for Students

In order to maintain registration in university science courses at as high a level as possible, the Department of Labour arranged for financial assistance to students who were well qualified academically but who could not attend university without financial aid. This resulted in the enrolment for the session 1942-43 of over 500 students in science courses (in the first year) who otherwise would have been unable to attend.

Each male science student in attendance at university is required to complete a declaration form stating whether he wishes to volunteer for active service as a technical officer, at the same time expressing his preference as to which branch of the service he desires to enter. When the regulations came into effect, in order to find out which students then in attendance were unlikely, for medical reasons, to be able to secure appointments in the armed forces, arrangements were made with the Department of National Defence to have each student in the final and pre-final years examined by a standing medical board.

In order to further the professional training of science undergraduates during summer vacations, war industries were circularized, with the result that somewhat over 4,600 openings were made available for summer employment for undergraduates. Lists of these openings were furnished the universities for the use of the students and arrangements were made for the Employment and Selective Service Offices to issue to undergraduates appropriate permits to cover prospective summer employment.

In March, 1943, the declaration forms of students about to graduate were used to prepare nominal rolls of volunteers for technical appointments in the three services. A total of 1,085 names were submitted for consideration for commissions, and representatives of the Navy, Army and Air Force commenced the work of interviewing and selecting candidates from the graduating class for their respective quotas of technical officers.

### Liaison with the Armed Forces

The publicity given to the Bureau's operations through publishing the Technical Personnel Regulations and the rapid increase in the number of individual contacts made by the Bureau's officers, particularly after regional offices were set up, resulted in a corresponding increase in the number of engineers and science workers who approached the Bureau for advice as to their proper sphere of service. At the same time, the close liaison already established with the armed forces tended to develop even further as more common problems developed. Also, the constant study of individual records in the Bureau's files continued to bring forward information regarding men who were obviously suitable for technical appointments in one or other of the three services.

Since the appointment of a military advisor to the Bureau, it has been possible to direct more quickly and effectively the many individuals who approach the Bureau for advice on service matters. The services have benefited, in that the rate at which suitable candidates (that is, candidates who in due course are actually commissioned for technical appointments) have been referred has roughly trebled since the new arrangement went into effect.

Another field in which the Bureau assists the services is that involving efficient use of men who are already serving but whose qualifications are not being used. Both from individual records and from notices of cessation of civilian employment which reach the Bureau, cases frequently come up where a man with engineering or scientific training is serving in the ranks in a capacity which has no relation to his technical background. In the case of the Army, for example, such instances are referred at once to the Directorate of Personnel Selection so that an Army examiner may look the man over and ensure that, if he is suitable for a technical appointment, proper consideration will be given to his case.

### Special Problems

As the Government of the Dominion of Canada, through its various departments, is one of the largest users of technical personnel, it was considered essential to familiarize technical persons in the government service with the details of the Bureau's operations. An interdepartmental committee was therefore set up, with the co-operation of the various deputy ministers, and a number of meetings have been held.

### Assistance to Mobilization Boards

In the National Selective Service Mobilization Regulations, specific reference is made to the Bureau as a body to which Mobilization Boards may refer when dealing with cases of technical personnel. Either through correspondence from Ottawa or by visits of Bureau officers, constant touch has been maintained, with the result that the numerous cases involving technical personnel which come before mobilization boards have been handled in what is believed to be the best interests of all concerned.

Under a plan sponsored by the governments of Canada and Poland, there are now in Canada some 225 Polish engineers and scientists. (In addition, there are over 300 Polish skilled workmen in the country.) These science workers have all been placed, where their qualifications may be used to best advantage, with some 70 different employers including most of the principal private war production industries, seven of the crown companies and four government departments.

### Operating Statistics

The statistics for the year are interesting. Although the figures cannot be used as a true measure of the Bureau's activities, certain facts are brought out which provide useful information. The number of inquiries received represents an increase of about seventy per cent over the previous year, but does not include certain inquiries which were not alloted numbers because they were in the form of "standing orders." This applies particularly to the constant search for suitable material for technical appointments in the armed forces, very little of which was done in the previous year, but which now is carried on actively.

The number of individual records referred to employers who filed inquiries represents an increase of about one hundred and sixty per cent over the previous year, which is a definite reflection of the increased activity in this branch of the Bureau's work, made possible by increasing the staff charged with the duty of investigating records and making such references. *(Continued on page 541)*

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## PROFESSIONAL EMPLOYMENT AFTER THE WAR

From *Engineering* (London, Eng.), July 30, 1943

In spite of the dramatically sudden disappearance of Mussolini from the Italian stage that he has dominated for 21 years, it cannot be said that the end of the war is in sight, even in the Mediterranean; but it is no more than obvious common-sense to look ahead and to consider so far as it may be done, how best to organise the eventual transition from war to a peace which, when it does come, may burst upon Europe, at any rate, with almost equal suddenness. The task is one of peculiar difficulty, which is likely to be enhanced if it should happen that enemy resistance in the Pacific collapses at the same time as in the West; an improbable contingency in the light of present indications, but not an impossible one. The difficulties of material will be serious enough, when so large a part of the world's population has been reduced to extremes of want of mediaeval severity, but those of personnel may be hardly less acute when once it is realised that demobilisation, from being a dream of the future, has become an imminent reality.

The problems of demobilisation are complicated by a time factor which did not enter into the initial mobilisation of the nation for war. The speed of the change from peacetime conditions to the present wholesale militarisation was dictated primarily by considerations of equipment. There was no reluctance on the part of the great mass of the population of military age to abandon their normal occupations and get into uniform, but all realised that there was no point in enrolling large numbers of men and women when there was little for them to do and a general lack of the equipment needed for training; they were content, therefore, to continue in their civilian roles until such time as their services could be properly utilised. The experiences of the last war showed clearly, however, that no such patience can be expected in the sudden reaction from the stress of active warfare to a comparatively inactive life in camp and barracks, entirely lacking in the common purpose that has sustained them previously; yet there will be many commercial and industrial adjustments to be made before the equipment for peace can be provided for all who are ready and anxious to use it, and there will always be trouble-mongers ready to make political capital out of the impatience of those who are dissatisfied with the sequence of demobilisation or reluctant to submit to military discipline any longer than they are obliged to do. It is easy to declare, as official spokesmen have done, the broad principle that the order of release will be determined solely by the needs of the community for men of particular trades and experience; but, with the best will in the world to apply the rules with the utmost fairness and impartiality, there are bound to be many cases requiring special consideration and others which are almost hopelessly intractable.

Among the instances of men possessing special qualifications, and whose demobilisation may have to be given a priority which those less fortunate may fail to appreciate, are likely to be many of the technically and scientifically trained men who have been drafted into the Forces in so much greater numbers than in the last war. The problems of releasing sufficient of them in the most advantageous sequence, and of finding appropriate civilian occupation for those who have no situations awaiting their return, obviously require early and special consideration. Not all of these men are in the Services; very many are engaged in war-time industry, but their cases must be considered in parallel with those of the engineers, scientists and other professional men who are in uniform in order to ensure a fair distribution of the peace-time civilian appointments as and when these become available. To explore these several needs in good time, the Minister of Labour and National Service has appointed a committee of inquiry of a somewhat unusual kind, under the chairmanship of Lord Hankey. The terms of reference are: to consider and report upon the arrangements which should be made to facilitate the employment after the end of hostilities of men and women qualified to undertake responsible work in the profession or elsewhere, with particular reference to (a) the organisation, premises and staff of the Appointments Department of the Ministry of Labour and National Service; and (b) the arrangements which should be made for co-operation between the Appointments Department and other organisations and institutions (including professional, industrial and commercial organisations) and universities, at home and abroad.

## THE ENGLISH BUDGET AND POST-WAR INDUSTRY

From *Trade and Engineering* (London, Eng.), May 1943

POST-WAR RESOURCES

Apart from the issue of taxation on wages much of the Budget discussions turned on the position of industry after the war, and concern was expressed as to the financial resources which will then be available to it. Sir Kingsley Wood's Budget speech showed how much this highly important matter is engaging his attention and that of his advisers, and he realized the need for giving assurances to industry. He referred to the discussions which had taken place between the Board of Inland Revenue and representatives of the principal industrial and commercial bodies and of the accountancy profession as having been most useful and productive of "progress" on a number of matters. One of these, of major importance, was what was known as "terminal losses" in changing from war-time to peace-time conditions. That, he said, was mainly an excess profits question and industry recognized that it could not be dealt with in detail now, but must be left over till after the war. But he gave industry the assurance to which, he said, it was entitled that "steps will be taken to see that all the expenses of a revenue nature which have been incurred in earning the excess profits will be allowed as a deduction in computing the liability to Excess Profits Tax".

SCRAPPING OF BUILDINGS AND PLANTS

The Chancellor of the Exchequer touched on several of the matters which are causing concern. As he said, the turnover from war production may involve the scrapping of buildings, plant, and machinery provided as part of the war effort. The law already provided relief both in income-tax and excess profits tax in respect of any loss so incurred, and Sir Kingsley Wood agreed that the relief should not be confined to cases where the equipment was actually scrapped but should cover also any loss in value where the equipment might continue in use. Another matter of concern is the treatment of losses in the event of a fall in value of stocks occurring after the war. The Chancellor recalled that in the excess profits duty of the last war there was provision for post-war stock depreciation in the Finance Act of 1921, and he agreed that at the end of the excess profits tax it might well be necessary to consider the question of a similar provision. But he went no further than to say that "consideration of this question and the precise nature of the provisions which may be required must obviously be deferred until the end of the war when it can be undertaken in the light of conditions then prevailing." Besides terminal losses, there was the general question of the incidence of income-tax on industrial profits. This, the Chancellor said, had been represented to him as a matter of post-war fiscal policy of great importance in relation to reconstruction. He had in mind in particular the position of profits that were not distributed but ploughed back into the business, and the treatment of capital expenditure for which no allowance was made in the existing code.

WASTING ASSETS

Sir Kingsley Wood said it was necessary to look closely at the facts and above all to find out the real effect of the tax provisions in actual cases over a period of time. That was why he hoped, as a next step, to set on foot a detailed examination by the Board of Inland Revenue of the matters which had been raised; these were not only of moment to industry itself but had wider importance in the sphere of economic policy. Another question on which the Chancellor touched was wasting assets. He reminded the House of the provision of the Finance Act of 1941 which gave relief from excess profits tax to concerns engaged in mining metal or getting oil in cases in which production had been accelerated in the interests of the war effort with the result that profits were brought under the tax which otherwise would not have been so affected until a later period when the tax might no longer be in force. Similar conditions had been found to exist in the case of certain minerals such as sand and gravel, and the Chancellor undertook to extend relief in such cases in the Finance Bill. He also proposes to provide relief in cases where normal management practice, both in the mining of metals and the getting of oil, had been departed from in order to accelerate production in the war but in such a way that working costs after the war would be increased.

## ADVICE TO APPRENTICES

From *The Engineer* (London, Eng.), July 30, 1943

We have much pleasure in reprinting admirable words of advice to pupils and apprentices compiled by Mr. C. M. Croft, chief engineer and general manager of the Wandsworth and District Gas Company. They are printed as a little folder under the title "Progress Data for Engineering Students," and we believe that Mr. Croft would offer no objection if other firms desired, very wisely, to copy them.

If you have good Health, good Brains and good Physique:
If you are—by nature—Neat, well Mannered and Even Tempered:
If you have been well educated:
Then thank your parents—They couldn't have done more for you.
If you start with all these qualities and don't get on THEN blame yourself.
To succeed you must start at the bottom rung of the ladder and not miss one step until you get to the top.
It does not matter how fast you climb as long as you first qualify for each upward step—and behave fairly to others in climbing.
Don't order people about—lead them.
The greatest danger of quick promotion is a swelled head. Watch yourself carefully. You have been warned!
Know your job—know your people. Consider their point of view and explain yours.
Personal progress largely depends on the goodwill of others towards you.
To gain goodwill you have to earn and deserve it.
Don't say one thing to one person and qualify it or contradict it to another.
Keep calm. When you lose your temper you also lose your judgment.
Be natural and cheerful—neither affectation nor gloom earns dividends.
"Facts" mean the truth—the whole truth and nothing but the truth. Report them clearly and concisely.
Your opinion will be most valued, if you wait to be asked for it.
If you cannot learn Human Nature at the same time as you are learning your job, give up Engineering. You will never succeed. Start again and try something else.
Be loyal to those over you, under you, and to yourself.
At times it will be your duty to correct people in your charge. Avoid, if possible, doing so before others.
Be fair, be firm, and you will impress them and not let yourself down.
Don't forget you get promotion because your chief trusts you.
Don't let him down by thought, word, or deed.
When in doubt, consult your chief. Like you, he learnt his job to start with. Unlike you, he has years of experience to guide him.
Don't try to get the better of people all the time. If you try, better people will be getting the better of you, most of the time.
Don't rely on your luck—rely on yourself.
Say what you think—but think before you say it.
If you cannot Trust yourself, why expect others to trust you?
Be Neat, Clean and Helpful in mind, body and work.
Cut out Jealousy—it has caused the failure or prevented the promotion of countless people who, otherwise, would have been successful.
YOU WILL FIND YOU HAVE MORE THAN ENOUGH TO DO IN MINDING YOUR OWN BUSINESS.

## LOOKING AHEAD

From *Trade and Engineering* (London, Eng.) July 1943

The far-sighted industrialist will certainly be well advised to keep himself informed in general terms as far as is practicable, of the advances which have been and are being made in the science of micro-biology and in its industrial applications, both actual and potential. Much work has been done and marked progress made in certain directions, but the field of research awaiting investigation is vast and much remains to be discovered. Explanatory literature on the subject is mainly of a highly technical character, and as its industrial and economic significance cannot be properly appreciated without some understanding of the nature of micro-organisms and their activities a brief indication of them is necessary.

YEAST, BACTERIA AND MOULDS

Three classes of these organisms are usually recognized: yeast, the reproduction of which is by means of daughter cells in the form of rounded out-growths, a process known as budding; bacteria, which multiply by fission; and moulds or microscopic fungi, which are filamentous. They range in diameter or in length and width from 1-25,000th to 1-2,500th of an inch, and the majority live in the soil or in water. There are cultural collections of them in the United Kingdom, the United States, Russia, the Netherlands, and Germany, and these are constantly being increased as new types are discovered or new strains developed. In research laboratories they are often grown for preservation on gelatinous media in test-tubes, and, in the case of yeast, in small flasks with open necks containing sterilized cotton wool for filtering the oxygen absorbed.

Most of them multiply with remarkable rapidity. In two days one yeast cell measuring 1-5,000th of an inch in diameter may be responsible with the cells of its daughters, grand-daughters, great-grand-daughters, etc., for 1,000 million buds. One ounce of yeast contains 300,000 million cells, and in 7 days a production of several tons can be derived from one cell. From such an initial amount enough yeast could be obtained by large-scale operations in a further 7 days to meet the whole requirements of the bread industry of the United Kingdom.

For their existence micro-organisms require moisture and, in the main, three elements, hydrogen, carbon, and nitrogen, while they can only grow within certain limits of temperature. Their industrial use is based on their analytic reactions, or in other words their ability to decompose substances. But they also possess synthetic powers, though these have so far found industrial application in only a few instances. In their activities they use far more material than is necessary theoretically for their growth and reproduction, and that is why they can be used in industry as living catalysts.

### Micro-Organic Activities

Certain types are able to utilize carbo-hydrates, such as sugar, starch and cellulose, and they can do so in a number of ways. Some break them down and convert them into carbon dioxide and water as the human body does, other into intermediate substances, such as butylene glycol, and others into acetone and butyl alcohol. By this means they get energy for their functions, which in most instances are not pathogenic. Yeast elaborates zymase, and enzyme or colloidal catalyst which induces the alcoholic fermentation of carbohydrates.

Some types of bacteria live in petroleum wells and utilize hydrocarbons as a source of carbon. A few years ago there was an investigation into the cause of some mysterious explosions in coastal oil storage tanks, and it was found that the water bottoms contained certain bacteria which had entered with the sea-water used in cleaning operations. These organisms had converted certain substances into gases which in combination with the oil vapours had caused spontaneous ignition.

Another type can act on sulphur in the free state, while others can utilize flowers of sulphur, convert it into sulphoric acid, and live in a 7-per cent solution of the acid. Some, again, operate on calcium sulphate, using the sulphur and reducing it to sulphuretted hydrogen, and in soils where this type is active pipe-lines have been corroded by the sulphuretted hydrogen thus generated. Sulphur bacteria, indeed, like many micro-organisms, account for various occurrences which were mystifying until the micro-biologist found the explanation. For example, there is the story of a gun which was salved some years ago from one of the sunken galleon of the Spanish Armada. When it was hauled on the deck of the salvage ship it was found to be quite warm, and as it lay there it became hotter still. To the curious sailors the ship's doctor explained that the gun had been in action and had not cooled down. To-day the true explanation is known. As the gun lay on the floor of the ocean it had undergone graphitization and micro-organisms had covered the cast iron with a shell of iron sulphide which, on exposure to the atmosphere, had oxidized so rapidly as to generate heat in the changed iron.

### Fixation of Nitrogen

Even more intriguing is the fixation of nitrogen by two types of micro-organisms present in the soil. These are azotobacteria, which live as free agents and require certain carbohydrates for the purpose, and certain symbiotic bacteria, which inhabit the roots of clover and beans and produce the nodular swellings in them. In contrast with the elaborate methods of the arc, Haber, cyanamide, and other processes which man has evolved, these organisms can form nitrogeneous compounds from elementary nitrogen with ease. Other bacteria can synthesize protein from inogarnic nitrogen, that is, utilize free ammonia or ammonium sulphate to build up proteins, which are as necessary to plants and bacteria as to human beings.

Micro-organisms have indeed been deliberately and scientifically used in industry for some years more widely than is generally realized. They play an important role in the dairying industry, in the conversion of milk into butter and cheese, and pure cultures of lactic-acid producing bacteria are readily available. In the tank retting of flax and hemp the stems are soaked in water inoculated artificially with a mixed bacterial flora, while in tobacco fermentation the flavour of the finished product depends on the particular grouping of the micro-organisms involved in the process. Bacteria, too, are used in making silage for cattle and in the fermentation of cocoa and coffee. More generally known is the fact that sewage disposal is essentially a bacterical process, depending in the final stages on the nitrifying bacteria used in the filter beds.

## WELDING CONTRACTION AND "LOCKED-UP" STRESSES*

From *The Engineer* (London, Eng.), May 28, 1943

A great deal has been written on welding contractions and "locked-up" stresses, but considerable misunderstanding still exists on this subject even among those who have long experience of welding. Possibly this is due in part to the tendency of some writers to enter into too many technicalities and complications. It is essential to welding progress in this country that it should be generally recognised that locked-up stresses cannot be disregarded, but they can be avoided provided certain fundamental principles are fully understood.

When a bar of iron is heated, as shown in Fig. 1, *i.e.*, with freedom in all directions, it returns to its original length and diameter on cooling, and there is no contraction or residual (locked-up) stress. When, however, a bar is heated, as in Fig. 2, with ends restrained against expansion, all the excess volume of metal must go laterally, to increase the diameter of the bulge. On cooling, this excess metal cannot return to its proper place, so that the bar contracts in

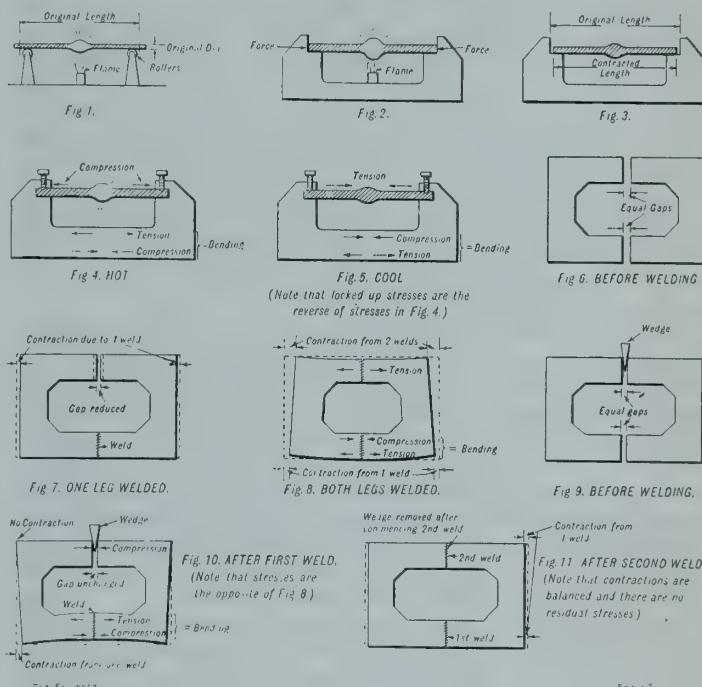



Fig 1. Fig. 2. Fig. 3.

Fig 4. HOT. Fig. 5. COOL (Note that locked up stresses are the reverse of stresses in Fig. 4.) Fig 6. BEFORE WELDING

Fig 7. ONE LEG WELDED. Fig. 8. BOTH LEGS WELDED. Fig 9. BEFORE WELDING.

Fig. 10. AFTER FIRST WELD. (Note that stresses are the opposite of Fig 8.)

Fig. 11 AFTER SECOND WELD (Note that contractions are balanced and there are no residual stresses.)

length, leaving a permanent bulge, and the cool bar is shorter than the original length. In other words, the centre part of the bar has been "upset" by the application of the forces indicated in Fig. 2, while centre was plastic.

In the foregoing cases there has been no residual stress, but imagine that in Figs. 2 and 3 the ends of the bar had been restrained so that the bar could not contract; there would have been a residual stress (tension) in the bar after cooling, as shown in Fig. 4 and 5. From the above, the following points will be noted:

(1) There will be no residual contraction or stress if the ends are free.

(2) There will be no residual stress if the ends are free to contract.

(3) There will be residual stress, but no contraction, if the ends are prevented from expanding during heat and from contracting on cooling.

In welding, these phenomena are essentially, but not exactly, the same. In practice, it is almost impossible to prevent some end restraint, and therefore there will usually be some residual contraction and some residual stresses. These can, however, be kept within perfectly safe limits if the above principles, and the following, are understood, and

*Communicated by the Admiralty.

measures are taken to counteract the undesirable effects.

In the following remarks it will be assumed that there is contraction at each weld, as is usual, owing to the progressive nature of welding, which is attended by restraint and "up-setting" due to the solidification of weld metal behind the arc. Fig. 6 shows a simple structure prepared for welding. After one leg has been welded, the conditions will be as shown in Fig. 7, that is, the overall length will have contracted, but there are no internal residual stresses. Fig. 8 shows the conditions after the second weld has been made. There are residual locked-up stresses, and it will be noted that these are entirely due to the second weld. This condition can be avoided by the procedure indicated in Figs. 9, 10, and 11. Strictly speaking, the wedge should be withdrawn half way before commencing the second weld, otherwise the cooled weld metal of the first few inches would act instead of the wedge, and the stresses shown in Fig. 10 would partially remain, but reduced by the contraction of the second weld.

It has been noted that the stresses shown in Fig. 10 are the opposite of those shown in Fig. 8, *i.e.*, they are the opposite of the residual stresses it is desired to avoid. It will also be noted that if a wedge were driven into the upper gap in Fig. 7, it would produce the same sort of stresses as shown in Fig. 10. This observation is of extreme importance in considering the application of these principles to a large structure such as a ship. It leads to the conclusion that the deck butts should be forced apart before welding. This is the exact opposite of what usually happens in practice. The common practice is rather to pull the joints together, thus producing tension instead of the desirable compression. This tension is added to the tension caused by the contraction of the weld and therefore the residual or "locked-up" stresses are increased.

It can be seen from the foregoing that unless proper precautions are taken a welded ship can easily develop quite heavy tension in the upper parts of the structure, such as sheer strakes and decks. She starts life with this stress. A new ship, being light, is very commonly in a "hogging" condition, which increases the tension in the deck. Again a new ship, being launched, may not have all its machinery on board, which increases the hogging tension. Further, it may be that if tide conditions, etc., are not exactly right, she may "tip"—*i.e.*, pivot about the end of the ways—producing a further serious increase in the tension. Other circumstances tending to increase this tension are: Excessively cold atmosphere with a relatively warm sea; heavy weather, causing alternating hogging and sagging stresses; state of loading and ballasting, etc. When, in addition to these conditions, there are geometrical features of the structure tending to cause local concentrations of stress, there is real danger of failure.

It has been suggested, in discussion on "locked-up" stresses, that these tend to relieve themselves by local plastic deformations at the points where the stress is over the elastic limit. There is small comfort in this theory. It is fallacious for two reasons: Plastic deformation only takes place at stresses above the yield point, and ceases when the stress is reduced to this point, so that stresses up yield point can remain in spite of the plastic deformation. (2) The extent of plastic deformation is dependent to a large extent upon the degree of restraint. In a narrow strip, such as a tensile test piece, plastic deformation takes the form of reduction in width and thickness, balanced by increase in length, so that the volume of metal is unchanged. In a large expanse of plate, the increase in length can only be compensated by reduction in thickness (not in width), and therefore fracture may occur at a much smaller elongation.

Nevertheless, plastic deformation due to over-stressing does tend to equalise stresses, and is therefore helpful, but—a very important "but"—it cannot reduce the overall type of stresses likely to develop in large structures due to disregard of the precautions suggested above. Also, such attempts to equalise stresses by over-loading are attended by considerable danger of failure, specially in complicated structures.

The outstanding moral to be drawn from these observations is that locked-up stresses cannot be overlooked, but they can be avoided. It is essential that these fundamental principles should be widely and thoroughly understood, and fully appreciated, so that they can be intelligently applied. There is quite a widespread tendency to believe that contraction, distortion, and "locked-up" stresses are inherent and incurable defects, inseparable from welding. This can only be due to lack of understanding of the nature, causes, and cures. Much the same attitude was prevalent in relation to many diseases, such as small-pox and other plagues, before medical science "debunked" them.

## LEAD IN WAR

From *Trade and Engineering* (London, Eng.), July, 1943

Since the invention of firearms lead has always been one of the most important munition metals. It is as essential for the production of modern small-arms ammunition as it was for the manufacture of musket-balls years ago. Indeed, quick-firing automatic rifles and machine-guns "consume" such vast quantities of ammunition that the current demand for lead for this purpose far exceeds any comparative figures of past wars.

Ammunition is, however, not the only "war-consumer" of lead. Considerable quantities of the metal are used in the equipment of munitions and chemical factories. Additional quantities are needed as anti-corrosive coatings for military purposes. Lead in the form of tetra-ethyl-lead is needed for aviation spirit. Military radio and field telephone equipment is very dependent on lead. Lead goes into the bearing metals of heavy guns and tanks. It forms an essential part of the solder for any type of equipment. The storage batteries of a submarine absorb as much as 250,000 lb. of lead, and a similarly large quantity of the metal is used in other parts of each submarine, including about 200,000 lb. for ballast.

### Not a Scarce Metal

At first sight it might be supposed that lead to-day is one of the scarcest metals. In fact, however, it is the least scarce of all the major non-ferrous metals under the control of the United Nations. Shortage of shipping space, however, sets a strict limit to lead imports into this country, and therefore, although lead is produced in this country in sizable quantities, the greatest economy in its use for non-military purposes remains essential. In the United States, where sea transport considerations for lead are less important than in this country (the bulk of the supplies being produced domestically or imported over land routes) lead is the only important metal which is not on the "critical list". The War Production Board of the United States has, in fact, released lead as a substitute for other metals, including steel. It has, moreover, accumulated such substantial reserve stocks during the past 18 months that the United States has from the beginning of this year discontinued the import of lead from Canada and Australia and has reduced the priorities on lead shipments from South America.

This remarkably favourable allied lead supply position is due to a number of causes. First of all the United Nations control the great bulk of world production. In the best pre-war year (1937) the world's lead mines produced close on 1,660,000 metric tons. Of this quantity not more than 248,000 tons were produced in Axis-controlled Europe. The same block of territories consumed in 1937 no less than 565,000 metric tons of lead. Japan, whose consumption averaged 120,000 tons a year immediately before this war, does not produce more than 10,000 tons domestically. In the Asiatic "Co-prosperity Area" the Burma Corporation's Bawdin mines, in the Federated Shan States (Upper Burma, near the Yunnan border), are the only major source. Before this war these mines produced between 80,000 and 85,000 tons of lead, but during the evacuation all the equipment was wrecked, and so far not even the Japanese have claimed that they have restored normal production at Bawdin.

### Producing Areas

The United Nations draw their lead chiefly from two continents, America and Australia. The United States, whose mines production amounted to 416,000 metric tons in 1937 but has since increased to 500,000 tons, is the world's largest producing area. Mexico and Canada, which produced 218,000 and 187,000 metric tons respectively in 1937 and have expanded their mines output during the war, are the third and fourth largest producing countries. In addition considerable quantities of lead are mined in the smaller American producing countries, of which Peru, Newfoundland, and Bolivia are the most important. In all, America's production of 922,000 tons in the pre-war record year represented over 55 per cent of world production.

Australia (the Broken Hill mines in New South Wales and the Mount Isa mine in North Queensland) is the world's second largest producing area, with an annual pre-war output of 250,000 tons (15 per cent of world production). There are some smaller sources of supply at the disposal of the United Nations such as the United Kingdom production, the African output from Northern Rhodesia, South-West Africa, and French North Africa, and the Russian output in Caucasus, Urals, and Siberia, which in the pre-war record year produced together 130,000 metric tons (8 per cent of world production) but have undoubtedly expanded their output during the war. As the great bulk of the world's lead—unlike zinc, the mining of which is closely associated with that of lead—is smelted in the mining areas and there is a considerable excess of lead refining capacity in the United States, the United Nations have no technical difficulties in utilizing their great supplies of lead ores to the full.

New supplies of lead are supplemented by secondary supplies. As the great bulk of the lead is used in metallic form and in very handy shapes (pipe, sheet, plate, etc.) secondary recovery from old scrap reaches high levels. The United States, the only country which publishes regular scrap recovery figures, recovered in 1941 no less than 380,280 short tons of lead from "old scrap" alone, to which a recovery of 17,136 tons from "new scrap" (the waste in the manufacture of lead products) has to be added. In this country, too, scrap lead recovery must have reached very high figures since the outbreak of war as a direct result of the demolition of bombed buildings.

### Restrictions on Use

The large primary and secondary supplies, however, are not the only and probably not even the chief reason for favourable allied lead position. Dislocations in consumption through the war play an important part in bringing about the comfortable supply situation. The main characteristics of lead are its high specific gravity, its softness, its low melting point, its unusual malleability, its resistance to corrosion and acids and its low electric conductivity. These properties have assured the metal a very wide variety of industrial uses, but in normal times there are two industries which account for the great bulk of the consumption, the electrical industry (including battery manufacturing) and building. In average peace conditions about 28 per cent of the lead goes into storage batteries and another 14 per cent into electrical cable coverings. Building absorbs about 11 per cent of total supplies in the form of pipes, sheets, and coatings for structural metals, and uses another 20 per cent of supplies in the form of paints (white lead, red lead, and litharge). All other uses, of which ammunition, foil, solder, bearing metals, typemetals, and calking, are the most important, thus account normally for less than three-tenths of total consumption. To-day building is an idle industry and electrical manufactures, with the exception of those of immediate importance to the war, have ceased. Many of the minor uses, too, are severely restricted. As a result the war industries do not find it difficult to meet their much increased requirements for direct munitions production, for the manufacture of battery plates and for similar uses which have been vastly expanded through the war.

The comparatively comfortable allied lead supply position has resulted in certain developments which may prove of lasting importance to the future position of this metal. In all other metals the existing shortage of supplies has not only stopped scientific research into the development of new uses for the duration of the war, but has also stimulated an intensive search for suitable substitutes. In the case of lead the position is exactly reversed. Here active research has been initiated, especially in the United States, Canada, and Australia, to find new uses for lead by substituting it for scarcer metals.

---

## THE POSITION OF MANUFACTURING . . .

(*Continued from page 514*)

ment. In the field of recreational services it is conceivable that the number employed could well be ten or more times the present amount. The shorter working hours and the decreased working years that appear inevitable will obviously increase the need for recreational services, comprising not only facilities for active forms of recreation such as playing fields and buildings for competitive sports and national and provincial parks and holiday sites, but also a vocational training and facilities for persons of sedentary habits.

Antagonism to the radical extension of useful services would probably be met from the generally held but erroneous opinion that the cost would be a heavy burden on the taxpayer. Such services are truly self-sustaining just as truly as in the case of the farm that produces useful needed food or the industry that produces useful needed goods. The exchange of food, fuel, goods and other services for these extended services would almost certainly be handled by taxation, but this would not alter the fundamental fact that they are self-sustaining.

There are two schools of thought on the future conduct of industry. One holds that the present system of free enterprise should continue, the other that there should be a large measure of socialism. The free-enterprise system inevitably tends towards the creation of facilities for production of goods in excess of the average demand for goods. This is good from the standpoint that it also creates competition for the available market, which in turn tends to the wholly desirable result of lower costs to the consumer. The excess capacity, however, also makes it difficult to have production match the market, and when production falls out of balance with the market, unemployment results. Such unemployment is temporary and can be cared for by social insurance and the release of construction projects, whereas failure to plan for increasing employment in useful services will create permanent unemployment. The ideal set up may well be free enterprise for industry and socialism for those services, with an acknowledged responsibility on the part of the services to provide a much larger share of employment than in the past.

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

## ENGINEERS IN ORDNANCE

Even in these days of free and frequent criticism no one desires to say or do anything that might in any way retard the conduct of the war. Actually, there is a real appreciation of the good work that is being done by so many in the public and active services, but sometimes conditions develop or are exposed to the public that appear to be out of all reason, and in the absence of any plausible explanation there is a natural inclination to make comment or to ask questions. Conditions within the Royal Canadian Ordnance Corps seem to come within this category.

For many months the *Journal* has been reprinting material which has been supplied to it by the War Office in London. This material has told something of the story of engineering activity in the Imperial Army as performed by the Royal Electrical and Mechanical Engineers' Corps, the successors to the engineering side of the Royal Army Ordnance Corps. The thought was that this was news of special interest to engineers, and that in some way its appearance in the *Journal* might support Canadian officials in initiating a similar set-up in the Canadian forces. To date there appears to be no evidence that the latter hope was justified.

The failure to give engineers promotions and senior responsibilities in the R.C.O.C. has resulted in too many well qualified persons seeking places in other services. This is demonstrated strikingly by figures published not long ago in the University of Toronto *Monthly* relative to students. Here is the statement:

> "Figures recently compiled by contingent headquarters show that 402 members of the contingent are now being considered for advanced training by the three services. By units there are as follows: Navy Technical Officers, 39; R.C.A.F. Technical Officers, 35; Armoured Corps, 48; Artillery, 82; Engineers, 79; Ordnance Mechanical Engineers, 5; Signals, 62; Infantry, 36; Machine Guns, 6; Chemical Warfare, 9; Camouflage, 1."

Surely there is something wrong as far as Ordnance is concerned, and the answer isn't that the men are not needed!

The Institute, through its Committee on the Engineer in the Services, has made many direct inquiries as to the merits of the R.E.M.E. set-up. These inquiries have included cables and letters to members overseas—both in military and civilian circles—conversations with R.E.M.E. officers who have been in this country, and communications direct from R.E.M.E. headquarters in England. An interview has been had also with the Master-General of the Ordnance at Ottawa. All these sources of information, although not always in agreement, have combined to give the definite impression that the present Canadian arrangement in comparison to R.E.M.E. is inefficient, inadequate and indefensible. The R.E.M.E. corps in actual combat has proven the value of a separate corps. As the Canadian Army closely follows the organizational set-up of the British Army, it is difficult to see why this change has not been adopted. Our Canadian divisions are quite likely to go into action as part of a British corps or army, as has occurred in Sicily and Italy.

Frequently in articles and addresses on the R.E.M.E., both in Canada and England, one can now detect the implication that the refusal of Canada to follow the proven course of the British authorities is based on the selfish interests of non-technical persons in the Royal Canadian Ordnance Corps. For instance, in *Saturday Night* of August 21st in an article dealing with R.E.M.E. and Ordnance, it is said, "Unfortunately in Canada, where it is one jump from a department store to a full colonelcy and where the Permanent Force is intent on holding all it has and getting more, military efficiency has not always been the prime consideration" and "From the preponderance of Stores officers in the higher ranks it would appear that loss of prestige on the Socks and Shirts side may have been the determining factor." If this be true, a serious condition is indicated and should not be passed over lightly.

For a long time letters have been coming to Headquarters from members who are actually experiencing the things of which complaint is being made. Two of them are published in this number of the *Journal*. For obvious reasons, the writers' names have been omitted. These are not isolated letters, but are selected from many because they are typical. Most of the conditions complained of in these letters and by engineers generally would be overcome under a R.E.M.E. set-up, because engineers would then be in complete charge of their own work and could render their maximum of effort which many of them feel they cannot do under present conditions.

The *Journal's* interest in these matters is based not so much on the interests of the engineer as on the national interest. The engineer is in great demand in all three services and he doesn't need to go to Ordnance if he doesn't want to. However, this is the kind of work he is specially qualified to do and in many instances desires to do.

If the supply has not been equal to the demand, the blame cannot be placed on the engineers.

---

*Later. See page 526. "Has it Actually Come to Pass?"*

## WARTIME BUREAU OF TECHNICAL PERSONNEL

Elsewhere in this Journal is printed an abridgment of the annual report of the Bureau for the fiscal year ending last March. It is not sufficient to submit this to readers without comment. So many things of vital importance are touched on, and the accounting is done so modestly that it behooves someone else to emphasize the important points and to offer congratulations and praise to those who have actually done the work.

Of all the war organizations established at Ottawa, it is doubtful if any have functioned more satisfactorily or with less trouble to the authorities. The job was given to the technical societies; they have been left along to do it, and it has been done. The success of the Bureau is a genuine tribute to the professions involved in it. It is but further proof that the engineer is the one best qualified to administer his own work. It is too bad that certain other organizations do not recognize this plain truth.

Many persons are forgetting that the Bureau is still operated by the three national organizations that were first invited by the Minister of Labour to establish it; and that the responsibility for it still rests on those societies. This co-operative effort between the Canadian Institute of Mining & Metallurgy, the Canadian Institute of Chemistry, and the Engineering Institute of Canada, has been a pleasant and profitable experience. It may well be the model for many further enterprises.

One of the most useful accomplishments of the Bureau has been the development of co-operative relationship with the three active services, whereby some order and balance could be established for the distribution of engineering and science students upon graduation. The Bureau has done many things to help solve the confused and disturbing conditions that prevailed in the universities.

The figures given in the report do not begin to tell the story. The stabilizing effect of the Bureau's work, which has been one of its greatest accomplishments, cannot be expressed in figures. No other group of workers has wasted less time in idle wonderings and lost motion. The advice and counsel offered by the Bureau has been taken by unnumbered hundreds of technical personnel and employers. The figures of 11,730 personal interviews in one year gives some idea of the extent of this one phase of the work.

Engineers throughout Canada should take much satisfaction from the work that has been done. Their ready acceptance of the controls, and their whole-hearted co-operation, have made possible the splendid showing that is disclosed within the report.

The Engineering Institute offers to the director and staff of the Bureau its congratulations. Not only have they done a good job for the nation, but they have done a good job for the profession as well. Through representation on the Advisory Board, the Council of the Institute has a close association with all activities, and therefore is well qualified to offer these felicitations.

## THE PRESIDENT'S WESTERN TOUR

The itinerary for the president's visit to the western branches next month has just been completed. Present and past officers are invited to accompany the president on all or part of the tour.

The president will be accompanied by Mrs. Cameron and the general secretary, L. Austin Wright.

| | | | | |
|---|---|---|---|---|
| Lv. | Toronto | Sunday | Oct. 3rd | 10.55 p.m. |
| Arr. | Winnipeg | Tuesday | Oct. 5th | 9.30 a.m. |
| Lv. | Winnipeg | Tuesday | Oct. 5th | 9.00 p.m. |
| Arr. | Regina | Wednesday | Oct. 6th | 6.40 a.m. |
| | Branch Meeting—Oct. 6th—6.30 p.m. | | | |
| Lv. | Regina | Thursday | Oct. 7th | 7.40 p.m. |
| Arr. | Calgary | Friday | Oct. 8th | 9.20 a.m. |
| | Branch Meeting—Oct. 8th—6.30 p.m. | | | |
| | Lethbridge—Branch Meeting—Saturday 9th at noon | | | |
| Lv. | Calgary | Sunday | Oct. 10th | 9.15 a.m. |
| Arr. | Sicamous | Sunday | Oct. 10th | 8.30 p.m. |
| | By motor to Kelowna—Luncheon Meeting Monday noon | | | |
| Lv. | Sicamous | Monday | Oct. 11th | 9.10 p.m. |
| Arr. | Vancouver | Tuesday | Oct. 12th | 9.20 a.m. |
| | Branch Meeting Tuesday 12th of Wednesday 13th | | | |
| | Student Meeting | | | |
| Lv. | Vancouver | Thursday | Oct. 14th | Midnight |
| Arr. | Victoria | Friday | Oct. 15th | 7.00 a.m. |
| | Branch Meeting—Friday 15th | | | |
| Lv. | Victoria | Sunday | Oct. 17th | 1.20 p.m. |
| Arr. | Vancouver | Sunday | Oct. 17th | 6.35 p.m. |
| Lv. | Vancouver | Sunday | Oct. 17th | 7.15 p.m. |
| Arr. | Calgary | Monday | Oct. 18th | 7.35 p.m. |
| Lv. | Calgary | Monday | Oct. 18th | 11.45 p.m. |
| Arr. | Edmonton | Tuesday | Oct. 19th | 6.25 a.m. |
| | Branch Meeting—Tuesday 19th | | | |
| | Macdonald Hotel 6.30 p.m. | | | |
| Lv. | Edmonton | Tuesday | Oct. 19th | 10.15 p.m. |
| Arr. | Saskatoon | Wednesday | Oct. 20th | 11.35 a.m. |
| | Branch Meeting—Wednesday 20th | | | |
| | Student Meeting | | | |
| Lv. | Saskatoon | Thursday | Oct. 21st | 12.10 p.m. |
| Arr. | Winnipeg | Friday | Oct. 22nd | 8.10 a.m. |
| | Branch Meeting—Friday evening 22nd | | | |
| | Student Meeting—Friday afternoon 22nd | | | |
| | Council Meeting—Saturday 23rd | | | |
| Lv. | Winnipeg | Saturday | Oct. 23rd | 8.30 p.m. |
| Arr. | Fort William | Sunday | Oct. 24th | 7.10 a.m. |
| | Branch Meeting at Port Arthur—Monday evening October 25th | | | |
| Lv. | Port Arthur | Monday | Oct. 25th | 11.20 p.m. |
| Arr. | Franz | Tuesday | Oct. 26th | 8.48 a.m. |
| Lv. | Franz | Tuesday | Oct. 26th | 11.20 a.m. |
| Arr. | Sault Ste. Marie | Tuesday | Oct. 26th | 6.55 p.m. |
| | Branch Meeting—Wednesday evening Oct. 27th | | | |
| Lv. | Sault Ste. Marie | Thursday | Oct. 28th | 4.10 p.m. |
| Arr. | Sudbury | Thursday | Oct. 28th | 9.55 p.m. |
| Lv. | Sudbury | Friday | Oct. 29th | 12.25 a.m. |
| Arr. | Ottawa | Friday | Oct. 29th | 8.45 a.m. |
| Arr. | Montreal | Friday | Oct. 29th | 11.15 a.m. |

## GIFTS TO THE INSTITUTE

Many educational and technical organizations are aided materially by gifts of money from members and well wishers. A great deal of the good work done by such organizations is made possible solely by reason of this assistance.

Engineering societies in England and the United States have benefitted from this much more than have similar organizations in Canada. Sometimes an endowment is left whereby an annual feature such as a prize on a series of lectures is made possible. In other instances, a sum is made available for a single specific purpose such as a building or a library, or the printing of a special paper. In other instances, the disposal of the money has been left to the judgment of the officers of the society.

Perhaps the most noticeable gift of this kind was made in 1904 by Andrew Carnegie, when he turned over to the senior engineering societies in the United States 1½ million dollars to be used to meet part of the cost of a headquarters building and a club for engineers. This contribution made possible the establishment of an engineering centre, the like of which is not equalled anywhere else.

The Engineering Institute could make splendid use of any extra monies that members or friends would care to contribute. Perhaps some members would like to do this through their wills. For their benefit, it can be said that legal advice has been secured on succession duties, and the fact has been established in England that organizations such as the Institute are admitted to the group to which exemption from duties applies.

For such contributions there are several uses. If enough money were secured this way it should be possible to rebuild a portion of Headquarters so that Canada, like the United States, might have a professional centre. The library is always in need of new books, and smaller sums could be well used in this manner. The establishment of prizes and the printing of certain technical papers might also be worthy objectives. Additional assistance to students and young engineers is an important field that would thrive materially under the stimulus of financial assistance.

The purpose of this article is to suggest to those members who have enjoyed greater financial success than others, that through contributions to the Institute they may extend their good works to the betterment of the profession and the Institute.

## HOUSING AND COMMUNITY PLANNING

The following editorial has been taken from the September issue of the *Municipal Review of Canada*. The subject is one for consideration of engineers, and the reference to the Institute in the last paragraph may not be inappropriate.—(Ed.)

"This coming season the School of Architecture of McGill University is presenting an extension course of twenty lectures on "Housing and Community Planning," the course covering certain economic, social and political aspects of planning and zoning, but we note that very little will be said about the physical structure of planning. For some years now the economists and the sociologists have claimed the right to take a major part in town planning and zoning, and undoubtedly there is much to be said for their claim, but not for a principal part, for the reason that town planning is primarily a physical and not a social science. It is true that in every comprehensive city plan the social side and the economics of the community must be given wide consideration, but to assume that such consideration should take priority over the physical aspects of the district is to assume that the tail should wag the dog.

"The most successful piece of town planning on the North American continent is the Chicago Plan of 1908—the carrying out of which has changed one of the most ungainly and ugly of cities to one of the finest on this continent. Just after the Chicago Exhibition of 1893 closed, a committee of local business men called upon D. H. Burnham, the eminent architect of Exhibition, and asked him if he would prepare a comprehensive plan for the city and district of Chicago. Burnham, who loved his Chicago, answered in the affirmative; but he also stated that a sketch plan would cost in the neighbourhood of $75,000, and that he would not undertake the job unless the committee were prepared to put up another $75,000 to sell the plan to the people of Chicago.

"Within fifteen minutes the money was on the table, and that eventful meeting marked the beginning of events leading up to first, the Chicago Plan and then the Chicago Commission to carry out the plan. The Chicago Plan was a wonderful success from the beginning because intelligence was used in educating the common people to be *Chicago Plan* minded through series after series of sketch plans of the physical structure itself. There were no public talks or lectures about the social and economic aspects of the plan. The plan itself was thrust at the citizens and they responded 100 per cent. It was a story good enough to be told without frills.

"There being now no Canadian Town Planning Institute, we would suggest that the two national institutions—the Canadian Architects Association and the Engineering Institute of Canada—should make town planning and zoning *from the physical point of view* a major part of their activities, particularly as the tendency of the Federal Government is to insist that any community seeking federal housing aid must first have a town plan and a set of zoning by-laws."

## GREETINGS FROM ARGENTINA

The following greetings have been received at Headquarters through the Canadian legation at Buenos Aires.

Argentine Center of Engineers

Buenos Aires, July 6th, 1943.

To H. E. The Envoy Extraordinary and
Minister Plenipotentiary of Canada,
Dr. W. Turgeon

On the occasion of the anniversary of Dominion Day of the Dominion of Canada, I have the honour to address Your Excellency, worthy representative of her interests, and beg of you to convey to the engineers, architects and land surveyors of Canada the cordial greetings of the Argentine engineers, as a tribute on this glorious date.

We wish to express our emotion and complete solidarity in the defence of the principles of liberty and equality, the most noble attributes to the peoples of America and to express our hearty wishes for the prosperity and development of our brother and friend, Canada.

Please accept, Excellency, the assurances of our most distinguished consideration.

(Sgd.) Engineer Raul Martinez Vivot, *Secretary.*
(Sgd.) Engineer Luis V. Migone, *President.*

The letter has been acknowledged by the president of the Institute and the chairman of the Committee on International Relations.

## ENGINEERS AS AMBASSADORS

It is recognized readily that one of the few good things that have come out of this war is the better relationships between those countries that are collaborating in the defeat of the enemy. This goes all the way from governments to individuals. The necessity of collaboration has forced people of different countries to know each other, and there is no better way of overcoming prejudices and ignorances than to work together in a common cause.

One of the greatest influences for good in this field has been the engineer and science worker. These groups in all the allied countries have worked together very closely. The confidences which have been exchanged, the joint efforts which have been made, the community of interest and effort not only have produced miracles that have confounded the enemy but have laid foundations for international goodwill that may well be the principal contribution towards this desirable end.

These technically minded people travel from country to country to assist their fellow workers. The urgency of their work usually requires air transport, and the confidential nature of their missions usually demands no publicity. Thus the ordinary citizen is seldom aware of the internationally famous persons who are shuttling in and out of his country constantly. It seems too bad that the stories of the work of these miracle men are kept so quiet, for they are quite the most interesting narratives of the war, but of necessity we will not know of them until the war is over—and perhaps not then.

Much of the work of these groups is for destructive purposes but much of it can be converted to aid in better peace-time living. However, one of the great things they have done for their countries which will be converted fullfold is the establishment of international goodwill based on mutual respect, admiration and affection.

## CHEMISTS REORGANIZE

If a scheme now under consideration materializes, Canadian chemists and chemical engineers will probably request their present chemical societies to commit hara-kiri in favour of one national chemical organization. These three societies, the Canadian Chemical Association, the Canadian Institute of Chemistry, and the Society of Chemical Industry (Canadian Section), have long conducted a co-operate policy in a number of directions, including the holding of an annual Canadian chemical convention. At the convention last May, in Montreal, a resolution was passed empowering the Councils of the three organizations to proceed with the drafting of a scheme for the formation of one national chemical organization. Accordingly, the Councils appointed a Joint Committee on Chemical Reorganization to study the situation and draft a report in agreement with the resolution. The Joint Committee has already met twice and it is understood that discussions have proceeded to a point where the essential features of a new organization have been agreed to and need only be written in report form for submission to Councils.

The proposed national organization would, according to the views expressed at the convention, include both professional and non-professional members and permit one strong organization in place of divided responsibility as evidenced at the present time. No professional standards are to be sacrificed. It is estimated that the Wartime Bureau of Technical Personnel presently has on file approximately 6,000 qualified chemists and chemical engineers who would conceivably become members of the new organization, compared to the 2,000 or so members presently affiliated with one or more of the three existing organizations.

## HAS IT ACTUALLY COME TO PASS?

*Apparently something has happened in the Canadian Army in Italy as far as the Ordnance Corps is concerned, for, in the London Free Press of September 11th, appears a dispatch from the Canadian Press War Correspondent, Ross Munro, which is quoted below.*

*He definitely states that the Royal Electrical and Mechanical Engineers are a unit formation of the Canadian Army. This is very interesting, and will be good news if true.*

*"With Canadians in Italy, Sept. 8—(CP Cable)—Even repair unit formations of the Canadian Army—Royal Electrical and Mechanical Engineers—have taken prisoners in this strange advance through the Italian toe.*

*"One party of about 15 officers and men went along a road beyond the forward Canadian patrols and nearly a battalion of Italians surrendered to them. There were two colonels, two majors, eight other officers and 536 other ranks who gave up. The Italians were fully armed, in defence positions, but they gave up without a fight even to this tiny group."*

## WASHINGTON LETTER

This is not strictly a Washington Letter as it is being written as I sit on a beach on the shores of beautiful Lake Memphremagog. Like so many of my pro-tem countrymen, I decided to bring my family to Canada for our vacation. In any event, as this is being written, the French-Canadian city of Quebec—one of the oldest cities in the new world—has eclipsed both Washington and London as a focus for the attention of the world. The conference now being held in the ancient Citadel on the ramparts of the Plains of Abraham will take a ranking position among the historic conferences of the North Atlantic and Washington and Casablanca. The choice of a meeting place in French Canada has a significance far beyond considerations of the French Committee or the Bloc Populaire although these, no doubt, come within the meeting's province. Actually, the choice is yet another indication of the recognition on the part of the outside world of the important and key position of Canada in world affairs.

Hyde Park and Ogdensburg were also important conferences for Canada. Canada is recognised as the third largest trading nation in the world; she is the fourth greatest military power of the allies and the fourth largest munitions producer. Some of the implications of her trading position will be seen in the post-war trade pacts which the Honourable Hector McKinnon recently went to London to negotiate. Her military importance is attested to by her share in the strategic discussions at present under way at Quebec. Parenthetically, the recent *Saturday Evening Post* editorial on Canada's naval contribution is worth reading. Canada's amazing production job has won her a place on the Combined Production and Resources Board—a privilege not enjoyed by any other Dominion. Membership is certainly a privilege but a reading of the terms of reference of the Board will indicate that it is also a very real responsibility. An important meeting of the board was convened at Ottawa not long ago. The C.P.R.B., its sub-committees and the new Combined Export Market Board will play an increasingly important part in shaping the industrial and production policies of the United Nations and, later, of the world.

In financial matters, Canada's voluntary contribution to the United Kingdom and other United Nations has, on a per capita basis, been several times the amount extended under lend-lease. Her new Mutual Aid Plan will embody new and interesting principles and will carry the process still further. The activities of the National War Finance Committee under the chairmanship of Mr. G. W. Spinney, and now under Mr. Graham Towers, constitutes a proud record as does also the percentage of Canada's war costs which is borne by taxation. The Canadian plan for international currency stabilization was admittedly a step forward from both British and American plans.

In the diplomatic sphere, Canada has always been regarded as a go-between for the United Kingdom and the United States. In this particular service, it is hoped that Canada may soon take her place at the Pan-American Conference. Her chair has always been there. For a number of reasons, Canada may also be in a better position than anyone else to act as an intermediary between Russia and the United States and the United Kingdom. Recent events indicate that the need for such an intermediary will be very great. A glance at air maps of the northern hemisphere indicate clearly that Canadians may shortly be talking about "Our Great Neighbour to the North." This may be a very compelling reason for reaching a sympathetic yet realistic understanding with Russia. Many of the post-war political decisions will be so finely balanced that Canada's weight on one side or the other may be a deciding factor. Canada does well to insist on the principle of a hearing for smaller nations and Mr. Brooke Claxton does well to insist on a Canadian foreign policy. It is interesting to note that in appointing the Honourable Ray Atherton as Minister to Canada, the United States chose one of her senior diplomats and the former head of the Division of European Affairs of the State Department.

When we turn to the vital matter of post-war air policy, we find that Canada's air is strategic. This is especially true in respect to the very real possibility of trans-polar flying. Air maps show Winnipeg as the hub of the air world. In the phrase of the Honourable C. G. Power, "Geographically, Canada is sitting pretty." Canada has always been air-minded. Until the last few years, when she was nosed out by Russia, she held the world's air freight record—and not a per capita record either. She has been the home of the British Commonwealth Air Training Scheme and may well end the war with a quarter of a million Canadians trained in the various branches of aviation. Two great air routes, the North East and the North West staging routes are in operation and a vast network of airfields and ground facilities, representing a capital outlay approaching half a billion dollars, will be at her disposal. It is hoped that the bargaining power inherent in Canada's geographic position and in respect to the defence of her various approaches will be subjected to wise diplomatic negotiations on the part of all concerned. Tied up with air policy, is the development of Canadian North Country. The late Lord Tweedsmuir never tired of talking of Canada's northern potentialities and this far-seeing statesman felt it to be part of his task as Governor-General to travel through the North-West Country as often as possible. Canadians should read Mr. Finnie's new book "Canada Moves North."

On my way here from Washington, I had several days' work to do in Montreal and was interested and, at first, a little perturbed by a closer view of the Canadian scene. The results of five recent by-elections were being widely discussed. It is perhaps inevitable that the party which has done such a splendid job should, at this particular juncture, suffer from a public reaction against some of the stern measures which were so necessary. Then, too, some mistakes were unavoidable. It is also true that Canadian politics have for some time lacked an adequate opposition and that the C.C.F. party may, in some instances, be in a good position to provide such opposition. It is to be hoped that one does not have to take too literally phrases such as "a policy of militant socialism." However, the quickening of the tempo of Canadian political life is the important thing and the revivification of the Conservative Party is certainly a desirable factor. There does seem to be an unfortunate trend towards a multiplicity of political parties which Canada can ill afford. The example of France should be kept in mind.

Mr. Mackenzie King's three point statement on foreign policy is welcome but needs amplifying and implementing. Clear statements are also needed on labour policy, on living cost controls, on Pacific relations, on Pan-American policy, on immigration and internal minorities, and on the aims and methods of industrial conversion and the handling of incompleted war contracts.

It was very gratifying to read Mr. Austin Wright's letter to the *Toronto Saturday Night* in answer to the criticism that engineers were seldom administrators.

One of the best stories going the rounds in Washington has to do with the alleged German broadcast which opined that the explosions of R.A.F. bombs were so severe that pictures of Herr Hitler were seen flying out of windows for several hours after the raid was over.

E. R. JACOBSEN, M.E.I.C.

# JOINT MEETING

OF

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

AND

THE ENGINEERING INSTITUTE OF CANADA

## ROYAL YORK HOTEL, TORONTO

## September 30, October 1 and 2, 1943

## *Programme*

### THURSDAY, SEPTEMBER 30

**REGISTRATION (The Foyer, Convention Floor) - 9.00 a.m.**

**STEAM POWER (Ballroom) - - - - - - - 10.00 a.m.**

CHAIRMAN: A. G. CHRISTIE, *Past-President* A.S.M.E., *Professor of Mechanical Engineering, Johns Hopkins University, Baltimore, Md.*

**Scope of Session:** Changes in steam-generation principles, particularly marine, brought about by the war, and their effect on post-war power generation.

**Effect of This War on Steam Generation,** E. G. BAILEY, Mem.A.S.M.E., *Vice-President, Babcock & Wilcox Co., New York, N.Y.*

DISCUSSERS

M. G. SAUNDERS, M.E.I.C., *Mechanical Superintendent, Aluminum Company of Canada, Arvida, Que.*

G. N. MARTIN, Jr.E.I.C., *Dominion Bridge Company, Montreal.*

**LUNCHEON (Banquet Hall), $1.50 per ticket - 12.45 p.m.**

CHAIRMAN: C. R. YOUNG, *Past-President*, E.I.C., *Dean of Engineering, University of Toronto.*

**Weapon Maintenance in Battle,** Brigadier-General E. E. MACMORLAND, *Deputy Chief, Field Service Division, and Head of Maintenance Division, Ordnance Department, U.S.A.*

**TRANSPORTATION (Ballroom) - - - - - 2.30 p.m.**

CHAIRMAN: LT.-COMDR. C. P. EDWARDS, O.B.E., M.E.I.C., *Deputy Minister, Department of Transport, Ottawa, Ont.*

**Scope of Session:** Broad treatment of railway problems and presentation of railroad and air transport-equipment developments during wartime and their adaptation to peacetime transportation.

SPEAKERS:

EDWARD WARNER, Mem. A.S.M.E., *Vice-Chairman, U.S. Civil Aeronautics Board, Washington, D.C.*

LAWFORD H. FRY, Fellow A.S.M.E., *Director of Research, The Locomotive Institute, New York, N.Y.*

J. T. BAIN, *Superintendent of Engineering and Maintenance, Trans-Canada Air Lines, Winnipeg Man.*

F. L. C. BOND, M.E.I.C., *Vice-President and General Manager, Central Region, Canadian National Railways, Toronto.*

**PRODUCTION ENGINEERING (Concert Hall) - 8.15 p.m.**

CHAIRMAN: H. V. COES, *President*, A.S.M.E., *and Vice-President, Ford, Bacon & Davis, Inc., New York, N.Y.*

**Scope of Session:** Summaries of outstanding contributions of production engineering, particularly in ordnance and aircraft manufacture.

SPEAKERS:

**Comparison of Riveting, Casting and Welding Tank Hulls,** L. E. CARR, *Technical Director, British Ministry of Supply, Washington, D.C.*

**Plastic Plywoods in Aircraft Construction,** R. D. HISCOCKS, *Engineer in charge of the structural laboratory, Aeronautical Division, National Research Council, Ottawa.*

**Construction and Performance of Mosquito Aircraft,** R. B. MCINTYRE, *de Havilland Aircraft of Canada, Limited, Toronto.*

### FRIDAY, OCTOBER 1

**CONSERVATION OF MATERIALS (Ballroom) - 9.30 a.m.**

**Scope of Session:** Steps taken to achieve conservation of materials through modification of design, substitution of less critical materials, and simplification. Impact on future.

SPEAKERS:

C. B. STENNING, *Canadian Chairman, Joint War Production Committee on Conservation* and *Assistant Co-ordinator of Production, Department of Munitions and Supply, Ottawa.*

HOWARD COONLEY, Mem. A.S.M.E., *Chairman, Conservation Division, War Production Board, Washington, D.C.; President, Walworth Company, New York, N.Y.*

**LUNCHEON (Banquet Hall), $1.50 per ticket - 12.45 p.m.**

CHAIRMAN: J. W. PARKER, *Past-President*, A.S.M.E., *Executive Vice-President, Detroit Edison Company, Detroit.*

**Canada's War Production,** H. J. CARMICHAEL, *Co-ordinator of Production, Department of Munitions and Supply, Ottawa.*

**MAN-POWER UTILIZATION (Ballroom) - - - 2.30 p.m.**

**Scope of Session:** The problem of maximum production with a minimum of man-power. Steps taken by industry and government for training, up-grading, substitution, job breakdown, etc.

SPEAKERS:

A. L. AINSWORTH, *Vice-President and Gen. Mgr., John Inglis Co. Ltd., Toronto.*

LAWRENCE A. APPLEY, Mem. A.S.M.E., *Deputy Director, War Manpower Commission, Washington, D.C.*

## ROUND-TABLE CONFERENCES

**There will be held simultaneously with the sessions, the following conferences designed to provide an exchange of ideas regarding production methods, on each subject indicated. Admission to these conferences will be restricted to those holding "invitations." Those receiving this announcement are asked to confer with executives of their respective companies and notify Headquarters of the Institute as to who is delegated to receive an invitation to attend as the representative of that company. Two or three additional names may be submitted and if facilities permit invitations will be issued to each.**

**The schedule of these conferences is:**

| | | | |
|---|---|---|---|
| **September 30, Thursday** | **10.00 a.m.** | **Session M** | **Metal Cutting.** |
| | | **Session N** | **The Use of Modern Steels in Heavy Industry.** |
| | **2.30 p.m.** | **Session O** | **Shell Forgings.** |
| **October 1, Friday** | **9.30 a.m.** | **Session P** | **Fuel Substitutes.** |
| | **2.30 p.m.** | **Session Q** | **Plastics.** |
| **October 2, Saturday** | **9.30 a.m.** | **Session R** | **Synthetic Rubber.** |
| | **2.30 p.m.** | **Session S** | **Powder Metallurgy.** |

**DINNER (Concert Hall), $3.00 per ticket - - - 7.30 p.m.**

TOASTMASTER:

C. J. Mackenzie, *Past-President, E.I.C., Acting President, National Research Council, Ottawa.*

Bestowal of Honours by The Engineering Institute of Canada and The American Society of Mechanical Engineers.

SPEAKER:

Charles E. Wilson, Mem. A.S.M.E., *Vice-Chairman, War Production Board, Washington, D.C. Formerly, President, General Electric Company, Schenectady, N.Y.*

### SATURDAY, OCTOBER 2

**POST-WAR PLANNING (Ballroom) - - - - 9.30 a.m.**

**Scope of Session:** Description of the necessary components of post-war planning by government and by industry; need for coordination between these components and limits of their respective fields. Report of post-war planning already accomplished.

SPEAKERS:

Ralph E. Flanders, *Fellow and Past-President,* A.S.M.E., *and Chairman, Committee on Research of the Committee on Economic Development; President, Jones & Lamson Machine Co., Springfield, Vt.*

W. A. Macintosh, *Special Assistant to the Deputy Minister of Finance Ottawa; Canadian Chairman, Joint Economic Committees (Canada-United States); Vice-chairman, Advisory Committee on Economic Policy.*

W. S. Woods, *Associate Deputy Minister of Pensions and National Health; Vice-Chairman of Advisory Committee on Demobilization and Rehabilitation, Ottawa.*

DISCUSSERS:

Warren C. Miller, M.E.I.C., *Chairman of the Institute's Committee on Post-War Problems. City Engineer, St. Thomas, Ont.*

D. C. Tennant, M.E.I.C., *Dominion Bridge Company Limited, Toronto.*

**LUNCHEON (Banquet Hall), $1.50 per ticket - - 12.45 p.m.**

**Trends in Industrial Relations,** Prof. J. C. Cameron, *Head of Industrial Relations Section, School of Commerce and Administration, Queen's University, Kingston, Ont.*

**QUALITY CONTROL (Ballroom) - - - - - 2.30 p.m.**

**Quality Control in Industrial Technology.** Andrew I. Peterson, Mem. A.S.M.E., *Cons. Engr. on Quality Control, and Professor, College of Engineering, New York University, New York.*

#### REGISTRATION FEE

Members planning to bring non-member guests (male) are asked to keep in mind that unless a guest attendance card is secured in advance, a two-dollar registration fee for the entire meeting, or one dollar for any single day or session (except evening sessions or meal meetings), will be charged for those who do not belong to the E.I.C. or A.S.M.E. Members may secure two cards upon application to the General Secretary of the E.I.C., 2050 Mansfield St., Montreal, or of the A.S.M.E., 29 West 39th St., New York, before September 24.

#### PLANT TRIPS

If any visitors desire a trip through any plant and make wishes known in advance the committee will undertake arrangements.

#### LADIES' EVENTS

Ladies are cordially invited to attend the sessions and the luncheons and dinner, for which the charges will be the same as for men.

### MAKE RESERVATIONS NOW

#### RAILROAD

Consult your ticket agent *at once* regarding your railroad reservations, both going and return. There are no special rates or special trains for travel at this time, but space on regular trains for all trips must be requested well in advance.

#### LUNCHEONS AND DINNER

Food rationing necessitates advance reservations for luncheons and dinner. Therefore cheques should accompany requests to assure reservations. Refunds will be given on cancellations made by 11.00 a.m. of day of meal. Prices include gratuities.

#### HOTELS

Reservations for hotel accommodations should be made directly with the hotel as early as possible. The Royal York Hotel is headquarters for the meeting. Rates are:

Single rooms, $4.00 per day per person.
Double rooms, $3.50 per day per person.
Suites, parlor and one bedroom:
$13.00 and $16.00 per day, single.
$16.00 and $21.00 per day, double.
Suites, parlor and two bedrooms:
$21.50 per day, for two persons.
$26.50 per day, for three persons.
Baths, with all rooms and suites.

**D R E S S   F O R   A L L   O C C A S I O N S   I S   I N F O R M A L**

## VICTORY NOW WOULD FIND US UNPREPARED FOR PEACE

To the Editor,

What has happened to our leadership in Post-War Planning? The James Committee on Reconstruction, after two years of study, has presented its report to the government. This was a purely advisory body. Its job is done. The next logical step would be to implement its recommendations.

Yet apparently little if anything is being done. Precious months are being lost, time badly needed for making plans and designs for public works and other post-war construction projects. There are many engineers who could be spared for this work, now that the building-up period of the war effort is over.

Britain and the United States have both recognized the importance of post-war planning. Britain has a Ministry for it. The United States has a National Resources Planning Board. Canada to date has a Parliamentary Committee of some fifty members who have listened for eight months to briefs regarding post-war projects, but, so far as the public knows, nothing has yet been heard of their recommendations.

If the war should end tomorrow on all fronts, upwards of a million jobs would have to be found. The Reconstruction Committee's suggestion last February of the expenditure of a billion dollars on public works in the first post-war year, would provide jobs for perhaps two-thirds of this number. Industry could probably take care of the balance.

Recent trends indicate, however, that victory will come first in Europe, keeping our naval and air forces engaged for some time further against Japan, yet permitting partial demobilization of the army and conversion of many war industries to peacetime uses. Any attempt at this time to translate such developments into jobs needed would be a sheer guess. But for argument's sake, let us assume that there would then be half the number of jobs to provide, or five hundred thousand, in peace time production.

Normal employment in the construction industry takes care of around 200,000 "on site" employees. It has been estimated there are some 25,000 construction employees in the armed forces, most of them in the army. Adding these, and taking in the "offsite" employees required to support such construction activity—roughly another 265,000—would mean that normal construction activity would provide the half million jobs needed.

It is quite possible that a considerable number of these half million returned men and displaced war workers will rapidly be absorbed into other peacetime industries. Provision should be made, however, for the eventuality that the construction industry may have to employ the full number. The volume of construction activity necessary for such employment would represent an annual expenditure at the rate of some $650,000,000 per year in prewar dollars.

Mr. A. S. Mathers, president of the National Construction Council, addressing the Canadian Manufacturers Association convention last June in Toronto, stated that a survey made by the Council indicated there was roughly $500,000,000 worth of work that could be proceeded with. Normally the planning and designing for this work would have been proceeding ever since 1939. The more pressing demands of war, as well as man-power shortage and less money to spare, have retarded it. Much of this may have passed the preliminary planning stage, but the likelihood is that little or none of it has been designed. Again, for the sake of argument, assume half of it has been planned in a preliminary way.

Engineering costs are shown by experience to average 1½ per cent for preliminary plans, and a further 2½ per cent for making firm designs. These percentages exclude costs of organization, legal fees, purchase of lands, etc. They are purely engineering expenses for study and design Were none of this estimated volume of work designed in even a preliminary way, total engineering costs would approach $20,000,000. Were all preliminary work already done, which is highly improbable, there would still be $12½ millions to be spent on engineering designs. Assuming that 80 per cent of this represents salaries, and 20 per cent office and travelling expenses, etc., and that a median rate of engineer remuneration is $3,500 a year, there would then be required 4,600 or 2,800 engineers for the respective cases mentioned above, or from 4,600 to 2,800 "engineer-years." And this represents engineering for one year's construction only, at normal rate of construction activity. It represents minimum requirements. If the Marsh report figure of $1 billion a year is taken, all the foregoing figures can be doubled. Planning for following years must also be under way.

A survey of Canadian engineer personnel in 1941-2 by the Wartime Bureau of Technical Personnel revealed that there were about 20,000 engineers and architects registered as such in Canada. Suppose that, of these, some 7,000 were trained and qualified for planning and designing, including the three categories of electrical, mechanical and civil. While it is true that a sharp drop has occurred since the record year of 1941 in construction activity, many of those then engaged in design have been absorbed into other war industries and into Army, Navy and Air Force. Therefore it is doubtful if more than some 1,500 or so would be available between now and victory for diversion to the job of preparation of post-war plans and designs. Such a number would require two years to complete designs only, three years if preliminary plans were not already done.

We should know roughly at least what supplies are going to be needed, and where. Time is needed to plan and prepare for their replenishment. Months are required to purchase lands and smooth out legal difficulties standing in the way of construction. If plans are left till the last shot is fired, delays and unemployment will result. The cost of projects will be immeasurably increased, and many ill considered wasteful projects will obtain authorization just because they offer an earlier start.

There is no dearth of suggestions for projects to build, but much time is needed to sort them and weed out the undesirable or uneconomical ones. Why must all this preparatory work be left to be hurriedly and carelessly done under pressure of time, while men are waiting for the jobs these projects can provide?

If there are reasons for postponement in the formation of a "Department of Reconstruction," there can at least be no sound reason for further delay in encouraging the getting on with vigorous preparation of plans, estimates and designs. Many an industry or corporation would allot its own funds for such a purpose, if the Income Tax Department would agree not to consider this as capital expenditure and taxable as such. Provinces and municipalities have in many cases gone as far with planning as their funds permit. Encouragement is needed in some form of sharing this expense by the Federal Government, possibly on a loan basis. Twenty million dollars a year would cover the designing only, perhaps twice this figure if land purchase and legal expenses were included.

This is a domestic affair. This time if it is again a case of "Too little and too late" with our planning there are no "whipping boys" handy like "War Office indifference" or "phoney wars" or "Maginot lines" upon which to place the blame.

The average citizen does not visualize the time and effort involved in planning and designing for work of this nature. It is the clear duty of every Canadian engineer, not only to use his influence in hastening the commencement of real post-war planning on a brass tack basis, but to miss no opportunity of taking the lead in the formation of public opinion along these lines. The crystallization and expression of public opinion is the one sure way of getting action.

Montreal, Sept. 1, 1943. H. G. Cochrane, m.e.i.c.,

## ENGINEERS IN THE SERVICES COMPLAIN

The following letters are being published in the *Journal* because they are typical of many which have been received at Headquarters, and describe clearly and directly conditions in which the Institute has been interested since the outbreak of the war.

The Institute's committee on The Engineer in the Active Services is still inquiring into these matters, and it may be that by the time these letters are published, the committee may have presented its case to the proper authorities. In the meantime, however, it is felt that a wide circulation of these and similar communications will receive the approval of many members and, at the same time, may bring to the attention of others a regrettable condition of which they were not aware.

The problem is not easy of solution—particularly in the middle of a campaign. There can be no argument to justify this discrimination, but it is one thing to prove the case and another to have it corrected.—*Ed.*

General Secretary,
Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Que.

Halifax, N.S.,
August 10, 1943.

Dear Sir,

Lately, we have been having a few discussions as to the status of the graduate engineer in the Services. As general secretary of the largest engineering organization in Canada, we decided to write you for an opinion on the subject.

I am afraid the problem has mainly to do with the subject of pay—but pay is, we feel, a definite measure of status. We wondered why the Forces pay no more to the professional graduate engineer—whom they most definitely need—than they do to the ordinary officer who may have (with due respect to him) worked through the ranks—or a sales clerk, who has only a service education behind him. Then again, why should medical doctors who, having spent little more time at college than we, be given the privileges and professional pay they enjoy, and not us? In our arguments, the solution seemed to lie with an organization that stood out for the profession, demanding the recognition and status—like the Canadian Medical Association. The amount of professional pay given doctors, in the Navy is, besides the status or rank of lieutenant on enlistment, at least $1.50 per day. I think this is general among the other Services.

It may be argued, perhaps, that the Services do not need graduate engineers, as such, and that they are merely worth the ordinary officers' pay. I have not seen, however, any of the Forces turning engineers away. I had the experience of comparing a group of several engineers, graduates, with twice that number of "executive officers," selected from every branch of life, undergoing training. Of course I may be prejudiced, but I think in every way the engineers proved of more general proficiency.

Another argument may be that the young graduate engineer does not know anything in particular, and that he requires to be "experienced" to be of any use. Perhaps, but the average doctor entering the Service to-day is straight from a crammed and accelerated college course; and acquires both his training and experience after joining.

I hope that the tone of this letter does not give an impression that we may not be patriotic, or proud to serve with the Forces, or that we are grossly unsatisfied. Most of us—the fellow engineers with whom I associate, and speak for—enlisted in 1942, as soon as we finished college; we have been overseas in action with the Royal Navy in the Mediterranean and the North Sea, and we are proud to belong to a proud Navy. I have met a number of fellow engineers overseas and at home, in all the Services, and they all consider that where engineers are necessary in the Service, recognition of their education and professional status should surely be made—after the pattern of the medical fraternity. It is our opinion that a profession is largely judged at its own valuation.

We would be very pleased to hear your sentiments on the subject, Mr. Wright, or the attitude of the Institute to it.

Yours sincerely,

.................., S.E.I.C.
Sub. Lieut. (E) R.C.N.V.R.

### The Engineer in the Canadian Army

To the Editor,
Engineering Journal, Montreal,

Toronto, August 23rd, 1943.

Dear Sir,

It has been generally recognized that this is an engineers' war or, to put it another way, that engineering in its various phases is playing a much more important part in this war than in any previous war, with the high degree of mechanization and the extent to which science is being applied to the waging of war. In the Canadian forces, the Navy has its separate engineering branch, and in the R.C.A.F. there is the aeronautical engineering branch, signals, works and buildings, etc. In the Army, the civil engineering is represented by the Corps of Royal Canadian Engineers and the sphere of their work is constantly increasing. However, we find that electrical and mechanical engineering in the Army are part of the Royal Canadian Ordnance Corps which during and since the last war has largely been concerned with the supply of stores and accounting. Why these branches of engineering should be part of Ordnance is not clear, except that it is a carry-over from pre-war days and was modelled entirely on the British Army system.

However, the British found as a result of lessons learned in the early months of the campaigns in Libya and North Africa, that this system was not satisfactory and that the German system of mechanical maintenance, particularly in the forward areas, was superior to ours. A Commission appointed by Mr. Churchill and headed by Sir William Beveridge, studied this situation late in 1941 and early in 1942, in connection with a broad survey of "Skilled Manpower in the Army." This Commission recommended as a result of experience gained in THEATRES OF WAR that mechanical and electrical engineering and maintenance work in the Army be separated from Ordnance and a new Corps be established, which was later given the name of the "Royal Electrical and Mechanical Engineers." Formation of this new corps was commenced in June, 1942, and completed in September of the same year and its first phase included the taking over of the mechanical and electrical engineering side of Ordnance; maintenance facilities of the Royal Army Service Corps (except 1st Echelon) and certain electrical functions of the Royal Engineers. The formation of this new corps gave a tremendous lift in morale to those concerned. R.E.M.E. went into action two months later in Africa and from all accounts, both official and otherwise, it made a fine showing in that campaign across 1,300 miles of desert, ending with the capture of Tunis.

We understand that the second phase has been or is being completed, which entails taking into R.E.M.E. of all unit mechanical tradesmen such as motor mechanics, armourers, electricians, etc. This is a very desirable move, for it places these tradesmen in a corps where their chances for promotion are unlimited, whereas they could go no farther than the establishment of a unit allowed when they were unit tradesmen.

The Canadian Army Overseas studied this new development in the British Army and decided to WAIT AND SEE how it made out, although the British Army had adopted it as a result of experience in THEATRES OF WAR. The Canadian Army had had no such experience.

Last fall or early winter, as a result of accumulated evidence, the Canadian Army Overseas adopted the R.E.M.E. set-up, but WITHIN THE ORDNANCE. This has meant very little change and leaves the top and administrative positions in the hands of the non-technical side of Ordnance. As far as the Canadian Army in Canada is concerned, no discernable move has been made, and the mechanical and electrical engineering and maintenance remains an appendage of Ordnance.

The armies of Australia and India have adopted the British system of a separate corps and we understand the armies of the other Dominions have done so too.

Yours truly,

. . . . . . . . . . . . . . . .M.E.I.C.

---

## MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, August 14th, 1943, convening at nine thirty a.m.

*Present:* President K. M. Cameron in the chair; Vice-Presidents L. F. Grant and C. K. McLeod; Councillors J. E. Armstrong, E. D. Gray-Donald, R. E. Heartz, W. G. Hunt, J. A. Vance, H. J. Ward and J. W. Ward; Secretary Emeritus R. J. Durley and General Secretary L. Austin Wright.

*Canons of Ethics for Engineers*—The general secretary reported that he had received a progress report from Mr. F. H. Peters, chairman of a committee appointed by Council to study and report on the proposed Canons of Ethics for Engineers submitted to the Council of the Institute by the Engineers' Council for Professional Development. A synopsis of the opinions received from members of the committee had been circulated, and further consideration was being given to the matter. A report would be presented in due course. In Mr. Peters' opinion the question of ethics was a very important one, and should receive careful study before a report is submitted to E.C.P.D.

*Committee on the Engineer in the Civil Service*—The general secretary reported that it has been decided by the committee to call upon Mr. Ilsley, the Minister of Finance, to urge upon him that reconsideration be given to the suggestions made by the committee relative to the remuneration of the engineers in the Civil Service. It is the committee's intention to emphasize the encouragement which was given by the Coon Committee and the urgency of the situation. A copy of the original report made to the Coon Committee will be submitted to Mr. Ilsley, along with additional arguments. Mr. deGaspé Beaubien is arranging the interview and the full committee will attend as soon as the details are settled.

*Legal Action by Architects Against an Engineer*—President Cameron reported that following the last Council meeting he had interviewed the president of the Corporation of Professional Engineers of Quebec in Quebec City, and had been informed that the Corporation would shortly be holding a meeting to discuss the matter, and would advise the Institute as to what joint action might be taken. Nothing had since been heard from the Corporation, although the general secretary had unofficially been informed that such a report would be presented to the Institute at an early date.

*Committee on Civil Defence*—Mr. Armstrong, chairman of the Institute's Committee on the Engineering Features of Civil Defence, reported that in Montreal and Toronto the E.I.C. branch committees were well organized to co-operate with the provincial A.R.P. organizations. During his recent western trip he had discussed the work of his committee with the Winnipeg and Vancouver branches, but had found that in a general way, interest in this subject was waning.

Mr. Armstrong was contacting Dr. Manion's successor, Brigadier General Alex. Ross, offering the co-operation of the Institute committees in connection with A.R.P. work. At the moment he had nothing further to report regarding the work of his committee.

*Committeè on the Engineer in the Active Services*—The general secretary reported that the chairman of the committee, Dean D. S. Ellis, had prepared for the committee an interim report. The secretary summarized the report and explained that since it had been issued he had had a conversation with Dean Ellis and it looked as though the committee should meet again shortly and draw up its final conclusions for presentation to the minister of National Defence.

Dean Ellis pointed out that in spite of the difficulties of getting the Services to change their procedures he thought that the committee should go ahead with its report. There was no doubt but that the complaints made by engineers in the Services were well founded, and he felt that the Institute could not very well drop the subject now in spite of the improbability of bringing about any immediate reform.

Colonel Grant, who has returned from England recently, outlined some of the conversations he had had with engineers in the Old Country. He supported Dean Ellis in the thought that it would be almost impossible to have changes made now but he agreed that the committee should carry on its work to a conclusion.

There was general approval of the decision to present the case to the minister.

*Joint Meeting with A.S.M.E.*—The general secretary reported progress in securing papers and speakers for the joint meeting with the A.S.M.E., and submitted a draft of the programme as it appeared in the August number of the Journal. He reported that, in company with the president, he had called on the Hon. C. D. Howe to explain the nature of the meeting, and that Mr. Howe had thought that such a meeting would be of considerable advantage to war and post-war planning. He expressed his willingness to have members of his department participate in the meeting.

The general secretary described in detail the various sessions, which deal almost entirely with war and post-war problems. Prominent American and Canadian speakers have been secured, and the meeting promises to be an outstanding one in every respect.

*St. Lawrence Waterways*—President Cameron reported that he had given considerable thought to the proposal submitted by Mr. J. G. G. Kerry, and had discussed the matter with Past-President O. O. Lefebvre and others. The proposal was so tremendous in its scope that it would need very careful consideration, but he felt that as a technical society, the Institute should endeavour to investigate the possibilities of the proposition brought forward by Mr. Kerry, purely as a theoretical problem without, at the moment, considering the economies of it.

After considerable discussion, on the motion of Mr. Gray-Donald, seconded by Mr. Vance, it was unanimously resolved that a carefully selected committee be appointed to investigate and report to Council on Mr. Kerry's proposal.

*Financial Statement*—It was noted that the financial statement to July 31st, 1943, had been examined by the Finance Committee and found satisfactory.

*Conditions for Life Membership*—The Finance Committee had discussed the conditions applying to life membership in the Institute, and pointed out that a great many members continue to pay their fees long after they have established the conditions outlined in the by-laws. If the principle of automatic election to life membership were established, it would undoubtedly mean a heavy loss of revenue.

Following discussion, and on the recommendation of the Finance Committee, the general secretary was instructed to investigate the matter, and if considered necessary, to consult an actuary, in order to determine approximately what such a procedure would cost in rebated fees.

*Manitoba Agreement*— Information had been received from the secretary of the Winnipeg Branch to the effect that the Association of Professional Engineers of Manitoba would be sending out, within a week or ten days, a ballot on the co-operative agreement between the Institute and the Association. Three months was being allowed for the return of the ballot so that it would be sent to members serving overseas. The Winnipeg Branch recommended that the Institute ballot be sent out at the same time.

No changes had been made in the agreement as approved some time ago by the Institute's Committee on Professional Interests and by Council. Accordingly, on the motion of Mr. McLeod, seconded by Mr. Armstrong, it was unanimously resolved that the general secretary be authorized to proceed in accordance with Section 78 of the by-laws and publish the agreement in the *Journal*, send out a ballot to all councillors, and to all corporate members of the province of Manitoba.

*Committee on Industrial Relations*—A letter had been received from the chairman of the Committee on Industrial Relations inquiring as to whether or not the committee should include within its assigned field the general question of the retraining of demobilized men and their absorption into industry. In his reply President Cameron had expressed the view that although the specific problem of the professional engineer and his training and re-employment does not come within the scope of the committee, the retraining and rehabilitation of other members of the armed forces when demobilized and their absorption into industry and other forms of civil life, is directly within the scope of the Committee on Industrial Relations, inasmuch as this is a problem of management. In the expectation that Council would support this view, the president had suggested to the chairman that the committee proceed accordingly. On the motion of Mr. Armstrong, seconded by Mr. McLeod, it was unanimously resolved that the action of the president be approved.

On the motion of Mr. Gray-Donald, seconded by Colonel Grant, it was unanimously resolved that the following members be added to the committee: René Dupuis, M.E.I.C., Quebec; J. P. Brierley, Toronto.

*Dominion Council of Professional Engineers*—The general secretary presented a letter from the secretary of the Dominion Council of Professional Engineers inviting the Institute to associate itself with the Dominion Council and other technical bodies in sending a delegation to the Minister of National Defence to protest the procedures whereby technical personnel is being retained in the ranks when declined as candidates for commissions.

The general secretary pointed out that he had consulted military authorities at Ottawa relative to the new regulations, and that the point raised by the Dominion Council seemed to be settled already by Canadian Army Routine Order No. 3319 which indicated that "If rejected, they will be given the option of returning to civil life by discharge through the Depot of Enlistment or continuing in the Active Army as private soldiers." The general secretary reported that he had written to the Dominion Council to this effect and that it appeared that the proposal to send a delegation would not be carried out.

*Engineers' Council for Professional Development*—On the motion of Mr. Vance, seconded by Mr. Armstrong, it was unanimously resolved that Dr. C. R. Young be nominated as the Institute's representative on the Engineers' Council for Professional Development to replace Dr. J. M. R. Fairbairn whose term expires at the forthcoming annual meeting, and that Dr. Fairbairn be thanked for his services.

*National Construction Council of Canada*—The president reported on a programme of post-war study proposed by the National Construction Council of Canada. The proposal includes as its main objectives:

1. The re-establishment of the construction industry and the heavy manufacturing industry on a peace time basis, with employment of personnel and productive output developed to the full capacity of those industries, through re-organization and rationalization accomplished from within.
2. The development of construction projects and markets for heavy and other durable goods on a vast scale, for the benefit of the people of Canada and of the industries concerned.
3. Long range planning for the future of the construction and heavy industries, in order that a high level of business activity and employment be maintained over a long period as a steadying influence in the economy of the nation.

In order to reach these objectives it is proposed that an organization be set up consisting of a central headquarters along with divisional headquarters and regional committees.

The recommendations are submitted to the constituent members of the National Construction Council in draft form only and the Institute is asked for comments and endorsation at as early a date as possible. In view of the comprehensive proposal, it was decided that a copy of the draft be sent to each member of Council with a request for comments and that the item be placed on the agenda for discussion at the September meeting of Council.

*Wartime Bureau of Technical Personnel*—The general secretary reported that at the last meeting of the Advisory Board of the Bureau it was decided to ask the three Institutes supporting the Bureau to send a joint request to the Minister of Labour for additional authority whereby the Bureau might make compulsory transfers. The present legislation is of a negative nature and simply permits the Bureau to refuse permission for persons to take work of low priority, but does not give it authority to compulsorily move people to work of higher priority.

In view of the far-reaching effect of such a proposal, the meeting thought it would be advisable to have the subject submitted by mail to all councillors and the secretary was instructed to follow this procedure, placing the item on the agenda for the September meeting.

*Canadian Chamber of Commerce*—The general secretary presented a notice of the annual meeting of the Canadian Chamber of Commerce, which is being held at the Seigniory Club, Quebec, on October 27th, 28th and 29th. The Chamber asked for any resolutions or statements of policy which the Institute would like to submit for the consideration of the conference.

As Mr. deGaspé Beaubien is the Institute's representative on the Council of the Chamber, it was decided that this request should be referred to him, and that he be asked to attend the conference if at all possible.

*Annual Meeting 1944*—In response to an inquiry from Councillor Gray-Donald with reference to the financing of the entertainment for the forthcoming annual meeting in Quebec, Vice-President McLeod, chairman of the Finance Committee, reported that the committee had discussed this question for some time and that the general secretary had submitted a draft of proposed regulations which might meet the situation. These regulations were to be changed somewhat and resubmitted to the committee.

The general secretary reported that this matter was underway but that the redraft had not been completed. In view of the fact that the meeting is still six months away, he had not thought that the point would need to be settled at this meeting. He agreed to have the draft ready for the next meeting of the Finance Committee.

There was a general discussion on the procedure for developing the programme and the general secretary reported that a set of rules and regulations and suggestions applying to these meetings had been sent to the chairman of the branch, but that an additional set would be sent to Mr. Gray-Donald.

*Past President C. R. Young*—In response to an inquiry from Councillor Heartz, President Cameron advised that Past-President Young's illness was not as serious as was at first feared. He has been ordered to take a rest and consequently is spending a quiet summer at Niagara-on-the-Lake.

*Elections and Transfers*— A number of applications were considered and the following elections and transfers were effected:

*Members*

**Bastien,** Jean, B.A.Sc., C.E., (Ecole Polytechnique), divn. engr., Dept. of Roads, Prov. of Quebec, Ormstown, Que.

**Bessette,** Oscar, B.A.Sc., C.E., (Ecole Polytechnique), city engr., Drummondville, Que.

**Bonaventure,** Joseph Eugène, B.A.Sc., C.E., (Ecole Polytechnique), district engr., Dept. of Public Works, Canada, Montreal.

**Bush,** Orval Ferguson, B.Arch., (Univ. of Toronto), res. engr., T. Pringle & Son, Ltd., Montreal.

**Cadenhead,** Arthur Fordyce Grant, B.A. (Hon.Chem.), (Queen's Univ.), director of plant research, Shawinigan Chemicals, Ltd., Shawinigan Falls, Que.

**Christie,** Alexander Graham, M.E., (Univ. of Toronto), D.Eng., (Stevens Inst.), D.Eng., (Lehigh Univ.), prof. of mech. engrg., Johns Hopkins Univ., Baltimore, Md.

**de Chazal,** Philippe Marc, B.Sc., (Engrg.), (McGill Univ.), engr. i/c of mech. mtce. & Mech. constrn., Aluminum Co. of Canada, Arvida, Que.

**Emery,** Charles Leslie, B.Sc., (Mining & Metallurgy), (Queen's Univ.), teacher of surveying & dfting., Port Arthur Tech. School, Port Arthur, Ont.

**Harrison,** Thomas Blacker, B.Sc., (Mech.), (Univ. of Sask.), test engr., Brunner Mond Canada, Ltd., Amherstburg, Ont.

**MacConnell,** Howard Bruce, estimator & gen. supt., Barnett-McQueen Co. Ltd., Fort William, Ont.

**Mathieu,** Olier, B.A.Sc., C.E., (Ecole Polytechnique), divn. engr., Dept. of Roads, Prov. of Quebec, L'Assomption, Que.

**Murray,** Frederick Robert, B.Sc., (Civil), (Glasgow Univ.), district mgr., (Quebec Maritimes & Nfld.), Truscon Steel Co. of Canada, Ltd., Montreal.

**Perley,** Ernest Clint, B.Sc., (McGill Univ.), director of production, automotive & tank production br., Dept. of Munitions & Supply, Montreal.

**Peters,** Arthur W., B.Sc., (McGill Univ.), distribution engr. i/c C. & D. dept., Shawinigan Water & Power Co., Trois-Rivières, Que.

**Rigg-Story,** Leslie, B.Sc., (Eng.), (Rutherford College), designer, H. G. Acres & Co., Niagara Falls, Ont.

**Seabury,** George T., S.B., (Civil), (Mass. Inst. of Technology), secretary, American Society of Civil Engrs., New York, N.Y.

**Weigel,** Melvin Powell, B.S., (Metallurgical Engrg.), Missouri School of Mines & Metallurgy), chief engr., Aluminum Co. of Canada, Ltd., Montreal, Que.

**Wilcox,** Walter, Wigan Tech. College, engr., Union Gas Co. of Canada, Ltd., Windsor, Ont.

*Juniors*

**Harkness,** Wilfred Dickson, B.Sc. (Forest Engrg.), (Univ. of N.B.), chief cruiser & control man, Port Arthur Divn., Abitibi Power & Paper Co., Ltd.

**Wright,** Ralph Wallace, B.Eng. (Mech.), (McGill Univ.), engr., plant engrg. dept., Can. Gen. Elec. Co. Ltd., Peterborough, Ont.

*Transferred from the class of Junior to that of Member*

**Archibald,** Manning Clifford, B.Sc., (Elec.), (Nova Scotia Tech. Coll.), asst. purchasing agent, Montreal Engrg. Co., Ltd., Montreal.

**Lefrançois,** J. Germain, B.A.Sc., C.E., (Ecole Polytechnique), engr., Volcano Ltd., Montreal.

*Transferred from the class of Student to that of Member*

**André,** Kenneth Bailey, B.Sc., (Queen's Univ.), res. engr., Dept. of Transport, Kingston, Ont.

**Bedford-Jones,** Charles Edward, B.A.Sc., (Univ. of Toronto), district mgr., F. S. B. Heward & Co. Ltd., Montreal.

**Grothé,** P. André, Flying Officer, B.A.Sc., C.E., (Ecole Polytechnique), aeronautical engr., No. 3 Training Command, R.C.A.F., Montreal.

**Shector,** Lindley, B.Eng. (Civil), (McGill Univ.), struct'l. designer, T. Pringle & Son, Ltd., Montreal.

*Transferred from the class of Student to that of Junior*

**Guy,** Ross Thomas, B.Sc., (Mech.), (Queen's Univ.), project engr., General Motors of Canada, Ltd., Oshawa, Ont.

**Harkness,** Andrew Dunbar, B.Eng., (McGill Univ.), material engr., Hull Dept., United Shipyards, Ltd.

**Simpson,** C. Norman, B.Sc. (Civil), (Queen's Univ.), asst. engr., H. G. Acres & Co., Niagara Falls, Ont.

**Sweeney,** John Bartholomew, Pilot Officer, B.Eng. (Chem.), (Univ. of Sask.), O.C., Repair Squadron, No. 17 S.F.T.S. (R.C.A.F.), Souris, Man.

**Webster,** Gordon Frederick, B.Eng., (Univ. of Sask.), engr., Canadian Carborundum Co., Niagara Falls, Ont.

*Students Admitted*

**Bolduc,** Raymond, B.A., B.A.Sc., (Mining), (Laval Univ.), 257 Larch Street, Sudbury, Ont.

**Burton,** John Albert, (Univ. of British Columbia), 3855 West 9th Ave., Vancouver, B.C.

**MacDonald,** Cecil Ernest, (Acadia Univ.), General Tech. Dept., Aluminum Co. of Canada, Arvida, Que.

**Murray,** James Albert, B.Arch., (Univ. of Toronto), 220 Carlton St., Toronto, Ont.

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

*Members*

**Chappell,** Benjamin, B.Sc. (Civil), Univ. of Sask., asst. engr., C.N.R., Saskatoon, Sask.

**Friebel,** Werner Archibald, B.Sc. (Elec.), Univ. of Man., district supt., Saskatchewan Power Commission, Saskatoon, Sask.

**Guthrie,** James, B.Sc. (Mech.), Univ. of Sask., senior engr., Saskatchewan Power Commission, North Battleford, Sask.

**Peters,** Clarence Gordon, B.Eng. (Civil), Univ. of Sask., asst. engr., R.C.A.F., No. 19 E.F.T.S., Virden, Man.

*Junior*

**Osberg,** Gunder, B.Sc. (Elec.), Univ. of Alta., Sub.-Lieut. (E), R.C.N.V.R., c/o F.M.O., Halifax, N.S.

*Transferred from the class of Student to that of Junior*

**Samuel,** Albert Benjamin, B.Sc. (Civil), Univ. of Alta., junior engr., Calgary Power Company Ltd., Banff, Alta.

In announcing that the next meeting of Council would be held in London, Ontario, on Saturday, September 11th, at the Hotel London, President Cameron stated that it would be appreciated not only by himself, but by members of the branch, if councillors from Quebec could attend that meeting. On behalf of the chairman and members of the branch, Mr. Vance extended a cordial invitation to all councillors to attend the Council meeting and the branch meeting in the evening.

# PROPOSED CO-OPERATIVE AGREEMENT BETWEEN THE ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF MANITOBA AND THE ENGINEERING INSTITUTE OF CANADA

**MEMORANDUM OF AGREEMENT** made in duplicate at the City of......................., in the Province of............ this ..........day of....................19.....

By and Between:

THE ENGINEERING INSTITUTE OF CANADA, having its head office at the City of Montreal, in the Province of Quebec, hereinacting by its President and General Secretary, duly authorized for the purpose hereof by a resolution of its Council passed at a meeting duly called and held on the............day of.......... 19.... hereinafter called the "Institute";

Party of the First Part,

and

THE ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF MANITOBA, having its head office at the City of Winnipeg, in the Province of Manitoba, hereinacting by its President and Registrar duly authorized for the purpose hereof by a resolution of its council passed at a meeting duly called and held on the...................day of....................19........, hereinafter called "The Association."

Party of the Second Part.

Whereas it is desirable in the interests of the Engineering Profession that there be close co-operation between the Institute and the Association, and

Whereas such close co-operation will be promoted if, so far as is practicable, there is effected:

(a) A common membership in the Province of Manitoba of the Institute and the Association.

(b) A simplification of existing arrangements for the collection of fees.

(c) A co-ordinated management.

Now, therefore, the parties hereto agree with each other as follows:

1. Any person resident in the Province of Manitoba who, on the date of this Agreement, is registered as a Professional Engineer in the Association and is not a Corporate Member of the Institute, shall have the right, under the provisions of this Agreement, to become a Corporate Member of the Institute. If such registered Professional Engineer desires to become a Corporate Member of the Institute under the conditions of this Agreement, he shall so notify the Registrar of the Association, in writing, within 12 months of the date of this Agreement.

2. Any person resident in the Province of Manitoba registering as a Professional Engineer in the Association subsequent to the date of this Agreement who is not a member of the Institute shall, upon such registration, have the right to be accorded the class of membership in the Institute warranted by the age, experience and professional qualifications of such person, according to the by-laws of the Institute and the decision of the Council of the Institute. If such Registered Professional Engineer desires to secure membership in the Institute under the conditions of this Agreement, he shall so notify the Registrar of the Association, in writing, within 12 months of the date of such registration.

3. Registered Members of the Association shall not be required to pay the transfer fees of the Institute. Registered members of the Association shall not be required to pay the entrance fees of the Institute, provided they make application in accordance with Sections 1 or 2.

4. Any Corporate Member of the Institute who is, at the date of this Agreement, a resident of the Province of Manitoba, shall be eligible for membership in the Association, and all entrance fees ordinarily payable to the Association shall be remitted provided that application for membership in the Association is made within 12 months of the date of this Agreement.

5. Any Corporate Member of the Institute, as at the date of this agreement, who subsequently becomes a bona-fide resident of the Province of Manitoba as defined by the by-laws of the Association, shall be eligible for membership in the Association, and all entrance fees otherwise payable to the Association shall be remitted provided that application for membership in the Association is made within 12 months of becoming a resident of the Province of Manitoba as defined by the by-laws of the Association.

6. Any person who subsequent to the date of this Agreement becomes a member of the Institute, or advances his grade of membership therein and who is or becomes a resident of the Province of Manitoba, shall be eligible for membership in the Association if qualified for such membership, and entrance fees otherwise payable to the Association shall be remitted up to the amount of the entrance fee currently required for the grade of Institute membership held, provided that the application for membership in the Association is made within 12 months of the date on which he becomes a member of the Institute or advances his grade of membership therein.

7. Notwithstanding the provisions for the total or partial remission of entrance fees in sections 3, 4, 5 and 6 hereof, if subsequent to the date of this Agreement either or both parties hereto change the amount of the entrance fee required, then provision shall be made for the total or partial remission of entrance fees to continue the intention of this Agreement, namely that when a resident of the Province of Manitoba, who is a non-member of both the Institute and the Association, but who becomes a joint member within a 12 months period, shall be required to pay in entrance fees a total amount not greater than the larger of the two individual entrance fees.

8. (1) In lieu of the ordinary membership fees of the Institute, the following annual fees are hereby established for members of the Association who at the same time are, or who may become members of the Institute:

    (a) Corporate Membership $6.00 per annum.

    (b) Junior Membership $3.00 per annum.

    (c) Student Membership $2.00 per annum.

   (2) The annual fee payable to the Institute by members of the Association who are, or who may become members of the Institute shall be due and payable on the First day of January in each year, and shall be paid to the Association on behalf of the Institute;

   (3) Each member of the Association who pays such annual fee to the Institute through the Association shall be entitled to all the privileges of Membership in the Institute, and to the annual subscription to the Institute Journal.

   (4) The Association undertakes to receive the appropriate annual fee for membership in the Institute from each of its members who pay the same, and to remit the amount collected to the Institute at its Head Office at least once a month.

   (5) The provisions of this section of this Agreement shall become effective on the First day of....................19.....

9. On the First day of January of each year the General Secretary of the Institute shall furnish to the Registrar of the Association a list of members of the Institute resident in the Province of Manitoba, indicating as far as possible those who are not members of the Association. On the same date the Registrar of the Association shall furnish the General Secretary of the Institute with a list of members of the Association in good standing as on the thirty-first day of December preceding, indicating as far as possible those who are members of the Institute under the terms of this Agreement.

10. It is agreed that the Winnipeg Branch of the Institute shall continue to function as such during the term of this Agreement. The Winnipeg Branch of the Institute shall consist of all members of the Institute resident in the Province of Manitoba. All functions of the presently existing executive committee of the Winnipeg Branch shall be assumed by what shall be termed the Management Committee of the Winnipeg Branch.
    The Management Committee of the Winnipeg Branch shall consist of:—

    (a) All members of Council of the Association who are elected in accordance with the by-laws of the Association and who are Corporate Members of the Institute.

    (b) Two Corporate Members of the Institute in good standing, preferably Registered Professional Engineers in the Association, who shall be appointed by the Council of the Institute. For the initial appointment one of these shall be for a two-year term, the second one for a one-year term. Thereafter, and throughout the term of this Agreement, one appointment shall be made for a two-year term, effective on the First day of January each year.

    (c) Any member of the Institute resident in the Province of Manitoba who is elected President, Vice-President or Councillor of the Institute, while holding such office shall be a member of the Management Committee.

11. Insofar as officers of the Association are members of the Management Committee as specified in section 10 hereof, they shall ipso facto be and become the corresponding officers of the Management Committee where the office is applicable. Any office in the Management Committee remaining unfilled due to the requirements of

section 10 hereof or for any other reason, shall be filled by the Management Committee from among its members, except the office of Secretary-Treasurer which may be filled by appointment by the Management Committee of a suitable member, in good standing, of both the Institute and the Association, who upon appointment shall thereupon become a member of the Management Committee.

12. The representative upon the Council of the Institute of the members of the Institute in Manitoba will be nominated and elected in accordance with the by-laws of the Institute.

13. The Management Committee as constituted by sections 10 and 11 hereof shall be responsible for the management and financing of the Winnipeg Branch. Each year, The Institute shall pay to the Winnipeg Branch the regular Branch rebate of fees in accordance with the by-laws of the Institute for each member of the Institute resident in the Province of Manitoba who is not a member of the Association. The Management Committee shall recommend to Council of the Association the sum or sums to be paid by the Council of the Association to the Winnipeg Branch. The total of such sums to be paid by Council of the Association in each financial year shall not be less per joint member than the rebates now required by the Institute by-laws, provided, however, that such payments shall be made from annual revenue and in no case from capital reserve.

14. Each meeting of the Winnipeg Branch of the Institute and the Association will be announced as a joint meeting thereof with the exception of any legally required special or annual meetings of either the Winnipeg Branch of the Institute or of the Association.

15. Upon the occasion of any of the following, the other party to this Agreement shall be so informed within a period of one month, in writing;

    (a) the acceptance of the resignation of a joint member by one party to this Agreement, or;

    (b) the removal from the membership roll or from the register, of the name of a joint member by one party to this Agreement, or;

    (c) the receipt by one party to this Agreement of notification from a joint member that he has taken up permanent residence outside the Province of Manitoba.

16. The term of this Agreement shall be for a period of three years commencing on the........................day of........... 19.... and ending on the........ day of..................... 19.... on which date this Agreement shall terminate provided either party has given to the other a notice of termination at least six months prior to the........ day of...................... 19.... and if no such notice is given, this Agreement shall continue after the ........ day of................ from year to year but may be terminated at the end of any calendar year by either party giving notice in writing to the other of such termination at least six months prior to the end of the calendar year. Notice of termination of this Agreement shall be given by the delivery by one party to the other of a certified copy of a resolution of the Council of the one party to that effect.

17. It is hereby provided, however, that in the event of the approval of this Agreement by formal ballot, that this Agreement shall not come into operation unless a percentage of the membership of both bodies, satisfactory to their respective Councils, signify their intention of becoming joint members under the provisions of this Agreement.

18. The terms and conditions of this Agreement may be amended by mutual agreement, in writing, between the Councils of the parties hereto duly executed by their accredited officers.

19. This Agreement and the terms and provisions thereof shall not be applicable to the Institute members who are not, and do not become, registered with the Association. Likewise, this Agreement and the terms and provisions thereof shall not be applicable to Registered Professional Engineers of the Association who are not, and do not become, members of the Institute.

20. Nothing in this Agreement shall prevent either party thereto from exercising its rights and privileges with respect to the disciplining, the suspension, or the expelling of any of its members. Any person suspended, or expelled from the Association or from the Institute during the term of this Agreement shall forfeit all rights under this Agreement until re-instated. When final action is taken by either party the other party shall be so notified.

21. This Agreement is intended to apply with respect to residents of the Province of Manitoba only, and no person who is not a resident of the Province of Manitoba may become or continue to be a Corporate Member of the Institute under the provisions of this Agreement, but may continue to be a Corporate Member of the Institute and/or a member of the Association on the same conditions as if he had been admitted as a Corporate Member of the Institute and/or a member of the Association without reference to this Agreement.

In witness whereof these presents have been duly executed on behalf of the parties hereto on the date and at the place first above written.

THE ENGINEERING INSTITUTE OF CANADA

IN THE PRESENCE OF

..........................

..........................

.............................. *President.*

.............................. *General Secretary.*

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF MANITOBA

.............................. *President.*

.............................. *Registrar.*

## THE CIVIC MORALS OF SCIENCE

(*Continued from page 516*)

is dependent on practicalities, is as important as legislation, primarily a function of political ideology. Popular balloting is less efficacious than business competition in picking executives to direct economic affairs, hence, instruction in any socialistic theory which unduly emphasizes political agencies of management does not lead to sound administration. "If to do were as easy as to know what were good to do, chapels had been churches" and sociology, the citizen's guidebook. Administration depends chiefly on knowing men, and as Vivian Grey said, "we do not learn men from books." In practical affairs both social studies and science must be supplemented by a knowledge of men and of circumstances, and although they approach the problems from different angles there is no evidence to show that the former as a methodology is superior to the latter.

In a sanguine moment, one might assert superior moral values for science in education, but a safer postulate would be that purpose, the still small voice of the spirit, does not emanate from knowledge alone, either scientific or humanistic. Attitudes and motives are too egocentric to derive from external origins and too vital to be engendered by inert book lore. Practicalism is a proper and necessary counter-balance to idealism. Such qualities as honor, commonsense and good citizenship are not taught by courses but are instilled by a communion of personalities. Character and ability in teachers are essential and scientific subject-matter will serve as well as the humanities as the "carrier current." Engineering education is aimed at producing good citizens who earn their living by "diverting the forces and materials of nature to the benefit of man." Therefore, while I would include in engineering education as much liberal learning as accommodating the sciences will allow, I should do so under no misapprehension as to its superior civic morals but rather in order to round out that education into a symmetry of understanding and harmony of feeling to enrich life's satisfactions. The warp of scientific realism is no less essential than the woof of humanistic idealism in the fabric of civic morals for an advancing organized civilization.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Sir Hugh Beaver,** M.E.I.C., received a Knighthood in the last King's birthday honours list. He is director general of the Ministry of Works in England.

**Robert Blais,** M.E.I.C., is the new assistant chief engineer of the Department of Public Works of Canada, succeeding R. de B. Corriveau who retired last year. Mr. Blais was previously superintending engineer in the Chief Engineer's Branch of the department. He has been with the department ever since his graduation from the Ecole Polytechnique in 1912. He first joined as an assistant engineer in the district office at Ottawa becoming senior assistant engineer in 1921. He went to the Chief Engineer's Branch in 1936 and was promoted to the position of superintending engineer in 1941.

He has been promoted to the head of the Department of Civil Engineering (Municipal and Structural) as professor of civil engineering and aeronautics.

Wing Commander Loudon organized the R.C.A.F. School of Aeronautical Engineering in 1940 and has been with the R.C.A.F. Test and Development Establishment since November 1940, first as Chief Technical Officer and then as Officer Commanding since May 1941. He will be Commanding Officer of the R.C.A.F. University Air Training Corps at the University of Toronto.

Frank Williams, M.E.I.C.

Robert Blais, M.E.I.C.

N. F. McCaghey, M.E.I.C.

**Frank Williams,** M.E.I.C., has been appointed chief mechanical engineer of Canadian National Railways, Montreal. He was born at Otterton, Devon, Eng., and following his early schooling received special apprenticeship training in the shops and round-house drawing offices of the former London and South Western Railway. This was amplified by technical instruction at Regent Street, Battersea, and the Borough Polytechnical Schools in London.

Coming to Canada in 1911, Mr. Williams was employed at the Montreal Locomotive Works, and in 1914 entered the services of the Canadian Government Railways as a draughtsman in the mechanical department. In 1916 Mr. Williams was loaned to a munitions plant, and in 1918 returned to the railway service at Moncton. Later he advanced to the positions of mechanical designer and mechanical engineer, and in January, 1929, was transferred to Montreal as mechanical engineer, shops methods. In April, 1933, Mr. Williams took charge of shop methods for the system, and continued to do so until his present promotion.

**Commander R. L. Dunsmore,** R.C.N.V.R., M.E.I.C., has been director of fuel at Naval Service Headquarters, Department of National Defence, Ottawa, for the last few months. Mr. Dunsmore is superintendent of the Imperial Oil Refinery at Halifax and is a past vice-president of the Institute.

**R. W. Dobridge,** M.E.I.C., is now general equipment engineer with Canadian Pacific Telegraphs at Montreal. He had been district engineer for Alberta and British Columbia with the same company since 1939, with headquarters at Calgary.

**Wing Commander T. R. Loudon,** M.E.I.C., has been returned by the R.C.A.F. to the University of Toronto for academic duties, at the request of the university authorities.

**N. F. McCaghey,** M.E.I.C., of Price Brothers and Company has recently been transferred from Riverbend to Kenogami where is now superintendent of properties and welfare. He has been with the company ever since his return from overseas in 1919. He was chairman of the Saguenay Branch of the Institute in 1933 and again in 1941.

**P. E. Cooper,** M.E.I.C., has been appointed vice-president and general manager of Pacific Mills Limited, Vancouver, B.C. He was formerly deputy director and general manager of the Thames Board Mills Limited, Purfleet, Eng. A graduate of McGill University, he has been in the paper business for twenty years, ever since he joined the International Paper Company as construction engineer. He participated in International's extensive construction programme during the 1920's, and in 1929 he was appointed resident engineer of the Piercefield mill of International Paper Company in northern New York State.

In 1933 Mr. Cooper was transferred to the Rumford mill of Continental Paper & Bag Corporation at Rumford, Me., later becoming manager there.

Soon after, he resigned to join Thames Board Mills in England as chief engineer in charge of the design and construction of a new board mill at Warrington, Lancashire. When the job was completed in 1937 he took over management of the mill.

While a resident of Warrington Mr. Cooper was president of the Chamber of Commerce and chairman of the Lancashire Area Waste Paper Recovery Association.

In 1941 he was appointed deputy director and general manager of the Thames Board Mills, with head office at Purfleet, Essex. The Thames Board Mills is the largest board producing and converting factory in the British Empire, producing all grades of board and converting both into solid and corrugated containers.

**Alexander Wilson,** M.E.I.C., branch manager at Saint John, N.B., for the Toronto Shipbuilding Company, retains his connection with Canadian Comstock Company where he was employed before. This company has taken over the management of the Saint John Branch of the Toronto Shipbuilding Company and has placed certain of their key personnel in that organization, amongst whom is Mr. Wilson. The announcement in the Personals column of the August issue may give the impression that Mr. Wilson had severed his connection with Canadian Comstock Company.

**R. A. Young,** M.E.I.C., has recently joined the engineering staff of McColl Frontenac Oil Company Limited, Montreal. He was previously with Federal Aircraft Limited, Montreal.

**J. M. Anderson,** M.E.I.C., who was district engineer of the Department of Public Works of Alberta at Drumheller, has been transferred to the same position at Medicine Hat.

**Lieut.-Col. W. B. Pennock,** M.E.I.C., of the Royal Canadian Engineers was erroneously reported as being stationed at Petawawa, in the last issue of the Journal. Colonel Pennock was stationed for sometime at Petawawa but he is at present at Prince George, B.C.

**W. A. Cappelle,** M.E.I.C., who is overseas with the 2nd Batallion, Royal Canadian Engineers, has been promoted to the rank of lieutenant-colonel. In 1940 he led the 1st Corps Field Park Company of Winnipeg overseas, and has since been in charge of road construction work in Great Britain. Before joining up, Colonel Cappelle was an assistant engineer in the district office at Halifax of the Department of Public Works of Canada.

**W. L. Fraser,** M.E.I.C., of the Works and Buildings Branch, Naval Service, Department of National Defence, Halifax, N.S., is at present located at Wolfville, N.S.

**R. M. Doull,** M.E.I.C., has been appointed district supervisor (Quebec) for the Naval Shipbuilding Branch, Department of Munitions & Supply with headquarters in Montreal. For the past two years he has been production engineer for this branch in the Montreal district. Before joining the Department in 1941, he was assistant manager of Construction Equipment Company Limited, Montreal.

He was graduated from Dalhousie University in 1927 and from McGill University (mechanical) in 1929.

**W. S. Kidd,** M.E.I.C., has recently been promoted to the position of vice-president and general manager of The E. B. Eddy Company, Limited, Hull, Que. A graduate in engineering of the University of Toronto, and a veteran of the Great War, he entered the employ of The E. B. Eddy Company seventeen years ago as assistant chief engineer. During that time he has been successively chief engineer, production manager and, since 1938, general manager.

**Henry G. Wong,** Jr.E.I.C., has left the employ of Federal Aircraft Limited to join the staff of Héroux Industries Limited, Montreal.

**Major F. A. Fleming,** Jr.E.I.C., is Deputy Assistant Director of Inspection (Electrical Engineering), Inspection Board of the United Kingdom and Canada, Ottawa. Upon graduation from the University of Toronto, in 1936, he joined the staff of the Canadian General Electric Company and in the summer of 1939 he enlisted in the permanent force as an Ordnance Mechanical Engineer with the Royal Canadian Ordnance Corps. Since that time he has been responsible for the inspection of purchases of electrical engineering equipment for the army.

**Walter K. Dow,** Jr.E.I.C., has left the Aluminum Company of Canada Limited, Montreal, and is now employed with Canadian Comstock Company Limited, Montreal. He graduated in electrical engineering from the University of Toronto in 1937 and had been with the company ever since.

**Pilot Officer Marcel Papineau,** Jr.E.I.C., graduated last month from No. 9 Air Observers School, R.C.A.F., St. Johns, Que., and is now overseas. He joined the R.C.A.F. in 1941 in the aeronautical engineering branch and for some time was posted at Trenton, Ont. He reverted from Flying Officer to his present rank in order to qualify as a navigator. Before enlisting he was on the staff of Noranda Mines Limited at Noranda, Que.

**D. L. Mackinnon,** S.E.I.C., has joined the R.C.A.F. at Montreal. He was previously employed with Foundation Company of Canada Limited, Montreal.

**Bernard Beaupré,** S.E.I.C., who recently received the degree of M.Sc. from the University of Toronto after a year of post-graduate work in health engineering has now taken a position as engineer in the division of Industrial Hygiene, Ministry of Health, Quebec.

**J. G. Wall,** S.E.I.C., is now employed with the Department of Transport in the Yukon. He graduated from the University of New Brunswick in 1939.

**Robert Renaud,** S.E.I.C., a student at the Ecole Polytechnique, is employed for the summer with Canadian Power Boat Company Limited, Montreal.

**Pilot-Officer R. L. Blackett,** S.E.I.C., has been selected for an appointment as Navigation Officer with the R.C.A.F. He is a graduate of Queen's University in the class of 1943, and the son of V. C. Blackett, secretary-treasurer of the Moncton Branch of the Institute.

## VISITORS TO HEADQUARTERS

**Sarto Plamondon,** M.E.I.C., Ministry of Health, Province of Quebec, Department of Industrial Hygiene, Quebec, on August 3rd.

**Bernard Beaupré,** S.E.I.C., engineer, Ministry of Health, Division of Industrial Hygiene, Quebec, on August 3rd.

**Charles Flint,** M.E.I.C., McNamara Construction Company, Toronto, Ont., on August 5th.

**Norman A. MacKay,** Jr.E.I.C., lubricant engineer, Dominion Steel & Coal Corporation, New Glasgow, N.S., on August 7th.

**Squadron Leader J. M. Pope,** R.C.A.F., M.E.I.C., Trenton, Ont., on August 7th.

**P/O Marcel Papineau,** R.C.A.F., Jr.E.I.C., now overseas, on August 9th.

**Capt. R. E. Kirkpatrick,** R.C.A., Jr.E.I.C., Ottawa, Ont., on August 9th.

**Lieut. John S. MacMillan,** R.C.O.C., Jr.E.I.C., Debert, N.S., on August 10th.

**H. J. Ward,** M.E.I.C., Superintendent of Property, Shawinigan Water & Power Company, Shawinigan Falls, Que., on August 14th.

**Major J. T. Hugill,** Jr.E.I.C., National Defence Headquarters, Ottawa, Ont., on August 16th.

**Lieut. R. E. Jess,** D.S.C., R.C.N.V.R., S.E.I.C., Quebec, Que., on August 18th.

**Prof. R. F. Legget,** M.E.I.C., assistant professor of Civil Engineering, University of Toronto, Toronto, Ont., on August 19th.

**F. X. Granville,** M.E.I.C., Defence Industries Limited, Nobel, Ont., on August 19th.

**Sydney Hogg,** M.E.I.C., assistant superintendent, St. John Drydock and Shipbuilding Company Limited, Saint John, N.B., on August 23rd.

**P. C. Hamilton,** M.E.I.C., engineer, Gunite and Waterproofing Limited and Construction Equipment Company Limited, Halifax, N.S., on August 24th.

# Obituary

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

**W. G. McBride,** M.E.I.C., head of the Department of Mining and Metallurgical Engineering at McGill University, died suddenly at his summer residence near Montreal, on August 22, 1943. Born at Inglewood, Ont., on February 8, 1879, he was educated at Orangeville High School and later came to McGill University, Montreal, where he obtained the degree of B.Sc. in Mining Engineering in 1902. While at McGill he spent his vacations working in mines in Canada, including the coal mines at Fernie, B.C., and the lead and silver mines near Nelson. In 1901 he did surveying and exploration work for the British Columbia Department of Mines.

In 1903 he went to Bisbee, Arizona, where he had been appointed chief engineer of the Copper Queen Mine. While holding this position he was deputed to examine numerous mines in the southwestern United States and in Mexico, and from 1907 to 1909 he acted as superintendent of the Sierra de Cobra Mines in Cananea, Mexico, a subsidiary of Copper Queen. In 1909 he became general superintendent of the Great Western Copper Company at Courtland, Ariz. He remained with that company until 1916, when he accepted the position of assistant general manager of the Detroit Copper Company, Morenci, Ariz.

In the following year, operations at Morenci were halted by a strike and before they were resumed, Prof. McBride was appointed general manager of the Old Dominion Company at Globe, Ariz. He was remarkably successful at Globe where, despite the increased difficulties as mining operations were carried to greater depths, he achieved a reduction of nearly 35 per cent in the cost per pound of copper produced.

Professor McBride came to Quebec in June, 1927, and was appointed professor of mining engineering at McGill University in the same year. A few years later that department and the department of metallurgical engineering were merged and Professor McBride was elected president of the enlarged department. As an elected representative of the Faculty of Engineering, he served for six years as a member of the Senate of the University, and for two years as president of the McGill Chapter of Sigma XI. He had a long and distinguished record of service with the Canadian Institute of Mining and Metallurgy, of which he was president in 1941-42.

In 1942, The Engineering Institute of Canada awarded him the Julian C. Smith medal "for achievement in the development of Canada," in recognition of his distinguished service as teacher, engineer and administrator. He was also a member of the American Institute of Mining and Metallurgical Engineers and, during his residence in Arizona, was chairman of the Southwestern Section of that Institute. He had also the distinction of being a member of the Council of the Institution of Mining and Metallurgy (London).

Professor McBride joined the Institute as a Member in 1936.

# Library Notes

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## ADDITIONS TO THE LIBRARY

### TECHNICAL BOOKS

**American Standards Association:**

*C8.12—1942: American standard specifications for cotton braid for insulated wire and cable for general purposes. Approved February 6, 1942. (Revision of C8k2—1932.)*

*C8.16—1940: American standard specifications for rubber-insulated tree wire. Approved May 14, 1940.*

*C8.18—1942: American standard specifications for weather-resistant (weatherproof) wire and cable (URC type). Approved November 6, 1942.*

*C50—1943: American standard rotating electrical machinery. Approved March 29, 1943.*

*Z32.3—1943: American standards for graphical symbols for power, control and measurement. Approved February 6, 1943. (Revision of Z10g2—1933.)*

*Z32.5—1942: American standards for graphical symbols for telephone, telegraph and radio use. Approved November 4, 1942. (Revision of Z10g3—1933 and Z10g6—1929.)*

*Z32.9—1943: American standards for graphical electrical symbols for architectural plans. Approved February 6, 1943. (Revision of C10—1924.)*

**American Institute of Electrical Engineers:**

*No. 19—June, 1943: Standards for alternating-current power circuit breakers. (Supercedes A.I.E.E. standard No. 19—1938.)*

*No. 45A—April, 1943: Modification of and supplement to A.I.E.E. standard No. 45. Recommended practise for electrical installations on shipboard.*

### TRANSACTIONS, PROCEEDINGS

**Canadian Institute of Mining and Metallurgy:**

*Transactions for the year 1942, volume 45.*

### REPORTS

**The Hydro-Electric Power Commission of Ontario:**

*Thirty-fifth annual report for the year ended October 31st, 1942.*

**The Quebec Streams Commission:**

*Twenty-seventh and twenty-eighth annual reports for the years 1938 and 1939.*

**Royal Society of Edinburgh:**

*Year book for the year 1941-1942.*

**U.S. Bureau of Standards—Building Materials and Structures Reports:**

*BMS98—Physical properties of terrazzo aggregates. BMS99—Structural and heat-transfer properties of "multiple box-girder plywood panels" for walls, floors and roofs. BMS100—Relative slipperiness of floor and deck surfaces.*

**Bell Telephone System—Technical Publications—Monograph:**

*B-1361: Cryoscopic and viscosity studies of polyisobutylene. B-1363: A new direct crystal-controlled oscillator.*

**Chauffage des Habitations:**

*Huet Massue,* M.E.I.C. *Reprinted from the Revue Trimestrielle Canadienne.*

### BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.**

**AIR TRANSPORT NAVIGATION for Pilots and Navigators**

*By P. H. Redpath and J. M. Coburn. Pitman Publishing Corp., New York and Chicago, 1943. 612 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

The basic information contained in this comprehensive work is useful to the private pilot as well as to the transport pilot and navigator for whom it is primarily intended. Fundamental theories are explained, necessary instruments are described, and practical procedures are discussed for establishing and flying a course by the various methods available. The combination of dead reckoning and radio direction finding is of particular interest. Routine navigation practice, including sample log sheets, and airline flight dispatching are also covered. A wealth of ready-reference information is provided.

**ALTERNATING CURRENTS FOR TECHNICAL STUDENTS**

*By C. C. Bishop. 2 ed. D. Van Nostrand Co., New York, 1943. 424 pp., illus., diagrs., charts, tables, 8 x 5½ in., cloth, $2.50.*

The purpose of the book is to explain graphically and with simple mathematics the fundamental principles of alternating-current theory, circuits and apparatus. In this second edition some of the material has been rearranged and expanded to conform with changes in recent years. In particular a chapter on complex quantities has been added, and their application to circuit problems is shown and compared with the step-by-step method of solution.

**CERAMIC TRADE DIRECTORY, 1943**

*Ceramics Publishing Co., 6th ed. Newark, New Jersey. 300 pp., illus., tables, 7 x 4½ in., fabrikoid, $6.00.*

Informative data are presented concerning companies engaged in the ceramic industries, classified with respect to character of ware manufactured. There are also a complete geographical index to companies and plants and an alphabetical index of company officials. A buyers' guide to materials and equipment, a list of technical and trade associations and a list of trade names of ceramic wares are included.

**DYNAMICAL ANALOGIES**

*By H. F. Olson. D. Van Nostrand Co., New York, 1943. 196 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $2.75.*

This book deals with the analogies between electrical, mechanical rectilineal, mechanical rotational and acoustical systems. By means of analogies the knowledge of electrical circuits may be applied to the solution of problems in mechanical and acoustical systems. The subject matter is developed in stages from the simple element to complex arrangements of multi-element systems. The text assumes a familiarity with the elements of alternating circuit theory and physics.

**ELECTRICAL AND RADIO DICTIONARY, including Symbols, Formulas, Diagrams, and Tables, prepared by C. H. Dunlap and E. R. Hahn. Rev. and enl. ed.**

*American Technical Society, Chicago, Ill., 1943. 110 pp., diagrs., tables, 8½ x 5½ in., cloth, $1.00.*

The main dictionary section of this book is separated into two parts, one for electrical terms and one for radio terms. In addition to these there are a brief glossary of electronic terms, a list of electrical symbols with pictorial explanations and several pages of useful reference data.

**FERROMAGNETISM, the development of a General Equation to Magnetism**

*By J. R. Ashworth. Taylor & Francis, London, E.C.4, 1943 printing, first published in 1938. 97 pp., charts, tables, 9 x 5½ in., cloth, 7s. 6d.*

The contents of this book are confined closely to the development of a ferromagnetic equation based on the analogy of the fluid laws. This development depends to a considerable extent upon the application of the Van der Waal's equation of state to magnetism. The material in the book is a revised and coordinated presentation of the results of experiments published over a long period in various English scientific journals.

**FUNDAMENTALS OF ELECTRICITY**

*By W. H. Johnson and L. V. Newkirk. The Macmillan Co., New York, 1943. 212 pp., illus., diagrs., charts, tables, 11½ x 8 in., linen, $2.00.*

This pre-induction course in electricity is prepared in accordance with Army specifications for skilled training. It covers basic magnetic and electrical theory, describes the construction and operation of typical electrical apparatus such as storage batteries, meters, motors, rectifiers, etc., and illustrates all topics by means of effective photographs and diagrams. Many practical laboratory experiments are included.

**FUNDAMENTALS OF SHOPWORK**

*By W. H. Johnson and L. V. Newkirk. The Macmillan Co., New York, 1943. 200 pp., illus., diagrs., charts, tables, 11 x 8 in., linen, $2.00.*

The first two chapters of this elementary text classify and describe essential shopworking tools. Succeeding chapters discuss measuring and gaging, woodworking and metalworking practice, wiring and wire splicing, ropes and block and tackle rigging. Photographs and diagrams are effectively used to illustrate practical points. The book has been planned to meet the Army specifications for skilled training

**LABORATORY MANUAL FOR CHEMICAL AND BACTERIAL ANALYSIS OF WATER AND SEWAGE**

*By F. R. Theroux, E. F. Eldridge and W. L. Mallmann. 3 ed. rev. and enl. McGraw-Hill Book Co., New York and London, 1943. 274 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.00.*

This manual provides the engineer with procedures for all the usual tests made in water and sewage plant laboratories, as well as with many special tests required for stream surveys and trade water analysis. A particular feature is the manner of presentation, which permits the student to follow the methods of analysis by definite step-by-step procedures. In this third edition a section dealing with the testing of boiler waters has been added.

**The OFFICE LIBRARY OF AN INDUSTRIAL RELATIONS EXECUTIVE. 1943. (Bibliographical Series No. 72.) Prepared by H. Baker. 4th ed.**

*Princeton University, Industrial Relations Section, Princeton, N.J. 33 pp., 9 x 6 in., paper, 40c.*

This publication contains a list of books and pamphlets suggested as a useful library for an industrial relations executive. Approximately 150 items are listed under the broad headings of general works, specific personnel problems, trade unions and collective bargaining, labor legislation, social insurance and additional sources of information.

**The PHYSICS OF BLOWN SAND AND DESERT DUNES**

*By R. A. Bagnold. William Morrow & Co., New York, 1943. 265 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $5.00.*

The phenomena produced by the action of wind on sand, with which this book is directly concerned, are but one aspect of the wider problem of the transport of solid particles of any kind by fluids in general. Much of the information included is therefore useful in other engineering fields. Part I deals with wind-tunnel experiments on the mechanism of sand transport. Part II covers small-scale surface phenomena such as ripples and the problem of size-grading of grains. Part III explains the growth and movement of dunes in general and the peculiar characteristics of the two main types.

**PRACTICAL EMULSIONS**

*By H. Bennett. Chemical Publishing Co., Brooklyn, N.Y., 1943. 462 pp., illus., diagrs., tables, 9 x 6 in., cloth, $5.00.*

The practical aspects of emulsions are emphasized in this new treatment of the subject. The theory of emulsions is briefly discussed in the early chapters of Part I, followed by very full lists of emulsions, emulsifying agents and demulsifying agents. Part II explains how to make, use and evaluate emulsions for industrial use in a large number of important fields. Hundreds of actual formulas for specific uses have been included.

**PRACTICAL PHYSICS. (Industrial Series.)**

*By M. W. White, K. V. Manning, R. L. Weber and R. O. Cornett; prepared under the direction of The Division of Arts and Science Extension, Pennsylvania State College. McGraw-Hill Book Co., New York and London, 1943. 365 pp., illus., diagrs., charts, maps, tables, 9½ x 6 in., cloth, $2.50.*

This elementary, practical and abbreviated text in introductory general physics is designed to meet a specific need created by the pressure of wartime conditions. Primary emphasis is placed upon the basic principles of those portions of physics that are of immediate use in war industry, technical work and the armed services. Simple illustrative experiments are included.

**PRODUCTION ENGINEERING, JIG AND TOOL DESIGN**

*By E. J. H. Jones. Chemical Publishing Co., Brooklyn, N.Y., 1941. 304 pp., illus., diagrs., charts, tables, fabrikoid, $5.00.*

Basic tool elements and general principles of jig and fixture design serve as the groundwork for succeeding chapters presenting specific design procedures. The designs are related to the most economical form for the production of varying quantities of an article, and embrace a wide variety of machines and processes. A final chapter deals with air-operated fixtures.

**XV. SHIFT SCHEDULES FOR CONTINUOUS OPERATION (Industrial Relations Digests)**

*Princeton University, Industrial Relations Section, Princeton, N.J., May, 1943. 8 pp., tables, 10 x 7 in., paper, 20c.*

This digest of current practice has been prepared for the use of managements facing the need for re-arrangement of schedules on a 48-hour basis. It is based on information received from representative companies and covers three-shift schedules and also the two-shift schedule with three crews.

**SMALL ARMS MANUAL**

*By J. A. Barlow and R. E. W. Johnson. Rev. ed. John Murray, Albemarle St., London W., 1942. 232 pp., diagrs., tables, 5½ x 4 in., flexible, $1.00.*

The major part of this manual is devoted to detailed instructions for the operation, taking-down and assembling of various types of small arms, chiefly British. The classes covered are rifles, light machine-guns, machine carbines, revolvers and automatic pistols. Ammunition and special features are noted, and there is brief information on the functions in battle of these types of weapons.

**SYNTHETIC RESINS AND ALLIED PLASTICS by various authors, edited by R. S. Morrell. 2 ed.**

*2 ed. Oxford University Press, New York; Humphrey Milford, London, 1943. 580 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $12.00.*

In the general introduction a summary is given of the chemical and physical properties of the most important classes of synthetic resins and plastics. Succeeding chapters deal with the technology of the preparation and use of these various classes of synthetics. Considerable space in devoted to the problems of resinification, and the last chapter discusses methods of identifying and testing synthetic resins and other raw materials of plastics. Chapter bibliographies are included.

**ORGANIC CHEMISTRY, and Advanced Treatise. 2 Vols., edited by H. Gilman and others.**

*2ed. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 1,983 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $7.50 each volume.*

This treatise, the work of some thirty well-known chemists, is intended to meet the need for an advanced general treatise, suitable for graduate study. Attention is focused upon new developments. The book is liberally provided with references to recent literature. The new edition has been thoroughly revised, and eight new chapters have been added.

**PLUMBING PRACTICE AND DESIGN, Vol. 2**

*By S. Plum, John Wiley & Sons, New York; Chapman & Hall, London, 1943. 329 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

The second volume of this useful handbook, like the first, attempts to consolidate the scattered data on plumbing and to present them in a uniform terminology. The topics dealt with in this volume include water piping, drainage, sewers and sewage treatment, and gas piping. Architectural practice, codes and regulations, and water supply are also discussed, and there is a chapter on definitions. The book will be welcomed by plumbers, architects and builders.

**PRINCIPLES AND PRACTICE OF RADIO SERVICING**

*By H. J. Hicks. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 391 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

This textbook explains the fundamental principles of radio and discusses their application to the various components of radio receivers. Definite instructions are then given for performing all the more complicated servicing procedures. Test equipment is discussed at length. The new edition has been thoroughly revised.

**PRISM AND LENS MAKING**

*By F. Twyman. Adam Hilger Ltd., London, 1942. 178 pp., illus., diagrs., tables, 9 x 5½ in., cloth, $4.50, (obtainable from Jarrell-Ash Co., 165 Newbury St., Boston).*

This is an authoritative account of methods of optical working in glass as carried on in the optical workshops of Adam Hilger Ltd., the prominent firm of British instrument makers. The materials, tools and methods are described practically and in detail, together with methods of testing. This is a useful addition to the scanty literature in this field.

**QUESTIONS AND ANSWERS FOR MARINE ENGINEERS, Book VIII—Materials and Calculations—Handy Tables, compiled by H. C. Dinger. (Marine Engineering and Shipping Review)**

*Simmons-Boardman Publishing Corp., New York, 1943. 159 pp., diagrs., charts, tables, 8½ x 5 in., paper, $1.00.*

This is the final collection of questions and answers culled from recent files of the "Marine Engineering and Shipping Review". The contents are a miscellany of problems relating to the calculation of strength and of tank capacities, to the properties of metals, the treatment of steel and to protective coatings. A collection of useful tables is included.

**(The) REFRIGERATING DATA BOOK AND CATALOGUE, 5th ed. 1942**

*American Society of Refrigerating Engineers, 50 West 40th St., New York. 518 pp., Catalogue Section, 160 pp., illus., diagrs., charts, tables, 9½ x 6½ in., fabrikoid, $4.00 in U.S.A. ($4.50 other countries).*

This edition of this well-known reference book has been thoroughly revised and reset in more readable form. It is substantially a revision of the 1939 edition, being devoted chiefly to the basic principles and data of refrigeration and to the major kinds of refrigerating and air conditioning machinery.

**(The) RISE OF THE ELECTRICAL INDUSTRY DURING THE NINETEENTH CENTURY**

*By M. MacLaren. Princeton University Press, Princeton, N.J., 1943. 225 pp., illus., 9½ x 6 in., cloth, $3.75.*

This volume presents an interesting, useful general account of the early development of all of the principal branches of electrical engineering. The story is told in non-technical form, but an extensive bibliography is provided for further study. The author, as an engineer actively connected with many electrical developments, and as a teacher, writes with firsthand knowledge of much of his field. Photographs of many historic pieces of apparatus are included.

**SIMPLIFIED DESIGN OF REINFORCED CONCRETE**

*By H. Parker. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 249 pp., diagrs., charts, tables, 8 x 5 in., leather, $2.75.*

Beginners whose preparation does not extend beyond a knowledge of the principles of mechanics and of high-school algebra will find this a helpful text. The design of the commonest structural elements is explained simply and concisely, with some discussion of the theory involved. Illustrative problems are solved.

**SYMPOSIUM ON RADIOGRAPHY**

*American Society for Testing Materials, Phila., Pa., 1943. 256 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $4.00 (to A.S.T.M. members, $3.00).*

This book contains thirteen papers presented at a symposium held by the Society in 1943, together with reedited copies of five papers presented at its 1936 symposium. The papers deal with the principles of radiography, various applications to production problems and testing, portable radiographic apparatus and other practical matters.

**INDEX TO THE LITERATURE OF FOOD INVESTIGATION, Vol. 13, No. 3, Dec. 1941.**

*Compiled by A. E. Glennie, assisted by C. Alexander. His Majesty's Stationery Office, London, 1942. 231 pp., tables, 9½ x 6 in., paper, (obtainable from British Library of Information, 30 Rockefeller Plaza, New York, $1.35).*

Several hundred magazine articles published during 1941 are listed, with brief abstracts. The subject matter covers both theoretical and practical aspects of the storage, packing, canning, analysis, spoilage and by-products of the various major food industries. There are also sections listing bacteriological, mycological and engineering articles relating to the general subject.

**HISTORY OF SCIENCE and Its Relations with Philosophy and Religion**

*By Sir W. C. Dampier. 3 ed. rev. and enl. Macmillan Co., New York; University Press, Cambridge, England, 1942. 574 pp., diagrs., tables, 9½ x 6 in., cloth, $2.95.*

This valuable work, which has been out of print for some time, now appears in a third edition. In the interval since the previous publication, much new information has been obtained, which called for extensive changes. A new chapter, covering the period 1930 to 1940, has also been added. The book continues to be one of the best, if not the best, accounts of the development of scientific knowledge, from ancient times to the present day.

**LECTURES ON MACHINE DESIGN**

*By L. F. Moody. Princeton University Store, Princeton, N.J., 1942. 75 pp., diagrs., tables, 11 x 8½ in., paper, $1.75.*

The lectures which have been combined in this volume are directed primarily to the application of the principles of the mechanics of materials to the more usual forms of machine members. These fundamental principles are extended in the various chapters to cover special cases and problems which are of importance in the design of machinery. Notes on practical applications are included.

---

## WARTIME BUREAU OF TECHNICAL PERSONNEL — REPORT

*(Continued from page 518)*

The total number of recorded placements made increased seventy-five per cent over the previous year, including those who were accepted for technical appointments in the service. The actual increase in numbers, however, is no measure of the increased effort necessary to locate suitable prospects. As might be expected, the steady drain on the supply of available technical personnel, particularly during the last two years, by expanding war industry and by substantial increase in service establishments, has made it more and more difficult to locate suitable candidates. At the same time, the Bureau has directed its efforts to discouraging transfers of employment except where the national interest is to be served. Typical of this is a case where a secondary school teacher engaged in the teaching of science or mathematics approached the Bureau with the suggestion that he transfer to some form of war activity. The practice in such cases has been to endeavour to persuade the teacher to stay in the teaching field, unless an immediate replacement is available. The actual benefit to the war effort from the numbers that have been located for essential positions should be considered in relation to the fact that most of the individuals concerned are responsible for planning or directing the work of large numbers of other workers.

The number of interviews recorded is nearly five times that of the previous year. Approximately one-half of the interviews were conducted in the regional offices. There is no doubt that many persons interviewed pass on to others the information received from Bureau officers. The result is that this phase of activity has been of great value in publicizing not only details of the Bureau's operations and the regulations under which it operates, but also to a large extent general man-power policies of the government. It is gratifying to report that, both at Ottawa and in the regional offices, there has been the closest co-operation between the Bureau's officers and those of the various branches of the Department of Labour with which they have been in contact.

---

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

August 25th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the October meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

### FOR ADMISSION

ARCHAMBAULT—RAYMOND G., of 77 William St., Longueuil, Que. Born at Sherbrooke, Que., Oct. 9th, 1910; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1937; 1937-39, asst. divn. engr., 1939-40, constrn. engr., and 1940 to date, asst. divn. engr., Dept. of Roads, Prov. of Quebec, Boucherville, Que.

References: E. Gohier, A. Gratton, J. O. Martineau, J. A. Lalonde, L. Trudel.

ANDERSON—KENNETH HUNTER, of 161 Park Home, Willowdale, Ont. Born at Saskatoon, Sask., Jan. 8th, 1909; Educ.: B.Sc. (Mech.), Univ. of Sask., 1934; 1928-29, service repair work, Massey Harris Ltd.; 1930, erection crew, Dominion Bridge Co. Ltd.; 1934, mechanic, International Harvester Co. Ltd.; 1935-36, mechanic, Little Long Lac Gold Mines; 1936-37, head pipefitter, Sigma Gold Mines; 1937-41, mech. and structl. dftsman., Little Long Lac and MacLeod Cockshutt Gold Mines; 1941 to date, tool engr., i/c of plant tooling and tool design dept., General Electric Co. (Canada) Ltd., Toronto, Ont.

References: R. S. Segsworth, I. S. Widdifield, C. J. Mackenzie, C. W. Holman, I. M. Fraser.

CHOLETTE—ALBERT, of Quebec, Que. Born at Quebec, Oct. 12th, 1918; Educ: B. Eng., McGill Univ., 1942. S.M., Mass. Inst. Tech., 1943; 1939-42 (summers), inspection of asphaltic materials, Montreal East Refinery, Imperial Oil Ltd., control of bldg. materials, laboratory of highway dept., chief inspr. on constrn. of waterproof stabilized base course, Trans-Canada Highway; At present asst. professor of chem. engr., Faculty of Sciences, Laval University, Quebec, Que.

References: R. Dupuis, E. D. Gray-Donald, P. E. Gagnon, P. Vincent, J. P. Lecavalier.

de PENDOCK—H. VICTOR, of 100 Columbia Ave., Westmount, Que. Born at Montreal, June 24th, 1906; Educ.: 1927-28-29 (evening classes), extension courses, metallurgy and geology, McGill Univ.; 1927-28, mech. and structl. dftsman., Canadian Car & Foundry Co., Turcot, Montreal; 1928-30, mech. and structl. dftsman., power plants and dam constrn., Power Corporation of Canada Ltd.; 1930-31, estimating engr., Guardian Construction Ltd.; 1931-32, engr. on design of reinforced concrete, Joseph A. Forgues Ltd.; 1933-35, in business for self; 1936, engr. and designer, elec. and mech. layouts, Canadian Marconi Co. Ltd.; 1937, engr. and designer, Foundation Co. of Canada Ltd.; 1937-40, mech. engr. and dftsman., Aluminum Laboratories Ltd., Montreal; 1941-42, engr. on layouts of industrial plants and shipyard expansions, Wartime Merchant Shipping Ltd.; at present, president and chief engr., Anglo-French Development Corpn. Ltd., Montreal, Que.

References: J. Stadler, O. J. McCulloch, J. E. Thicke, A. R. Sprenger, S. J. Montgomery, N. Beaton.

GENEST—ADRIEN, of 8518 Henri-Julien Ave., Montreal, Que. Born at Montreal, Sept. 1st, 1900; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1925; R.P.E. of Que.; with Dept. of Roads, Prov. of Quebec, as follows: 1925, res. engr., 1925-26, asst. divn. engr., 1926, asphalt analyst, 1927-36, asst. divn. engr., 1936-39, engr. i/c surveys, 1939-43, traffic engr.; at present, technical divn., City of Montreal.

References: E. Gohier, A. Gratton, J. O. Martineau, H. Gaudefroi, L. Trudel.

McGRUER—ALFRED EDWIN, of Toronto, Ont. Born at Barrow, Lancs., England, Dec. 13th, 1900; Educ.: 1914-20, Montreal Commercial and Technical Inst. (evening classes). I.C.S. Steam Engrg., Elec. Engrg.; 1914-20, ap'ticeship, Canadian Vickers Ltd., Montreal; 1920-21, plant operator, (steam-Elec.), Detroit Edison Co., Port Huron; 1921-24, shop foreman, Lake Erie & Nor. Rly., Preston; 1924-27, shop foreman, Montreal & Southern Counties Rly.; 1927-42, plant engr., C.P.R. shops, West Toronto; at present, supervisor, stationary boiler plants, C.P.R., Toronto, Ont.

References: H. B. Bowen, J. A. Shaw, J. R. W. Ambrose, J. E. Armstrong, J. G. Hall.

RULE—PETER LEITCH, of Winnipeg, Man. Born at Edmonton, Alta., Jan. 21st, 1913; Educ.: B.Sc. (Arch), Univ. of Alta., 1939; 1934-37 (summers), surveys, Alta. Govt., engrg. dept., City of Edmonton; Jan., 1941, to date, inspecting officer, Shell Inspection Board, United Kingdom, i/c of the following districts—Montreal, Toronto, Western Canada—administration, inspection and production, upkeep.

References: A. W. Haddow, I. F. Morrison, R. M. Hardy.

ULOTH—MILTON MacRITCHIE, of 309 Park St., Peterborough, Ont. Born at New Harbor, N.S., March 31st, 1918; Educ.: B.Eng. (Elec.), N.S. Tech. Coll., 1942; 1940-41 (summers), telephone apparatus mtce., installn. of automatic telephone exchange equipment, Mar. Tel. & Tel. Co. Ltd., Halifax; 1942-43, test course, and at present junior engr., Can. Gen. Elec. Co. Ltd., Peterborough, Ont.

References: G. R. Langley, W. M. Cruthers, A. R. Jones, A. L. Dickieson, D. J. Emery.

### FOR TRANSFER FROM THE CLASS OF JUNIOR

MACREDIE—JOHN ROBERT CALDERWOOD, of 4965 Decarie Blvd., Montreal, Que. Born at Fredericton, N.B., Aug. 4th, 1910; Educ.: B.Sc. (Civil), Univ. of N.B., 1931; 1928-31 (summers), on rly. constrn., C.P.R., Sask. and Saint John; 1931-33, asst. to land surveyors in N.B.; 1933-35, land surveys for prov. govt. and various lumber companies; 1935, paving inspr., 1936-39, asst. res. engr., Dept. of Highways of N.B.; 1940 (2 mos.), chief of party, airport survey, Dept. of Transport, Pennfield, N.B.; 1940 (8 mos.), asst. to engr. i/c constrn. of R.C.A.F. equipment depot No. 5, Moncton; 1941 to date, asst. supervising engr., and at present, technical asst. to records engr., Allied War Supplies Corporation, Montreal.

References: T. C. Macnabb, W. D. G. Stratton, C. C. Kirby, E. O. Turner, P. G. Gauthier.

FLEMING—FREDERICK ALEXANDER, of 293 First Ave., Ottawa, Ont. Born at Toronto, March 11th, 1913; Educ.: B.A.Sc., Univ. of Toronto, 1936; with Can. Gen. Elec. Co. Ltd. as follows: 1936-37, transformer, motor testing and switch gear testing depts., 1937-38, asst. engr., wiring supplies and devices and elec. appliances, Ward St. works, 1937-38, asst. engr., transformer design, Davenport works, 1938-39, asst. meter and instrument engr., Peterborough, also asst. engr., wire and cable design and mfre.; Commissioned in the permanent force as Ordnance Mech. Eng., i/c of inspection of elec. engrg. purchases; 1940, promoted to Capt. and O.M.E. 3rd Class; June, 1942, promoted to Major, Technical Staff Officer, Grade 2, and O.M.E. 2nd Class; at present, Deputy Asst. Director of Inspection (E.E.), Inspection Board of United Kingdom and Canada, Ottawa, Ont. (Jr. 1938.)

References: B. G. Ballard, G. A. Wallace, N. L. Dann, N. L. Morgan, J. Cameron, W. T. Fanjoy, G. W. Arnold.

REEVE—DAVID DOUGLAS, of Arvida, Que. Born at Vancouver, B.C., Nov. 29th, 1912; Educ.: B.A.Sc., Univ. of B.C., 1933; R.P.E. of Que.; 1936 (June-Dec.), dftsman., B.C. Pulp & Paper Co., Port Alice, B.C.; 1937-39, dftsman., Abitibi Power & Paper Co., Smooth Rocks Falls; 1939-40, designer, Quebec North Shore Paper Co., Baie Comeau; 1940 (1 mo.), designer, Bloedel, Stewart & Welch Ltd., Port Alberni; 1940-41, dftsman., Jan. 1942 to date, chief dftsman., Aluminum Co. of Canada Ltd., Arvida, Que. (Jr. 1940.)

References: R. H. Rimmer, A. T. Cairncross, M. G. Saunders, B. E. Bauman, J. W. Ward.

### FOR TRANSFER FROM THE CLASS OF STUDENT

ALLEN—RICHARD THOMAS WEBSTER, of 482 Parkdale Ave., Toronto, Ont. Born at Roseisle, Man., Feb. 29th, 1912; Educ.: B.Sc. (E.E.), Univ. of Alta., 1935; one year post-graduate study; 1934-36, radio control operator; 1935-36, instructor, Physics and dfting., Univ. of Alta.; 1935-37 (summers), highway surveys; 1937 (6 mos.), dfting., soil surveys; 1939, dfting., irrigation plans; 1939 to date, supervision of concrete mtce. work and new concrete and steel structures, Gatineau Power Company, Ottawa, Ont. (St. 1935.)

References: W. V. G. Gliddon, R. C. Silver, H. J. MacLeod, E. Viens, W. E. Blue.

NEAR—JAMES DAILEY, of 54 Thomas St., St. Catharines, Ont. Born at Stratford, Ont., Dec. 27th, 1915; Educ.: B.A.Sc., Univ. of Toronto, 1941; 1938-40 (summers), Dept. of Highways of Ont., and W. C. Brennan Contracting Co.; 1941 to date, Lieut., R.C.E., at present overseas. (St. 1940.)

References: R. F. Legget, C. R. Young, J. J. Spence, M. H. Jones, A. L. McPhail.

NOBLE—WILLIAM LAWRENCE, of Windsor, Ont. Born at Winnipeg, Man., June 9th, 1921; Educ.: B.Sc. (Civil), Univ. of Sask., 1941; 1941-42, dftsman., and Feb. 1942 to date, estimator, Canadian Bridge Co. Ltd., Walkerville, Ont. (St. 1941.)

References: R. A. Spencer, I. M. Fraser, W. G. Mitchell, P. E. Adams, J. M. Wyllie.

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

PARTNER WANTED, graduate mechanical engineer wanted in small but successful manufacturing plant and machine shop in central Ontario city. Plant currently engaged on war work but with extensive peacetime programme definitely settled. Applicant must have executive and administrative ability, preferably with some production experience on machine tools. Moderate investment required. Apply to Box No. 2660-V.

EXPERIENCED STRUCTURAL STEEL DRAUGHTSMEN. Location Windsor, Ontario. Apply to Box No. 2662-V.

### SITUATIONS WANTED

MECHANICAL ENGINEER, executive ability, desires permanent position with responsibility and future. Presently employed but war conditions necessitate change. Apply to Box No. 270-W.

CIVIL ENGINEER, B.A. Sc., Age 34, married. Experience covering heating, air-conditioning, mining. Design, construction and maintenance of sewers, waterworks, streets and highways, including surveying, location, estimating, inspection, drainage and soundings. Presently employed but desires advancement. Apply to Box No. 1859-W.

STRUCTURAL ENGINEER, M.E.I.C., modern methods reinforced concrete design, experienced on construction. Location immaterial. Preference for West. Excellent civil experience home and abroad. Apply to Box No. 2425-W.

GRADUATE CIVIL ENGINEER, Queen's University, age 43, 20 years experience highways, bridges, buildings, docks, municipal pavements, sewers and waterworks. Surveying, estimating and design; emphasis on economy in earthwork and concrete. Versatile, practical and good personality for meeting the public. Presently employed, desires position as municipal engineer or with general contractor. Apply to Box No. 2453-W.

### FOR SALE

One Clinometer or Slope Level (No. 5805 in K. & E. Catalogue. Never used.

One Recording Barometer, similar to No. 5941 in K. & E. Catalogue. Size of case 11¼"x5¼"x6". No reasonable offer refused. Apply to Box 52-S.



## AMATOL

### Health and Safety Hazards and Precautionary Measures


NATIONAL SAFETY COUNCIL, INC.
CHICAGO 6, ILLINOIS


*Uses*—Amatol is used as a bursting charge for high explosive shells.

*Description and Properties*—Amatol is a mixture of ammonium nitrate and TNT in equal parts, for shells from 75 millimeters up to and including 4.7 inches. For shells above 4.7 inches the mixture is 80 per cent ammonium nitrate and 20 per cent TNT (1)

Amatol is hygroscopic, insensitive to friction, but can be detonated by severe impact. It is more insensitive than TNT to explosions by initiators. 50-50 amatol has approximately the same rate of detonation and strength as TNT, but 80-20 amatol is slightly lower in rate of detonation and brisance. Amatol has no tendency to form dangerous compounds with metals other than copper. (1)

Another reference states that by itself ammonium nitrate can be exploded only with difficulty (2), but mixed with TNT the mixture is stronger than pure TNT, and is easily detonated. (14)

*Manufacture*—Amatol is mixed at the loading plant by adding molten TNT to hot granular ammonium nitrate to form a liquid which is poured into the shell (15); however 80-20 amatol cannot be loaded by the casting method. (1)

*Safety*—Inasmuch as amatol is mixed at the time of shell loading, there should be no occasion for storing. However, if stored, boxes lined with moisture-proof paper, holding 100 pounds net weight, are recommended. (2)

Drenching systems controlled automatically and by instantaneous devices are desirable on melting kettles and other process machinery. Safety uniforms and safety shoes are required in the process building. All practices and precautions relating to safety in the handling of TNT are required in processes involving amatol. (2)

*Health Hazards*—The ammonium nitrate in amatol is very hygroscopic and acts as a vehicle to hold TNT in contact with the skin, tending to increase the rate of TNT absorption (15). TNT is a more severe skin irritant than ammonium nitrate alone.

Ammonium nitrate is not a systemic poison; however, the TNT present in amatol can cause systemic poisoning and all precautionary measures indicated for the control of TNT exposures should be applied to amatol exposures. Atmospheric contamination by TNT fumes or dust should be kept below the currently accepted maximum allowable concentration of 1.5 milligrams per cubic meter of air. (3)

References


(1) *Military Explosives*. Technical Manual TM9-2900, War Department, Washington, D.C.
(2) *Ordnance Safety Manual*, Office of Chief of Ordnance, December 1, 1941.
(3) *Manual of Industrial Hygiene*, United States Public Health Service.
(14) *Industrial Chemistry*, E. R. Riegel.
(15) Address before Mid-West Safety Conference, Major Geo. D. Rogers, Ordnance Department Safety Officer, May 8, 1941.


This Wartime Safety Digest is prepared for the immediate information and use of companies handling and processing amatol.

It is not an exhaustive treatment of the subject, but it does provide sound, basic data.

Members may write to the Division of Industrial Safety, National Safety Council, for comment on specific aspects of their problem not covered in this Digest.

# Industrial News

**Industrial development — new products — changes in personnel — special events — trade literature**

### TAP DRILL DATA CHART

Canadian SKF Company, Ltd., Toronto, Ont., have for distribution chart No. 28 in the series of "Useful Tables and Charts" being issued by the company. It contains specifications on tap drills for A.S.M.E. machine screw threads under the headings; Size of Tap Threads per Inch, Size of Drill for Tapping, Suggested Clearance and Drill for O-dia. Machine Screw. All sizes of tap from 0-80 to 30-16 are given.

### PRACTICAL ARC WELDING

Canadian Westinghouse Company, Ltd., Hamilton, Ont., have prepared a 24-page booklet, the contents of which are directed towards the specific objective of the conservation of vital war materials. It provides instructions to welding operators covering each step in the repair by arc welding of shanks or tangs on drills, reamers, end mills and similar tools; of chipped cutting edges or broken teeth on tools made from high speed steel; of machine parts made from medium carbon and alloy steels and of bronze castings, the latter by the electric carbon arc process. A section is devoted to the means of eliminating the unused stub ends of arc welding electrodes.

### RETURNS TO PRIVATE BUSINESS

It was recently announced from Ottawa that W. H. Milne has left the Munitions & Supply Department, where he served as technical advisor to the Naval Shipbuilding Branch for the past two years, to return to his firm, German and Milne, of Montreal, naval architects. On the occasion of Mr. Milne's leaving Ottawa, the Department paid high tribute to the service he had given and stated that his experience as a naval architect and shipbuilder had contributed effectively to the success of the programme. Mr. Milne's services will continue to be available to the department if required.

### PRIZE WINNERS

J. A. M. Galilee, assistant advertising manager of the Canadian Westinghouse Co. Ltd., won first prize in the recent essay contest sponsored by the Canadian Electrical Association. Entrants were required to write on "How Can Electricity be Used for Greater Efficiency in Industry ?". Other winners in the contest were H. H. Schwartz of Northern Electric Co. Ltd., Montreal, and P. W. Shill of British Columbia Electric Railway Co. Ltd., Vancouver, B.C.

**J. A. M. Galilee**



**S. W. Fairweather**

### RECENT APPOINTMENT

The appointment of S. W. Fairweather as vice-president of research and development of the Canadian National Railways was recently announced by R. C. Vaughan, chairman and president of the National System.

Mr. Fairweather who has had extensive and varied experience in transportation matters, comes of New Brunswick United Empire Loyalist stock. He studied engineering at Acadia and McGill Universities, and after graduation joined the forces of the Department of Railways and Canals, his appointment dating May, 1916. His first service for the department was as assistant engineer on the car ferry terminals to Prince Edward Island. He was later employed as assistant engineer on the Quebec bridge. Afterwards he was transferred to Ottawa where he was attached to the consulting engineer for the Dominion Government. In 1919, he joined the staff of the Grand Trunk Arbitration on the Government side.

In 1923 Mr. Fairweather joined the Bureau of Economics of the Canadian National Railways, serving, first, as assistant to the director, and in 1930, being appointed director of this branch of the system activities. In 1939, he became chief of research and development, and has now been appointed vice-president.

### ELECTRONICS

So great has the interest proved and so insistent the demand for information regarding the nature and possibilities of electronics that Canadian General Electric Company, Ltd., Toronto, Ont., has just issued a most attractive book—"Electronics—a New Science for a New World"—in which the whole fascinating story of electronics is pictured and described.

Thanks to electronics, ships and planes can be guided to safety through the densest fog. The surgeon can examine the sub-microscopic structure of the body tissue. The fireman can "smell" smoke in a home far across the city. The cosmetician can match lipstick colour. The steel worker can detect flaws in battle ship armour plate. Electronics can aid the textile manufacturer, the printer, the potter, the miner, the bottler of drinks and the packager of foods.

Copies of "Electronics—A New Science for a New World" are available upon request to the company.

### RECENT APPOINTMENTS

H. N. Mallon, president of Dresser Manufacturing Company, has announced the election of Norman Chandler of Los Angeles, as a member of the company's board of directors, and R. E. Reimer, of Bradford, Pa., as secretary and treasurer. Mr. Chandler is president and general manager of the Los Angeles Times and secretary of the American Newspaper Publishers Association. He is also a director of Pacific Pump Works, of Huntington Park, Calif., one of Dresser's subsidiaries. Mr. Reimer has been with the company since January, 1929, and has been treasurer since May 1932. His election to the additional office of secretary fills a vacancy by the death of Merrill N. Davis.

### NEW DIVISION

La Salle Builders Supply Ltd., Montreal, Que., have announced the formation of a new department, to be known as the "Industrial Division," incorporating the foundry supplies, refractories and specialties branches.

Mr. E. F. Vincent, who is a director of the company, will be in charge of the division. Mr. Vincent has been with the company since its inception and is well-known throughout the industrial trade, and prior to his joining this company was with The Canadian Fairbanks-Morse Co. Ltd.

**E. F. Vincent**

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 | MONTREAL, OCTOBER 1943 | NUMBER 10


"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."

* * *


PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL





Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.




# CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont.
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Beauharnois, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que.

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**PAPERS**
L. F. GRANT, *Chairman*

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PUBLICATION**
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**PROFESSIONAL INTERESTS**
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

**STUDENTS' AND JUNIORS' PRIZES**

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. P. BRIERLEY
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
R. DUPUIS
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY A. H. PASK
A. H. MACQUARRIE
*(Ex-Officio),* G. E. MEDLAR
H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY,
1614 Ontario Street,
Walkerville, Ont

**CALGARY**
*Chairman,* J. G. MACGREGOR
*Executive,* F. A. BROWNIE
H. R. HAYES
A. HIGGINS
W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS
G. P. F. BOESE
H. J. McEWEN
*Sec. Treas.,* K. W. MITCHELL,
803-17th Ave. N.W.,
Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN,
60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN
J. W. JUDGE
E. D. ROBERTSON
J. D. A. MACDONALD
I. F. MORRISON
H. W. TYE
*(Ex-Officio),* D. HUTCHISON
E. NELSON
*Sec.-Treas.,* F. R. BURFIELD,
Water Resources Office,
Provincial Government,
Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE D. C. V. DUFF
G. J. CURRIE L. E. MITCHELL
J. D. FRASER P. A. LOVETT
J. W. MacDONALD
G. T. MEDFORTH
J. E. CLARKE
R. B. STEWART
K. L. DAWSON
*(Ex-Officio),* J. R. KAYE S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY,
Wartime Bureau of Technical
Personnel, 84 Hollis Street,
Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON
R. J. G. SCHOFIELD
NORMAN EAGER
A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID
STANLEY SHUPE
A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN,
91 Barnesdale Blvd.,
Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN
J. R. CARTER
J. D. LEE
*(Ex-Officio),* T. A. McGINNIS
L. F. GRANT A. JACKSON
*Sec. Treas.,* R. A. LOW,
Dept. of Civil Engineering,
Queen's University,
Kingston, Ont.

**LAKEHEAD**
*Chairman,* R. B. CHANDLER
*Vice-Chair.,* S. T. McCAVOUR
*Executive,* S. E. FLOOK
O. J. KOREEN
E. L. GOODALL
J. I. CARMICHAEL
W. H. SMALL
A. D. NORTON
E. A. KELLY
J. S. WILSON
*(Ex-Officio),* E. M. G. MacGILL
(Mrs. E. J. Soulsby)
E. J. DAVIES H. G. O'LEARY
*Sec.-Treas.,* W. C. BYERS,
c/o C. D. Howe Co. Ltd.,
Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON G. S. BROWN
N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE,
McKenzie Electric Ltd.,
706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT
W. C. MILLER
F. T. TAYLOR
F. C. BALL
V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN
J. A. VANCE
*Sec. Treas.,* H. G. STEAD,
60 Alexandra Street,
London, Ont.

**MONCTON**
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS H. W. HOLE
A. GORDON G. C. TORRENS
G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE
G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT,
Engrg. Dept., C.N.R.
Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE
R. C. FLITTON
G. D. HULME
C. E. GELINAS
K. G. CAMERON
G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD
J. E. ARMSTRONG
R. E. HEARTZ
W. G. HUNT
J. A. LALONDE
G. MacL. PITTS
E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL,
40 Kelvin Avenue,
Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR
C. G. MOON
G. F. VOLLMER
H. E. BARNETT
J. W. BROOKS
G. MORRISON
D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE
A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS,
2135 Culp Street,
Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY
G. A. LINDSAY
R. YUILL
W. H. B. BEVAN
J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY
K. M. CAMERON
N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON
Dept. of Mines & Resources,
Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN
A. L. MALBY
F. R. POPE
C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY
H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD,
308 Monaghan Road,
Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD G. ST-JACQUES
L. GAGNON A. E. PARÉ
G. W. WADDINGTON Y. R. TASSÉ
*(Ex-Officio),* H. CIMON
R. B. McDUNNOUGH
P. MÉTHÉ
L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT,
Colonization Department,
Room 333-A, Parliament Bldgs.,
Quebec, Que.

**SAGUENAY**
*Chairman,* CHAS. MILLER
*Vice-Chair.,* G. B. MOXON
*Executive,* J. FRISCH W. E. COOPER
F. T. BOUTILIER
*(Ex-Officio),* R. H. RIMMER J. W. WARD
ALEX. T. CAIRNCROSS
*Sec.-Treas.,* ALEX. T. CAIRNCROSS,
8-C Brittany Row,
Arvida, Que.

**SAINT JOHN**
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN
C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH
J. P. MOONEY
D. R. SMITH
G. W. GRIFFIN
*Sec.-Treas.,* G. L. PHILLIPS,
Saint John Dry Dock &
Shipbldg. Co. Ltd.,
East Saint John, N.B.

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vice-Chair.,* R. DORION
*Executive,* G. B. BAXTER
E. BUTLER
A. G. JACQUES
R. D. PACKARD M. EATON
E. T. BUCHANAN J. JOYAL
W. E. A. McLEISH H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN
H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS,
Shawinigan Water & Power
Company,
P.O. Box 190,
Three Rivers, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN
E. K. PHILLIPS
J. I. STRONG
F. C. DEMPSEY
N. B. HUTCHEON
J. G. SCHAEFFER
R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG,
P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK
C. R. MURDOCK
G. W. MacLEOD
K. G. ROSS
H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG
A. E. PICKERING
L. R. BROWN
*Sec. Treas.,* O. A. EVANS,
159 Upton Road,
Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR R. F. LEGGET
E. G. HEWSON A. H. HULL
C. F. MORRISON E. A. CROSS
*(Ex-Officio),* H. E. BRANDON W. S. WILSON
T. H. HOGG C. R. YOUNG
N. MACNICOL
J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. DEJONG,
Dept. of Civil Engineering,
University of Toronto,
Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER H. P. ARCHIBALD
R. E. POTTER I. C. BARLTROP
E. S. JONES H. J. MACLEOD
*(Ex-Officio),* W. O. SCOTT
C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN,
2099 Beach Avenue,
Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD
A. N. ANDERSON
F. C. GREEN
J. H. BLAKE
*(Ex-Officio),* E. W. IZARD
A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING,
41 Gorge Road West,
Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING
N. M. HALL
B. B. HOGARTH
R. H. ROBINSON
R. A. SARA
*(Ex-Officio),* W. P. BRERETON
J. W. SANGER
D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY,
55 Princess Street,
Winnipeg, Man.

# DECEW FALLS DEVELOPMENT

OTTO HOLDEN, M.E.I.C.
*Chief Hydraulic Engineer, The Hydro-Electric Power Commission of Ontario, Toronto*

While the DeCew Falls development cannot be classed among the major water power projects from point of size, it is somewhat unusual in the number and variety of the conditions and problems encountered.

DeCew falls, themselves, take their name from one of the first settlers in the district who in 1788 secured the lots embracing the falls on Beaver Dams creek. His name originally was John DeCou and, while of Huguenot French descent, he came to Canada with other United Empire Loyalists in the years following the American Revolutionary War.

John DeCou built various mills near the falls, and finally developed a considerable settlement. He later built a substantial home, which still stands. He served as a captain of militia in the war of 1812, and it was while he was a prisoner of war that Laura Secord made her famous journey to warn Captain Fitzgibbon, then stationed at the DeCou home, a story which is familiar to all Canadians.

Following the war, a plan was considered to bring more water to his mills by diverting flow from the Welland river to Twelve Mile creek. This proposal, it is recorded, was the genesis of the original Welland canal. At first, it was suggested, this canal should follow the valley of Twelve Mile creek and its tributary, Beaver Dams creek.

The name "DeCew Falls Development" is apt to be somewhat misleading, in that it perhaps conveys the impression that the works are designed to utilize the water now passing over the waterfall of this name. Instead, the development is supplied with water drawn from the Welland canal near Allanburg, and the major works are located on Twelve Mile creek, a relatively small stream, about three miles west of the city of St. Catharines. It will utilize the major portion of the difference in level of 326 ft. between lake Erie and lake Ontario.

In the Queenston development, on the Niagara river, which also employs the drop in level between these two lakes, the water reaches the forebay by way of the Niagara river and the Queenston-Chippawa canal. In the course of this route there is a drop of some 30 ft. to the forebay level, the net head on the plant being about 295 ft. In the DeCew Falls development, the water travels through the Welland canal from lake Erie to Allanburg, and thence into the forebay of the development. Over this distance there is a drop of some 16 ft. From the DeCew Falls plant to lake Ontario, however, there is a further drop of 39 ft., resulting in a net head of 270 ft.


**Fig. 1—Plan of Niagara Peninsula showing location of DeCew Falls development.**

At the end of the last century, one of the earliest high head developments in Canada was undertaken by the diversion of water from the Welland canal and its conveyance to the escarpment at DeCew falls. The works constructed at that time constitute the present DeCew Falls plant, and its conception and successful operation for forty years are a tribute to the courage, foresight and ability of its builders.

The first development consisted essentially of a channel starting from the Welland canal at Allanburg and extending north to an artificial lake in the valley of Beaver Dams creek, created by the damming of this stream, and known as lake Gibson. From this lake, water was conveyed by pipe lines down the escarpment to the power house located on the banks of Twelve Mile creek. Through this waterway and the Second Welland canal, the discharge from the plant found its way to lake Ontario.

In 1930 this plant and its associated facilities were purchased by The Hydro-Electric Power Commission of Ontario, which has maintained its operation. Its eventual enlargement as a peak load plant in the Commission's Niagara System was envisaged at the time of purchase.

The rapid and continued increase in power requirements, resulting from the ever growing industrial activity consequent on the production of munitions and military equipment, rendered necessary the provision of additional generating capacity. The opportunity offered by the DeCew Falls site to secure additional power at a comparatively early date was regarded favourably by the Commission, and the construction of a new power house and appurtenant works was authorized.

### Water Supply

Before proceeding with a description of the various components of this development, it is of interest to note that the water required for the operation of this additional installation is to be provided by diversions from the Albany river watershed into the Great Lakes basin. These diversions are commonly known as the Long Lac and Ogoki diversions. The former, now in operation, brings from Long lake into lake Superior water which normally flowed north to James bay. This is accomplished by means of a dam on the Kenogami river some 15 miles north of Long lake, which controls the level of the latter, and by the excavation of a channel through the height of land at the south end of Long lake. At this latter point, works for the control of the flow to the south are provided, including a long slide for the passage of timber. These works, in addition to diverting water, also facilitate the transit of forest products to market from an area of over 1,500 sq. mi. To date, over 65,000 cords have been brought over this water route in a single season.

Further west and immediately north of lake Nipigon, work has just been completed on another project, known as the Ogoki diversion. By the construction of a dam on the Ogoki river, which is a large tributary of the Albany river, water now flowing to James bay will be diverted south, through a channel excavated on the height of land between the Albany and Nipigon watersheds, into lake Nipigon. This water can be utilized for the development of

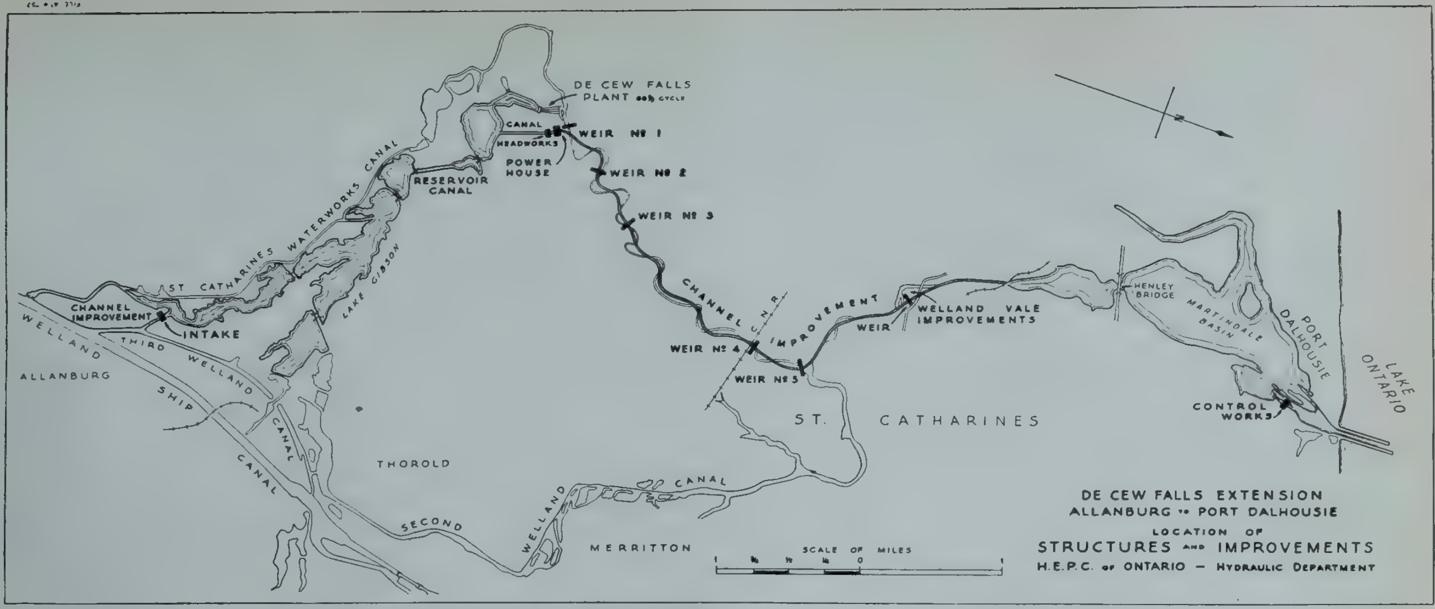



**Fig. 2—General plan showing location of structures and improvements.**

additional power on the Nipigon river, together with the water from Long lake, at Sault Ste. Marie, through the fall between lake Erie and lake Ontario, and on the St. Lawrence river. Work on this project was commenced in December of 1940. One of the interesting problems in connection with this diversion project was the construction of a large dam, containing 35,000 cu. yds. of concrete in the virgin wilderness some 50 mi. north of the nearest railway. Materials were transported over winter roads by means of sleighs and tractors, as much as 11,000 tons of freight being hauled in this manner in a single season.

## General Description of Development

The development now under construction, as shown on the general plan in Fig. 2, is similar to the earlier undertaking in that it draws its water supply from the Welland canal into lake Gibson, and thence to the escarpment of Twelve Mile creek where it enters the penstocks leading to the power house set at the creek level. There are, however, many changes in the component parts. The intake from the Welland Ship canal is located about one-half mile north of the original intake, and instead of drawing directly from the Ship canal, makes use of a portion of the Third Welland canal. The control and measuring structure is designed to give more accurate and convenient measurement of the inflow and, at the same time, to provide economy in operation. Additional excavation is required in the channel joining the southern and northern portions of the head pond (lake Gibson), and the material thus made available has been used to raise the dykes containing this lake on its west boundary.

From the head pond a new head race canal, approximately 2,100 ft. long, has been excavated largely in solid rock, to provide a channel to the edge of the escarpment, where a headworks structure accommodating racks and control gates and transition entrance to the penstock, has been constructed. A penstock 16½ ft. in diameter, located on the sixty-degree slope to which the cliff has been excavated, extends to the power house, which will house one 65,000 hp. vertical unit discharging by a short tailrace into Twelve Mile creek. The channel of this stream, which now carries the flow from the original development, is being materially enlarged over a length of some four miles to carry the additional discharge from the new installation. Rock fill weirs are being constructed at various points along this route, to reduce the amount of excavation required. At Welland Vale and Port Dalhousie, works to control the levels and accommodate the increased flow are nearing completion.

## Intake

To accommodate the increased draft of water from the Welland canal under conditions suitable to navigation, a new channel, connecting the ship canal with lake Gibson, is under construction about one-half mile north of Allanburg.

In the design of this intake, which will also accommodate the water now being drawn through the present intake, use is made of an unfilled portion of the Third Welland canal, which at this point joins the Ship canal at an acute angle. This circumstance makes it possible to secure, at reasonable cost, an outlet from the Ship canal with sufficient area to avoid a side draft which might make navigation difficult for passing vessels. By enlarging this earlier navigation channel, the water is conveyed to within 1,000 ft. of the head pond, from which point a new channel has been excavated. In this latter channel, the intake control works are constructed on sound limestone foundations.

The intake control works consist essentially of a series of piers with supporting wing walls, between which there are six tubes each 7 ft. in diameter. At the downstream end of each tube, an elbow, at 20 deg. with the horizontal, deflects the issuing jet from the channel bottom to reduce the scouring action. Stop-log checks are provided at both upstream and downstream ends of the tubes to permit of unwatering for inspection and maintenance. The function

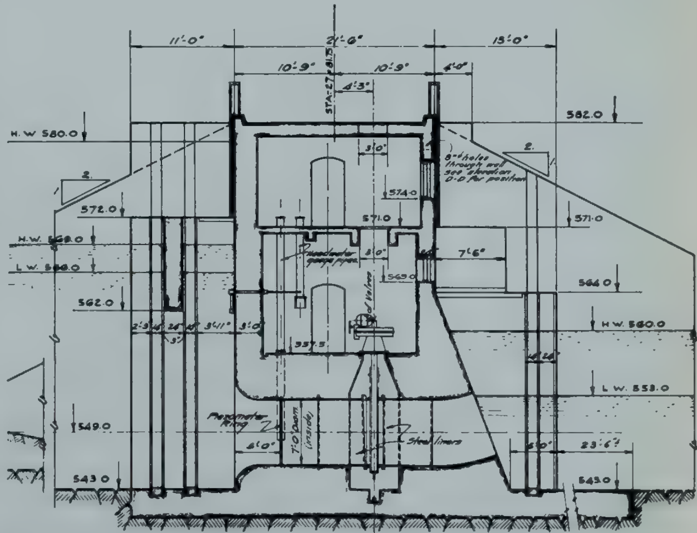



**Fig. 3—Cross-section of intake control structure.**

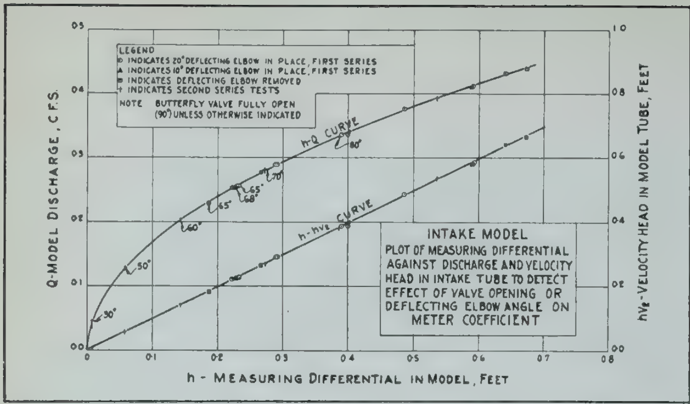



**Fig. 4—Plot of intake model test data, showing measuring differential to be a function of flow only.**

of these tubes is to control and measure the flow drawn from the Welland canal.

Control is secured by means of a butterfly valve located in each tube, while measurement is accomplished by using each tube as a meter. A high pressure tap is connected to the upstream face of the structure and a low pressure tap to the tube upstream from the butterfly valve. The pressure differential between these points is to be used to determine the flow.

As very definite limits are set on the amount of water that may be taken, it is essential that the measuring device be accurate and reliable. To determine the suitability of the tubes for this purpose, to gain a knowledge of overall discharging capacity of the tubes, and to discover the optimum angle of the deflecting elbow, tests were made of a model of the structure.

The scale ratio between prototype and model was 24:1, and one full bay and two half bays were reproduced. The tests thus corresponded to one tube operating with adjacent tubes closed.

To be assured of the suitability of the tubes as a measuring device, it was essential that the pressure differential be a function of the flow only, and unaffected by the position of the butterfly valve or the deflecting elbow. The results obtained confirmed that these requirements were met, as will be shown by reference to Fig. 4.

In order that the plant operators would at all times be cognizant of the amount of water being drawn from the canal, automatic metering is desirable. To simplify this arrangement, a meter coefficient constant over the operating range is necessary, and this condition requires a straight line relation between the measuring differential and the velocity head in the tube. Figure 3 shows this also to be the case. Except at lowest model velocities, the computed meter coefficient was found to be constant at 0.987, including the velocity of approach. In Fig. 5, a curve of Venturi meter coefficients expressed as a function of the Reynolds' numbers is reproduced from "Fluid Meters Reports" of the American Society of Mechanical Engineers. The meters referred to in this report all have a contraction ratio of 2:1, and only the limiting sizes are included. Super-imposed on this curve is the coefficient curve found for the intake model, extrapolated to prototype Reynolds' numbers. Despite the difference in shape between intake tube and a standard 2:1 contraction ratio Venturi meter, a striking similarity may be observed between their respective coefficients. As may be noted from Fig. 5 the prototype will operate at considerably higher Reynolds' numbers than the model, and as the meter coefficient became constant at model test Reynolds numbers, it may safely be predicted that a constant meter coefficient will exist over almost 100 per cent of the prototype flow range. This indicates that the intake tubes should be accurate flow measuring devices.

From tests made on various elbows, it was found that one with an angle of 20 deg. to the horizontal was most satisfactory in producing conditions which would not be conducive to scouring below the intake. Over the greater part of the range of flows, this elbow raised the high velocity jet from the channel bottom to the surface, and produced a slow upstream current on the channel bottom for a distance of about 150 ft. downstream from the intake. With the 20-deg. elbow in place, an overall coefficient of discharge of 0.94 was obtained for the tube. This coefficient appears constant for all headwater and tailwater levels and, from this, the overall discharge capacity of the tubes could be calculated, and the area to be provided in the intake determined. The model was operated so that similar Froude numbers existed between the model and prototype for corresponding flows. As the coefficient of discharge of the tubes, and the relative water levels above and below the intake, are functions of the Froude number, close similarity of results may be expected between the model and the prototype.

### Head Pond

Lake Gibson, into which the intake canal empties, forms the head pond of the development, and consists of two main pools connected by an excavated channel. It is contained on its western limits by earth dykes, and on the east by the natural ground contours. The channel connecting the two portions of the lake is being enlarged to pass the increased quantity of water required for the operation of the existing and new installations. The earth removed from this channel was used to raise the dykes to provide for higher water levels at some future date.

The storage provided by Lake Gibson is an outstanding feature of this site. It offers the pondage necessary to maintain operation at variable loads to conform with the load factor of the demand on the plant and, in combination with other power sources at greater than system load factors, will provide additional firm capacity.

The ultimate installed capacity of the site will probably range from 185,000 to 200,000 h.p. The present installed capacity is 52,000 hp. of 66⅔ cycle and construction plans provide for the installation of one 65,000 hp. 25-cycle unit, with certain elements being constructed to accommodate a further unit of similar capacity. As all the water available can be utilized by the present plant and the new unit, with the latter operating at high load factor, the existing

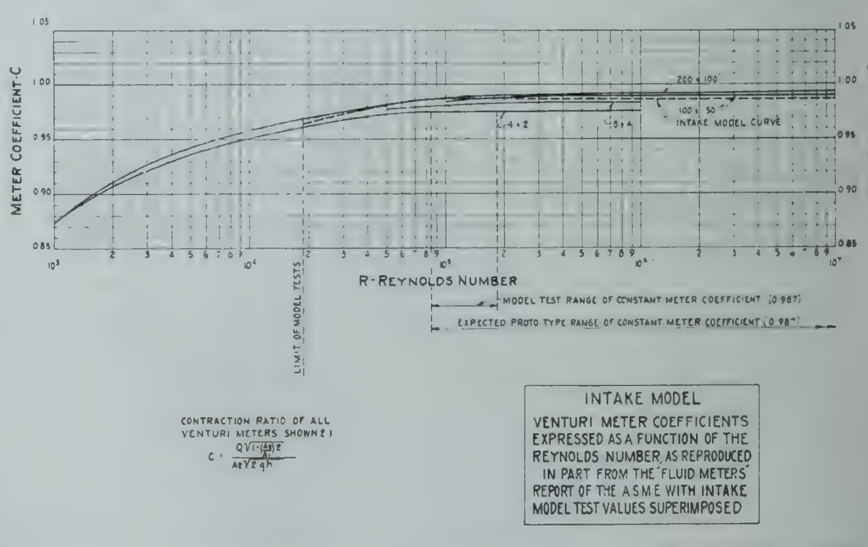



**Fig. 5—Comparison of intake meter coefficient, as determined by model tests, with standard Venturi coefficients.**

water level in the head pond provides sufficient pondage. With the installation of further generating capacity, however, and consequent operation of the plant at lower load factors, greater pondage will be required and it is to provide for these future requirements that the dykes are being raised.

### Headrace Canal and Gate House

From the downstream or northern end of lake Gibson, and to the east of the present gate house, a new headrace canal, 2,100 ft. long and 40 ft. wide, is being excavated in limestone to convey the water to the edge of the escarpment. The construction of this channel involves the removal of some 75,000 cu. yds. of earth and 85,000 cu. yds. of rock, to provide a normal depth of water of 28 ft. This waterway is of sufficient area to carry the flow for two 65,000 hp. units.

At the downstream end of this canal, and near the edge of the escarpment, a concrete structure containing the racks and control gates is now being erected. This structure is designed to provide transition from the canal to the penstock extending down the cliff face to the power house. The deck of this headworks and the retaining walls adjoining it are carried to an elevation sufficient to provide for abnormal water levels due to surges in the headrace canal resulting from the sudden shut-down of the generating units. The headworks is also constructed to provide for the installation of an additional unit, and should it be necessary to install a third unit, provision has been made for the excavation of more rock without injury to the structure now being built.

To protect against leakage from the canal between the various rock strata, the area along the cliff for some 300 ft. each side of the gate house is being pressure grouted with holes varying in depth from 10 to 150 ft. Grouting is also being carried out along the headrace canal in the vicinity of St. Catharines waterworks tunnel, over which the canal passes.

### Penstock, Power House and Equipment

The penstock connecting the headworks and the turbine casing is of rivetted construction throughout and has a diameter of 16½ ft. down to the lower elbow, which tapers to 13½ ft. in diameter. It is designed to withstand the static head plus pressure rise due to closure of the turbine gates. Constructed in a slot excavated in the rock cliff, it will be enclosed in a concrete envelope having a minimum thickness of 18 in.

Investigation of foundation conditions showed that rock was about 90 ft. below the ground surface in the vicinity of the 66⅔ cycle plant, which is located on the bank of Twelve Mile creek. To secure a rock support for the new installation, considered advisable in view of the loads to

**Fig. 6—Photograph of headworks nearing completion.**

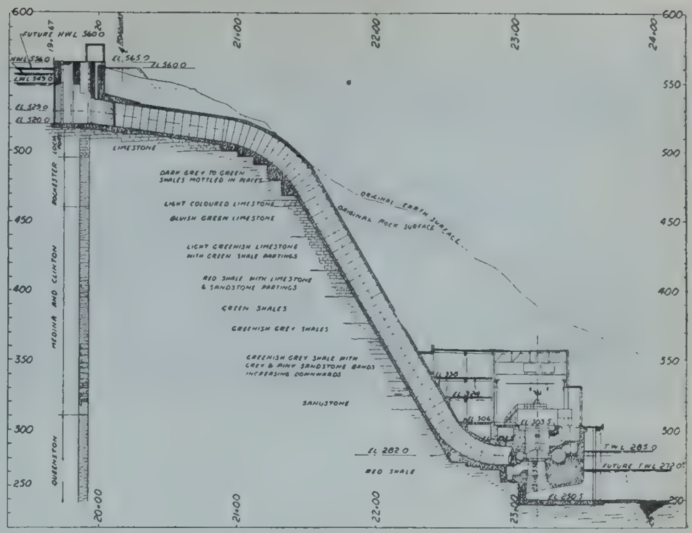


**Fig. 7—Cross-section of headworks.**

be sustained, it was necessary to place the power house in the escarpment some 300 ft. from the present water's edge.

The power house substructure is of reinforced concrete and, in addition to supporting and housing the generating equipment, will provide the water passages to and from the turbine and the necessary erection and storage space, as well as the passages for air supply to the generator. The superstructure is being faced with cut stone, and will be of windowless design. It provides support for a crane of 280-ton capacity for the handling of the equipment including the transformers. The latter are located in an outdoor station but are so arranged that they may be brought into the power house erection bay for maintenance and repairs.

Transferred from the Commission's Abitibi Canyon development, the unit now being installed at DeCew will have a capacity of 65,000 hp. when operating under the available head of 265 ft.

This unit is a Canadian Allis-Chalmers vertical shaft type, the turbine runner being of a Francis design, set in a steel plate scroll case and is controlled by an Allis-Chalmers oil pressure governor. It is directly connected to a Canadian General Electric generator with a rated capacity of 48,500 kv-a. at 13,800 volts.

When operating under the head of 237 ft. available at Abitibi Canyon, this unit had a rating of 65,000 hp., and the turbine capacity under the higher head at DeCew Falls would materially exceed this amount. The output, however, is limited to 65,000 hp. to conform with the generator capacity. With this limitation on capacity, the turbine will not operate over its full range. Operating under these conditions, it was thought, might seriously affect the operating efficiency.

However, tests made when the unit was in operation at Abitibi Canyon showed how this unit would perform at variable speeds, above and below the normal of 150 revolutions per minute and with constant head. With this information it was possible to determine how it would function under the conditions prevailing at DeCew.

Figure 9 shows expected turbine efficiency for heads of 237 ft. (original installation), 265 ft. (DeCew Falls), and 285 ft. From this curve, it will be seen that a high efficiency will obtain over a considerable range and, since the unit is to be operated at a high load factor and seldom at low loads, good operating results should be secured. When further units are added at DeCew Falls to provide for operation of the plant at low load factors and when operation at part load may be expected, a new runner, designed to suit the existing head, can be installed.

To provide emergency discharge capacity from the head pond into the tailrace, a nozzle has been provided on the steel plate turbine casing having a discharging capacity of

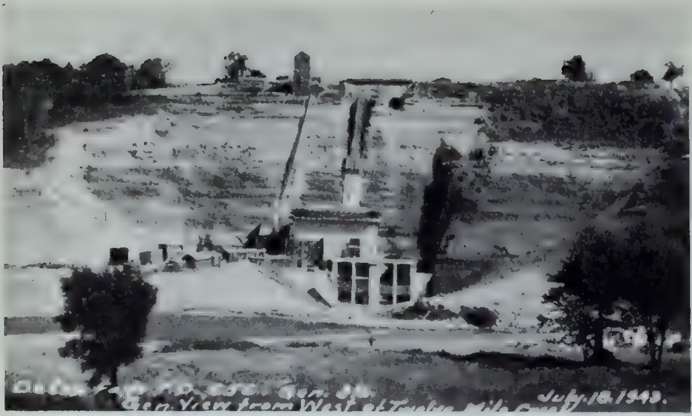


**Fig. 8—Photograph of penstock and power house.**

2,000 cu. ft. per sec. This nozzle is being equipped with a Howell-Bunger disperser valve which will dissipate the energy in the issuing jet and thus prevent damage to the tailrace slopes.

In constructing the substructure for the present installation, a considerable amount of excavation for an additional unit was carried out. This included not only excavation for the power house substructure, but also the cliff excavation other than the slot for the future penstock. The downstream portion of the draft tube for an additional unit was also constructed, so that the excavation and concrete work for this further installation may be carried out without the necessity of constructing a cofferdam.

### Tailrace

From the draft tube, the discharge from the turbine flows by way of Twelve Mile creek for three miles to its junction with the disused Second Welland canal in the city of St. Catharines and then follows this waterway to Martindale pond, whence it passes through the outlet works to Port Dalhousie harbour, and Lake Ontario.

A short tailrace, excavated in earth, extends from the power house to join Twelve Mile creek. This stream now carries the flow from the existing 66⅔-cycle plant, and is being enlarged to carry the additional flow from the new installation at non-eroding velocities. As will be seen by reference to the plan, Twelve Mile creek follows a tortuous channel in the bottom of a valley of considerable width. The additional carrying capacity is provided, in most part, by the excavation of a new channel of more direct alignment, cutting across loops of the present channel. To reduce the amount of excavation required, the combined capacity of the old and new channels was assumed to be available. In calculating the area required, the flow through the respective channels was determined by trial and error to give equal water levels at each point of the intersection.

Of the 39 ft. of fall from the tailrace level at the power house to Lake Ontario, some 17 ft. occurs between the power house and Welland Vale, which point is located about one mile below the junction of Twelve Mile creek and the Second Welland canal. Provision for the recovery of a considerable portion of this head has been made by setting the unit low enough to provide for sealing of the draft tube at lower tailwater levels. It was decided that the excavation in Twelve Mile creek necessary to secure this additional head be postponed until a later date and only a minimum be done at this time. To this end, a series of four rock-filled weirs was constructed between Welland Vale and the power house, thereby maintaining a series of pools with successively higher levels. Below the level of each pool the effective cross-sectional area of the channel can be calculated, and the amount of excavation reduced accordingly.

The difference in level above and below these weirs will be a maximum of some 3½ ft. for full load flow but, under conditions that would exist following the operation of the plants after a shut-down, this differential head would be considerably greater. As only a meagre amount of data on the design of such weirs was found, tests of model weirs were made to determine: the discharge coefficient (including overflow and leakage); the size of stone to be used in the weir; and the shape of the weir.

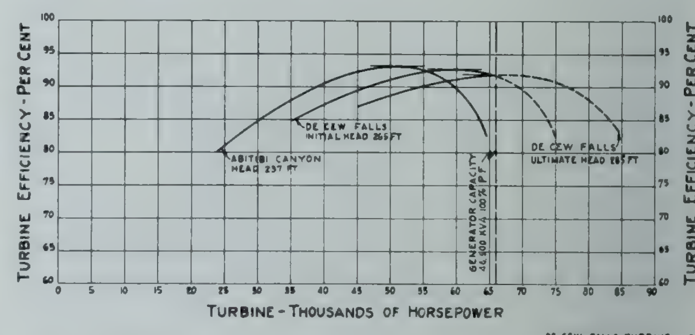



**Fig. 9—Turbine efficiency at various heads and constant speed.**

It was desirable in these tests to have as large a model as possible, in order to minimize scale effects. This was accomplished by reproducing only a portion of the weir length, and resulted in a scale ratio of 20:1. The rock grading was obtained by sieving, and the rock shape was generally rectangular, which was believed to resemble the shape of the rock in the prototype. It was anticipated that the weirs would be constructed, for the most part, by dropping the stones into the flowing water coming from the present 66⅔-cycle plant. In the initial tests, construction of the weirs was attempted by dumping the rocks into the flume under flow conditions corresponding to those which will exist when prototype construction is undertaken; also for flow conditions with the new installation in operation. In these cases, the action of the flowing water formed the weir shape, and the dumping of rock was continued until the required head

**Fig. 10—Photographs of enlarged channel in Twelve Mile creek. Original channel at left, disposal area at right.**

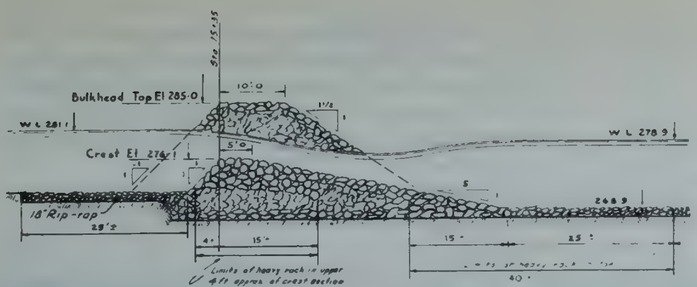
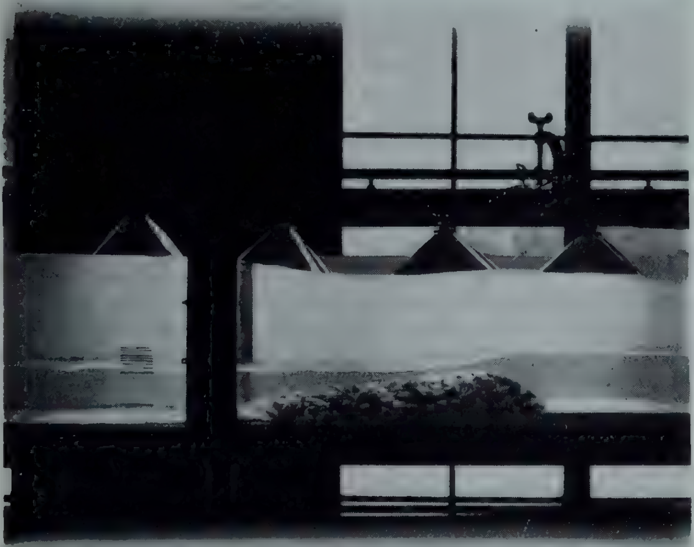



**Fig. 11—Typical cross-section of rock-fill weirs.**

drop across the weir was obtained. This experiment showed, however, that while rock-filled weirs may be constructed in this manner, the resulting weir section proved unstable if subsequent to their construction a more severe condition is produced, either by an increase in flow or a lowering of the tailwater. The most critical factor influencing the stability of the weir was found to be the downstream slope, while the rock sizes, within limits, appear to have a lesser effect. From the experiments, a design for the tailrace weirs was developed which proved stable under all expected flow and velocity conditions. This design consisted of a weir with an arbitrarily chosen 1:1 upstream slope, a top width of 5 ft. and a 5:1 downstream slope. The tests indicated that a prototype rock diameter of about 2 ft. would prove satisfactory. Figure 12 shows a photograph of a model constructed on these lines, with a flow corresponding to 4,500 cu. ft. per second equivalent to the full operation of the 66⅔-cycle plant and the unit now being installed under head and tailwater levels to be expected for continuous operation. Figure 13 shows the same weir discharging the same flow under minimum tailwater conditions, such as might exist when operation of the plants was resumed following a complete shut-down, and represents the most severe test with respect to stability.

**Fig. 12—Model of rock-fill tailrace weir discharging maximum operating flow at normal water levels.**



All the excavation for the tailrace channel was in earth, and was accomplished, for the major part, by an electrically operated suction dredge, and to a lesser amount by draglines. Suitable disposal areas were constructed at various points along the route. At two points in this portion of the work, the presence of bridges interfered with the excavation of a channel of sufficient area to avoid erosion, and at these points paving was placed to protect the bottom of the slopes against the higher velocity. From the junction with the Second Welland canal to Welland Vale, the work consists of the enlargement of the present channel, paving being resorted to in the area around Burgoyne bridge, where this structure again interfered with the provision of a channel of larger area. The excavation in this portion is being carried out entirely by suction dredge, with the exception of the trimming of the slopes, for which purpose draglines are being utilized.

### Welland Vale Weir

At Welland Vale, which was the site of No. 2 lock of the Second Welland canal, there is a drop of 8 ft., the discharge being by-passed around the old lock structure through waste weirs. As topographical and other conditions did not permit of the enlargement of the waste weir channel, a design was adopted whereby an enlarged channel should be continued through the location of the old lock, the water level upstream being maintained at its present elevation by means of a timber crib weir. By reason of the by-passing of the present flow through the waste weir channel, it was possible to entirely unwater the site of the weir and excavation in this area. Since unwatering would not be possible in the future, the channel and works were constructed to provide for the ultimate installation at the power house. The works constructed here consist of the excavation of a channel in earth and shale, the construction of the weir mentioned above with concrete wing walls adjacent to the weir in the areas where high velocity will exist, the replacement of a highway bridge crossing the old lock, and the relocation of the roadway leading thereto. The weir was so designed that, when further units are added, the crest may be adjusted to provide for the increased flow. As the bottom of the channel in this area was shale, it was necessary to protect this relatively soft rock against erosion from the overfalling sheet of water. The banks up-

**Fig. 13—Model of rock-fill tailrace weir discharging maximum flow at minimum tailwater level, (most severe conditions for stability).**

**Fig. 14—Photograph of completed rock-fill weir with discharge from present 66⅔ cycle plant.**

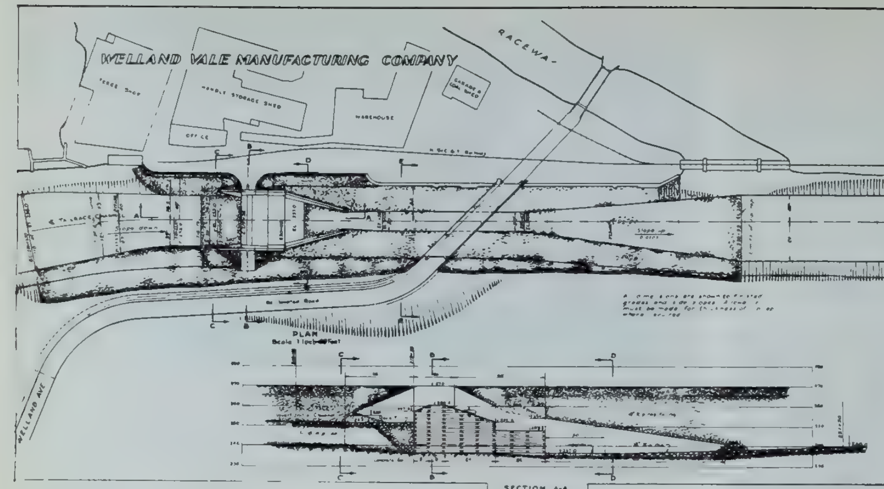



**Fig. 15—Plan of Welland Vale weir and channel.**

stream from the weir are only slightly above the regulated water level, so that the accurate prediction of the weir performance was essential. Confirming model tests of the weir were made which indicated the design chosen to be satisfactory after minor alterations were effected.

From Welland Vale to Martindale pond, a distance of one and one-half miles, enlargement of the channel to accommodate the increased flows will be made by suction dredge with suitable riprap protection under the Niagara, St. Catharines and Toronto Railway bridge, where the available area is again somewhat restricted.

### Port Dalhousie Outlet Works

Martindale pond, which has an area of 425 acres, is located immediately above Port Dalhousie harbour. It has a water elevation about 12 ft. above lake Ontario level, access being obtained through lock No. 1 of the Third Welland canal, the only portion of this waterway now serving as a navigation channel.

The water level in Martindale pond, as required for navigation, is maintained by spillways emptying into the harbour basin. To provide the additional outlet works necessitated by the increased flow, a new channel with regulating works is being constructed immediately east of the navigation channel and lock. This new waterway is designed to handle the additional flow resulting from the ultimate installation at DeCew falls, but only sufficient gates are being provided at present to handle the discharge from the unit being installed.

The channel itself is 700 ft. in length, and has sufficient area to carry the increase in flow at non-eroding velocities, except in the vicinity of the regulating works where the velocities are materially increased and the surfaces are protected by concrete and rock paving. The lower end of the channel is arranged to reduce the velocities and allow the water to enter the harbour under conditions suitable for traffic through the existing lock.

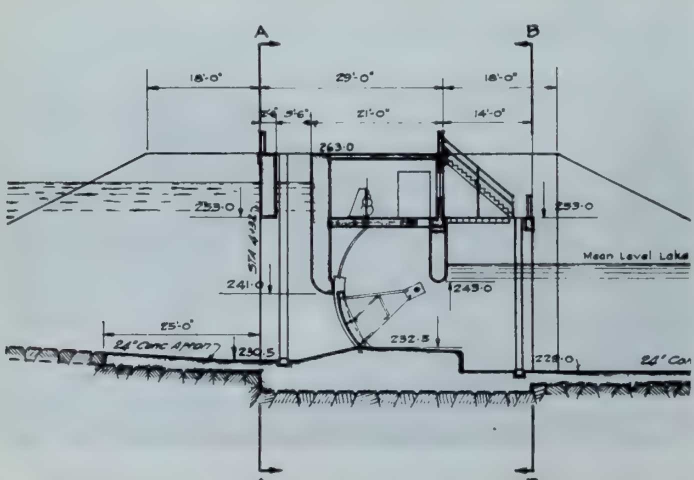



**Fig. 16—Cross-section of Port Dalhousie outlet works.**

The regulating works provide four submerged sluiceways controlled by Taintor gates between concrete piers, with supporting gravity wing walls at each side of the channel. These structures are all founded on shale of good bearing value. Two of these sluiceways are now being equipped with gates, while the remaining two will be closed until further additions to the plant and other modifications require their use.

Owing to the wide variations in flow to be expected when the DeCew falls station is operated as a peak load plant, water controlling equipment which could be operated easily and quickly was required, and gates rather than conventional stop logs were decided upon.

The water level above the regulating works, i.e., Martindale pond level, varies from elevation 258 to elevation 259.5, while the water below these works is at lake Ontario level, which varies from elevation 244 to 249.

To determine the discharge capacity of the sluices and also to observe the operating conditions, particularly as to erosion downstream, a model on a scale of 34:1 was made and tested. The model embraced two sluiceways equipped with gates and two half sluices closed.

Among the interesting and informative results of these tests was the behaviour of the sluices under large gate openings and low tailwater conditions. With these conditions, and despite the fact that the tailwater level was always above the top of the gate opening, there was apparently sufficient energy in the issuing jet to sweep the tailwater to the end of the passageway between the piers, where a hydraulic jump occurred to tailwater level. Under these conditions, the tailwater had no effect on the discharge, which depended only on the difference from headwater to centre line of the orifice. For smaller gate openings the discharge head was found to be the difference between the headwater and tailwater levels.

Between the conditions of complete submergence at small gate openings, and the free discharge condition at large gate openings and low tailwater levels, a transition between the results mentioned above existed. In this range, unstable flow resulted and the hydraulic jump formed in the passageway between the piers, causing considerable disturbance in the tailwater and pulsation in the headwater.

**Fig. 17—Surge in tailwater accompanying unstable flow condition in original model of Port Dalhousie outlet works.**

In the model under test, the floor of the sluice sloped downstream from the gate sill and, by trial, it was found that making the floor horizontal for a distance of 16 ft. downstream from the gate sill, with a vertical step at this point, considerably improved conditions. With this revision, it was found that: for wide open gate, free discharge and stable conditions existed for all tailwater levels, the elevation of the tailwater having no effect on the discharge; the range of discharge during which the hydraulic jump formed

**Fig. 18—Improvement in Port Dalhousie outlet works model effected by sill modification. High velocity region may be noted near surface.**

in the passageway was considerably narrowed with corresponding reduction in range where unstable flow was to be expected; and a slow back flow was induced on the floor downstream from the structure, thus protecting the channel bottom against erosion.

While these modifications did not entirely correct the objectionable surgings found in the original design, it materially reduced the range in which they occurred and resulted in stable flows at the great majority of gate positions and tailwater levels.

Figure 17 shows the conditions of unstable flow with the surging as found in the original model, while Fig. 18 shows the improvement effected by the sill modification. The high velocity region may be noted in the vicinity of the surface. In Fig. 19 is illustrated the quiet conditions at about one-third gate opening.

It is expected that the flow through the structure and the discharge predicted by the model will be essentially accurate when transferred to prototype dimensions. While the disturbance observed in the tailwater in the model will undoubtedly occur in the prototype, its effects may not be as severe, due to the full size channel being less suitable for wave propagation than in the model.

All of the investigations by models, herein described, were carried out in the Hydraulic Laboratory of the University of Toronto, and the writer wishes to tender thanks to the University and, in particular, to Professor R. W. Angus, M.E.I.C., for this privilege. The investigations were devised and directed by Mr. J. J. Traill, M.E.I.C., the work in the laboratory being conducted by Mr. J. B. Bryce, Jr.E.I.C., and Professor G. Ross Lord, M.E.I.C.

The design and construction of the hydraulic portion of the works were carried out under J. R. Montague, M.E.I.C., assistant hydraulic engineer, and S. W. B. Black, M.E.I.C., designing engineer, with Walter Jackson, M.E.I.C., as resident field engineer. The electrical portion was under the direction of A. H. Hull, M.E.I.C., electrical engineer. The major part of the work was constructed by the Commission's forces under David Forgan, M.E.I.C., construction engineer, and G. Mitchell, M.E.I.C., assistant, with J. N. Stanley, M.E.I.C., and A. A. Richardson as superintendents.

The Sterling Construction Company are contractors for the intake works, and the enlargement of the tailrace in

**Fig. 19—Quiet, fully submerged conditions at small gate openings, Port Dalhousie model.**

Twelve Mile creek and in the Second Welland canal is being carried out by the Canadian Dredge and Dock Company, while the Ontario Construction Company are constructing the outlet works at Port Dalhousie.

The major quantities of materials involved are as follows:

| | |
|---|---|
| Earth excavation | 1,767,000 cu. yds. |
| Rock excavation | 333,000 " |
| Rock fill and riprap | 76,000 " |
| Concrete | 44,000 " |
| Reinforcing steel | 860 tons |
| Structural steel | 1,190 " |

From this tabulation it will be seen that the undertaking is not of exceptional magnitude, but does include, it is believed, a greater variety of problems than are usually encountered on works of similar size.

# Speed the Victory

# CANADIAN SURVEYS AND MAPS IN PEACE AND IN WAR

F. H. PETERS, M.E.I.C.
*Surveyor-General of Canada, Ottawa, Ont.*

**Paper presented before the Joint Meeting of The Engineering Institute of Canada and the American Society of Civil Engineers, at Niagara Falls, Ont., Thursday, October 15th, 1942**

A very early map indicating with some clarity what is now Canada was produced by Sebastian Cabot and dated 1544. From that time onward the territory of Canada has been progressively depicted by discoverers, explorers, surveyors, geologists and trained topographers and hydrographers.

The first legal survey in Canada was made in the province of Quebec in the year 1626, by no less a personage than the first Governor and Founder of New France, the illustrious Samuel de Champlain. The earliest organized and accurate map was that of Admiral Samuel Holland, who commenced the survey and map of Prince Edward Island in 1764; at this time a general survey of British North America was ordered and he was appointed as "Surveyor General for making a correct survey of the Northern District upon the Continent of America."

Generally speaking, the early maps of eastern Canada from the time of its settlement until the Confederation in 1867 were compiled either officially or privately, from the plans of legal surveys made for grants of land for settlement or for timber berths. Outside the perimeter of these, the information of explorers, who usually followed river courses, was used to extend the maps, but there were many blank spaces.

While these interior surveys were going on, the exterior limits were being charted with considerable accuracy by the British Admiralty. The Admiralty charts of the Arctic regions from 1576 onwards bear references to many well known hydrographers—Cook, Back, Franklin, Gordon, Kellett, Parry and Richards. The set of charts eventually covering all of Canada's Atlantic seaboard, was commenced in the St. Lawrence waters in 1760.

The history of those vast areas west of the Great Lakes is somewhat different, because prior to the construction of the Canadian Pacific Railway in 1885 there was no considerable settlement and no need for extended legal surveys. The maps of this great interior area were largely compiled from information gained by the Hudson's Bay Company and its progenitors and early rivals.

In 1791, Captain Vancouver was sent by the British Government to take over from the Spanish the territory along the Pacific Ocean. He immediately began a survey of the coast and charted the coastline of Vancouver island and the mainland from Juan de Fuca strait to Latitude 60 deg. The gold rush into the Cariboo district in 1858 caused a considerable penetration up the Fraser river into the interior valleys.

### Early Instruments

As regards equipment it may be said that up to 1850 the survey compass was in vogue, and with the uncontrollable and inconsistent deviation of the magnetic needle, that type of survey left much to be desired on the grounds of accuracy. By 1867 the field transit theodolite was coming into its own, and since then there has been little radical change in ground survey instruments, save perhaps in the measurement of distance by the stadia and the rangefinder, which have, in general, displaced the earlier micrometers. The link measuring chain gave satisfactory results for ordinary field measurements, and the steel band or tape was not unknown, although it has since been improved in the constancy of its coefficient of thermal expansion by the introduction of Invar metal which has practically none. Accurate time signals now obtained by radio reception have made it unnecessary to carry chronometers long distances into the wilds.

The preceding résumé gives some historical background and an indication of the mapping situation at Confederation in 1867. At this time Canada—the third largest country in the world—had a population of 3,463,000, for the most part concentrated in the Maritimes and southern Quebec and Ontario, with the terminus of transportation within its own territory westward at Port Arthur on the westerly side of Lake Superior. The colony on the Pacific coast was reached by passage around Cape Horn.

The marked disparity which then existed—and still exists—between the small population and the great area of the country has had its effect upon the provision of surveys and maps. To map great areas adequately costs money, which it is difficult to procure from a small population of taxpayers. Thus in Canada, as in most democratic countries, mapping appropriations have been somewhat meagre. As a result those directing the surveys and maps have seen to it that all their moneys were carefully expended. Moreover, they have been active in developing technical methods of the greatest speed and economy for example, the ground survey camera used in mapping the western Cordilleras, the satisfactory contouring of the Sectional Maps of the western Prairies with aneroid barometers and the early development of the method of oblique air photography for mapping the comparatively smooth terrain of the northern areas.

### Meridian and Base-line Control

The year 1870 saw the beginning of the first large accurate survey, when the Dominion Land Survey was commenced in western Canada. The organized control by meridian and baseline was scientifically preplanned, with the benefit of all the experience which had been gained on earlier and similar work in the United States. The accuracy of the execution of the survey on the ground was far in advance of anything done before. Eventually it covered all the southern half of Manitoba, Saskatchewan and Alberta and a small portion of British Columbia. Serving as it did later on for mapping control it has produced the finest example extant of a perfect connection between the topographical map and the cadastre. It is important that there should always be an intimate connection between the cadastre or legal survey and the topographical map, so as to ensure an accurate relationship between the topographical features on the ground and the legal boundary lines according to which the title to land ownership is fixed.

Ground photographic surveying was commenced in 1886 and in reference to it we quote its introducer, the late Dr. Deville:

"When the surveys of Dominion Lands were extended to the Rocky Mountains region, it was found that the methods hitherto employed were inadequate. The operations in the prairies consisted merely in defining the boundaries of the townships and sections; these lines form a network over the land by means of which the topographical features, always scarce in the prairies, are sufficiently well determined for general purposes.

"In passing to the mountains, the conditions are entirely different; the topographical features are well marked and numerous, and the survey of the section lines is always difficult, often impossible and in most cases useless. The proper administration of the country required a tolerably accurate map: means had to be found of executing it rapidly and at a moderate cost.

"The ordinary methods of topographical surveying were too slow and expensive for the purpose; rapid surveys based on a triangulation and on sketches were tried and proved ineffectual, then photography was resorted to and the results have been all that could be desired."

This type of photographic survey is noteworthy because nowhere else has it been carried on to so great an extent or so successfully. Furthermore its undertaking was the reason why there were in Canada a number of surveyors with a knowledge of the science and practice of photographic surveying and this fortunate circumstance prepared the way after the last Great War for an early understanding of the possibilities of mapping with the air survey camera and for practical solutions of the many new technical problems which were then introduced.

The Sectional Map Series was commenced in 1891 as an office compilation from the returns of the Dominion Land surveys, but lacking contours these maps scarcely met the requisites of a true topographic map. In 1919 began the revision of these sheets by field surveys for obtaining the contours and other details to produce complete topographic maps. In this undertaking a new method was employed, namely, the use of batteries of aneroid barometers for obtaining elevations between spirit level controls. A standardized technique for their employment in the field produced a degree of accuracy never before attained by the use of aneroids.

### Important Part Played by Geological Survey

The Geological Survey, born in 1842, has played a very important part in the exploration, survey and mapping of Canada, but to properly understand the nature of the work done, it must be noted that this survey was regarded only as a means to an end. Its object was to conduct geological studies and present the results in the form of geological maps and reports; maps were made where geological information was required; and the map was designed mainly to facilitate the showing of geology on it. Up to about 1894 the mapping in the west and northwest was in the nature of exploratory and reconnaissance surveys, but in this year regular sheet mapping on the scale of one mile to one inch was undertaken.

About the year 1900 there was felt to be a need for geodetic control across the country, and definitely by the military and generally by civilian organizations, there was expressed the desire for accurate one-mile topographic maps of the well settled districts. The movement was supported by the Canadian Society of Civil Engineers and discussed at meetings of the Royal Society. As a result, during the next two decades, and particularly the first, notable progress was made.

In 1903 the Chief Geographer issued the first sheet of the Standard Geographic Series, and up to 1933, when the maps were discontinued, the series had been extended to cover the southerly part of Ontario and Quebec, the Maritimes and a portion of southern Alberta and British Columbia. These maps produced nothing new in the way of survey because they were compiled in the office from existing information and without contours. Issued at two scales—3.95 and 7.89 miles to the inch—they are interesting because for about 25 years they were the best maps available of the areas they covered.

In 1904 the Geographical Section, Department of National Defence, had its commencement. Its survey was designed for a sustained effort in purely mapping work to produce standard 1-mile-to-1-inch topographic maps in keeping with the best practice of the day. The sheet areas were prearranged with boundaries fixed by graticule lines so that eventually all would fit accurately together without gap or overlap. Originating as a plane-table survey to the standards of the Ordnance Survey of Great Britain, this survey now utilizes all the betterments that flow from the use of air photographs. Apart from servicing certain special needs of the Defence Department the work has been, for the most part, concentrated in the more densely settled portions of Ontario and Quebec.

**R.C.A.F. photographic detachment at Yellowknife, Northwest Territories.**

In the same year of 1904 the British Admiralty requested Canada, along with other self-governing dominions to conduct hydrographic surveys on their own coasts. As a result the Canadian Hydrographic Survey, whose earliest work was on the Great Lakes in 1883, was recognized by the appointment of the first Chief Hydrographic Surveyor. The accurate charts produced by this Service have been developed, particularly further north, far in advance of any accurate land surveys and consequently, perhaps more in a geographical sense than topographical, they have been an important contribution to the complete mapping of the Dominion.

In 1905 the Geodetic Survey was established and commenced the much needed work of extending precise horizontal and vertical control over the country; the high standard and the methods of this work have been the same as those of the United States Coast and Geodetic Survey.

The Geological Survey in 1906 adopted the use of the plane-table for mapping surveys and in 1908 a topographical division was instituted, staffed by topographers as distinguished from geologists.

The terrain of the province of British Columbia is largely mountainous, interspaced with fertile valleys and consequently, for purposes of development and administration, the value of the topographic map is at a maximum. In 1915 this province commenced work on photo-topography with its own organization and is to-day the only province maintaining a sizeable unit which performs purely mapping work.

### Air Mapping

The lines along which air mapping has developed since 1918 have differed in various regions. In Europe with its dense settlement and the boundaries of land holdings usually well marked by roads, fences, hedges, drainage ditches and the like, the need was for very accurate maps with a large scale and small contour intervals. Vertical photographs, wire favoured glass was used instead of film, and very complicated and expensive machines were designed for plotting the results. At first, people in the United States were somewhat cold towards this new development, but in Canada two main reasons led to the pioneering of air mapping. Firstly, many activities, particularly prospecting for precious metals, were stretching out far beyond the railways and there was a growing demand for accurate maps which could not be met because the difficulties of ground transportation and the blindfolding effect of the bush when surveying on the ground made the cost of mapping these undeveloped areas prohibitive. Secondly there were a considerable number of surveyors trained in the use of the survey camera and with a knowledge of its possibilities; they knew what the camera could do when set up high in the air on a

**Equipment for obtaining astronomic observations; radio set on the left; prismatic astrolabe at right centre on stool.**

mountain peak and they realised what the survey camera could do if flown over the vast areas which hitherto had been economically inaccessible.

This new development was taken up by the Topographical Survey Branch, which originated as the Dominion Land Surveys office and had introduced the ground photo-topographic survey as previously described. Much credit is due to the old Air Board of Canada for fostering the work in its early stages. Up to the outbreak of war towards the close of 1939 the actual flying and photographing was undertaken by the Royal Canadian Air Force.

In 1921, 280 square miles were photographed as a commencement and from 1924 on, something in the order of 50,000 square miles were photographed each year, utilizing both the oblique and the vertical method, with the former preponderating. Much of the area covered was far beyond the limits of geodetic control or indeed any accurate ground survey control. Ground control is of course a necessity for plotting air photos and this was provided by astronomic observation, the observers with the lightest suitable instrumental equipment being transported by aircraft. The British Admiralty pattern astrolabe was experimented with and a special light pattern was finally found most suitable and adopted for this work.

No paper on the subject under discussion would be complete without reference to the National Topographic Map Series established by the Topographical Survey Branch in 1924. This series is based on a modern conformal projection which suits the extent of Canada's domain. The paper sheets are of standard size 24 by 30 in. The scales used are one, two, four, eight and sixteen miles to the inch. The conventional signs and style are similar to the British Ordnance Survey maps. The index showing where each sheet will fit in covers the whole of Canada.

### Base Maps

It is hardly necessary to name the many benefits arising from the establishment of a basic system of map sheets covering the whole country. In the absence of such a system, map users, when they need maps of certain districts, are obliged to study a number of catalogues or indexes and when they receive the maps, are in trouble because they are at different scales, drawn to different standards and of different sizes.

It is not always easy to adhere to single organized system of base maps. In Canada the difficulty has been this. The development of the country has not been like the orderly and business-like development of a valuable estate. On the contrary development has occurred anywhere that pioneers and prospectors have chosen to go in searching for valuable natural resources. When the demand comes for a map it is evident that with meagre financial appropriations the strong tendency, if not necessity, is to lay down the map boundaries in any direction, adopt some special scale, and do what is necessary in order to meet this exigency here and that one there. The inevitable result is that many maps are produced with gaps and overlaps and the situation is unsatisfactory.

A set of accurate base maps is essential as the corner stone in the production of a national topographic series in any modern and progressive country. Such a series starts with an organized system of map sheets, each with its position on the ground predetermined so that as the maps are completed there are no gaps and no overlaps; the scale and design of all sheets is standardized. The accurate base topographic map is made showing all natural features and those made by man if there be any. Supposing the next year a forestry investigation is initiated. The same base map is used but the colours and conventional signs are added to illustrate the forestry data. Perhaps the following year a geological survey is undertaken. The same base map is used but new colours and conventional signs are added to show the geology. And similarly with other studies and investigations, which may be made from time to time, the new information is always added on a copy of the same base map. All these sheets are conveniently filed away in the same drawer or other container, because they are all the same size. As time goes on the data become more complete. At any time the drawer may be opened and all the information regarding that particular area is available. And if the forest area or the geological structure extends off the sheet, open the next drawer and there you have it.

And mark the advantages for a country like Canada with so much ground to cover, and so little money to do it with. It is economical. One base map serves all purposes and avoids the expense of drawing a new map each time for the forester, the geologist, and so on. In time of war when the nation may be in peril of invasion and maps or air charts are needed in a hurry it is no exaggeration to say that the accurate base map is a godsend.

### Air Charts

When, in recent years, the need arose for air charts in addition to ground maps, a start was made with a few strip charts of commercial routes but it was obvious from the first, because of the great ability of the aeroplane to cover distance, that the eventual requirement would be for area charts and many of them. There was a strong demand for an entirely new series of air charts designed exclusively from the air point of view, but with appropriations insufficient for any rapid expansion of even one series of base maps it seemed impossible to undertake a new and separate series of air charts. This need for economy, which it may be said often leads to good results, was met by extending the policy of one base map to meet all requirements. The base ground map at the eight mile scale was revamped in certain ways and a special red overprint was used to show all necessary air information. In actual service as air navigation charts the sheets have been found satisfactory. When war was declared in 1939 the first air charts covering the route of the "Trans-Canada Airways" were just about completed.

### Mapping for War

There is a great difference between the last Great War and the present one, in which it is difficult to hold command of the oceans; and modern aircraft, with trans-oceanic range, make our continent vulnerable. Western hemisphere defence is now a very real thing. In modern warfare nautical charts, topographical maps and air charts are all definite and necessary implements of war. Bearing this in mind it is easy to sketch the situation in Canada in 1939. We have an area reckoned at 3,695,000 sq. mi.—covering 48 deg. of latitude and 84 deg. of longitude—of which about 17 per cent had been accurately mapped, 16 per cent mapped with a fair amount of detail and 67 per cent mapped from meagre information. The necessities of war will not wait. The maps and charts that are required must be produced quickly and, compared to peace times, in large quantities.

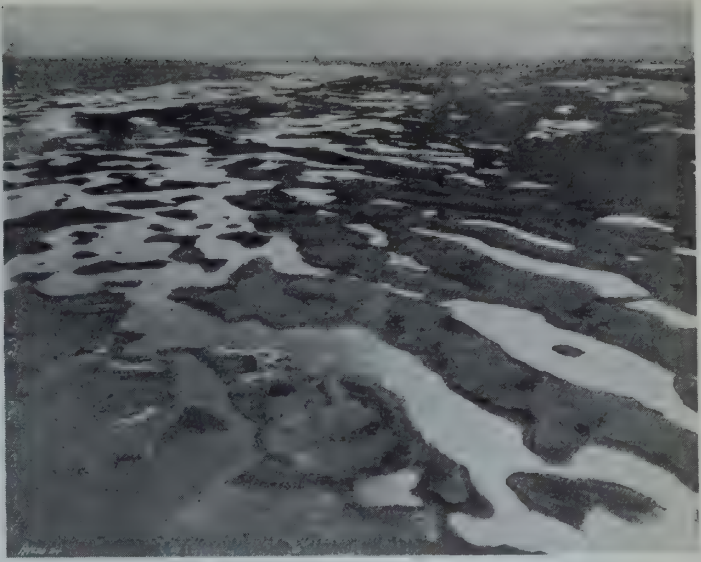
In war there is no time to survey and plot according to standard methods. Generally speaking, it is necessary to utilize the best maps or charts that are available and from them produce the best sheets possible of the kind required within the time available. In a situation of this kind a country is happily placed that possesses a good series of accurate base maps, because if these are available any kind of special map that may be required can be rapidly produced from them.

As a matter of civil administration it is good to maintain a series of standard maps. In wartime, standard maps do not lose any of their value, but over and above the field they cover there arises the necessity for new maps to meet special requirements. These often require a type of projection not commonly used in the ordinary run of work and similarly many questions of size, design, colour, etc., arise which must be decided quickly. Such a situation calls for the utilization of all the resources of the science of cartography and mapping.

This part of the story could be made more interesting if it were permissible to tell in detail what has been undertaken and what accomplished. But as this is forbidden for the present, we can only indicate the wide range of problems that have required attention.

In Canada there has been carried out a great plan for the training of all kinds of air personnel and to that end many flying schools have been established across the country. Each centre must of course be serviced with air charts of the surrounding district and it was necessary to undertake the quantity production of charts to keep step with the rapid extension of the training plan. Available facilities had to be stepped up to meet requirements. Canadian coastal waters had already been pretty well equipped with aids to marine navigation but the establishment across the country of ground aids to air navigation was just commencing and the same causes that affected the air charting work required a rapid expansion of radio beams and the like. The rapid construction of new ground air aids of course affected the keeping up-to-date of the air charts and special provision had to be made for their frequent revision. The map servicing of the training establishments does not by any means end with the supply of the district air charts, but in addition many special air charts are required to meet the needs of instruction and training. In this connection there arise a number of difficult problems. Inasmuch as a special chart often involves some new development of warfare, the descriptions of what is required usually come from abroad and often are still in the formative stage. There is of course an effort towards standardization between the Allies, but it is hard in wartime to get samples and specifications showing definitely just what is required. If it is a matter of reproducing in quantity copies of a multicoloured map received from abroad, the usual technical difficulties of unscrambling all the colours to procure a separate printing plate for each colour are increased by the fact that different processes are used in different places for printing maps. Further, paper copies transported across the ocean generally suffer considerable distortion, particularly in wintertime when Canadian workshops are usually warm and dry.

Since the last Great War there has been great development in radio and radio-direction work. It is now possible for a ship or a plane to obtain its location from a friendly radio net, but it is also possible for the enemy to pick up the signals if they have radio stations suitably located. So there is need for maps or charts for use in trying to spot enemy craft and in keeping track of the position of our own. Such charts usually cover large areas and require special projections so that, over the region mapped, the straight line of the radio signal through the ether will be a straight line on the chart, and equally so that the angular measurement of directions or intersections of lines will be true. Such charts cover land areas as well as oceans, because in the detection of far-off signals strange things happen. At the nearest point on the ocean shore the signal or impulse may pass undetected high up overhead, but at some suitable spot far inland where the signal comes down to earth it can be received clearly.



**This kind of country, on the Upper Dubawnt River, Northwest Territories, is difficult to travel on the ground.**

Practically all of the work referred to above since 1939 has been done on demand of the Royal Canadian Air Force, the Royal Canadian Navy, and to a lesser extent the Army because they have their own Geographical Section. All these military organizations have been most helpful. In many cases where arbitrary action, such as is often attributed to the fighting services, would have made things hard, they have acted otherwise and made things easy. Such co-operation with civilian organizations allows the Armed Forces to tap many sources of information and facilities which they do not themselves possess.

In the matter of western hemisphere defence it should be noted that along a boundary three thousand miles in length there are many American and Canadian map sheets which have to fit together. The northern air routes over Canadian territory are needed for the air attack on our enemies and might possibly be used in the opposite direction. Hence the interest in the production of adequate air charts over Canada has not been confined to Canadians alone, and the author has pleasure in acknowledging the great assistance which U.S. officials have given in getting on with this job. Under the ministration of the Permanent Joint Board on Defence there has been, between the civilian organizations and the armed forces on both sides, a very active co-operation which has contributed most effectively to the great effort of winning the war.

# MODERN TIMBER ENGINEERING

CARSON F. MORRISON, M.E.I.C.
*Associate Professor of Civil Engineering, University of Toronto, Toronto, Ont.*

**Paper presented before the Montreal Branch of The Engineering Institute of Canada, March 18th, 1943, before the London Branch May 26th, 1943, and before the Toronto Branch, October 21st, 1943**

It is interesting to note that timber, the oldest material in the history of construction, is now the most up-to-date. Recent changes and improvements in the technique of timber fabrication have brought it into use in many instances where designers had long considered it unsuitable.

The increasing use and the growing importance of timber in the structural field in recent years have resulted from several factors, including

(1) The marked increase in requirements for industrial buildings and other facilities.
(2) The difficulty of obtaining other materials of construction, particularly steel for structural shapes and for reinforcing rods.
(3) The development of new methods of timber fabricating.
(4) A more general appreciation by designers of the possibilities of the material.

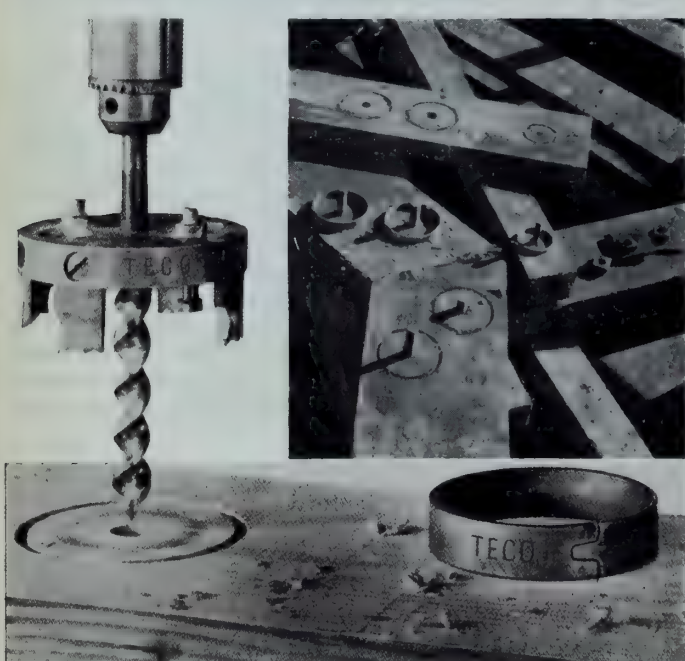
In certain instances, timber has been used where other materials would have been desirable but were not available. It is to be expected that when these other materials are once more available to the construction industry, they will be used for the jobs where they are more suitable.

However, modern timber construction has invaded the fields of competing materials to a considerable extent. In many of these cases, in which it can now be used more efficiently than the competing materials, it is not likely that timber will relinquish the position of predominance which it has gained.

While timber is used in the construction industry in many different ways, its use in long span roof-framing problems is of particular interest. Bridges, towers, forming and falsework also occupy the timber designer but one of the principal uses of timber is in protecting space from the weather. Consequently this article will deal chiefly with the design of roof structures.

The designer's problem is to provide a truss, arch or rigid frame to support a roof of the shape adopted, whether flat,

**Fig. 1—Fabrication of truss joint using split-ring connectors.**



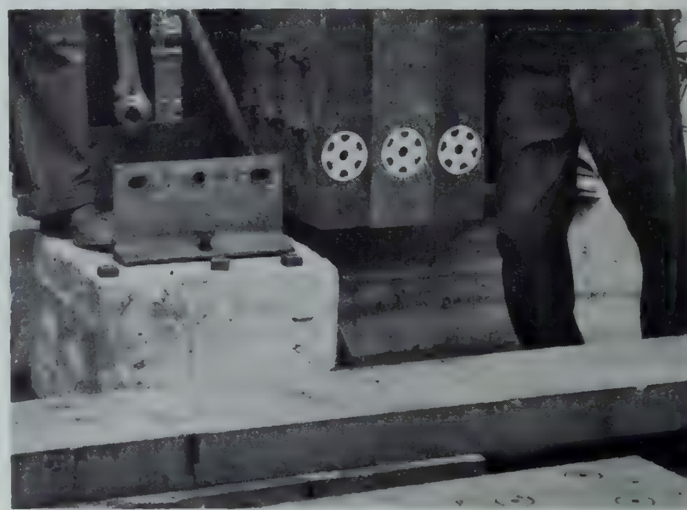



**Fig. 2—The use of shear plates in a column base connection.**

peaked or curved. Obviously for any outline of truss it is possible to have any one of several alternative web systems and the selection of the web system is an important part of the design.

The problem of structural design is one of choosing a *suitable* member or combination of members to make up the structure. This involves not only the choice of a suitable section for each of the component parts, but also the selection of the method of fastening together these various parts.

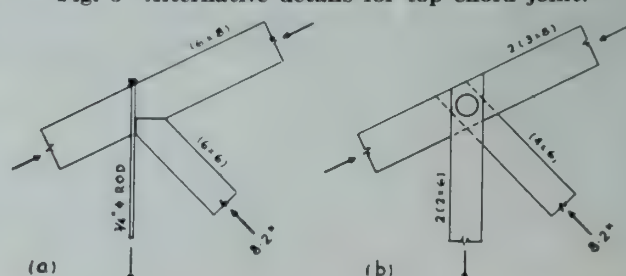
What constitutes suitability? What makes this or that selection suitable or more suitable than another? This involves a consideration of strength, cost, appearance, performance (which includes durability) and ease of fabrication: listed not necessarily in order of importance. From the engineer's point of view, strength is of paramount importance, but other factors must not be overlooked.

Two separate points are involved:

1. The selection of the members.
2. The fastening together of the various members.

The latter is more important in the design of timber structures than is the case with other materials—particularly reinforced concrete and structural steel. Concrete members are automatically joined together by the nature of the material and the methods of construction—except in the case of precast members. In steel design, members are chosen and details of connections may be worked out later in the detailing office. In timber, the details will often determine the members to be used. It should not be inferred from this that proper steel design does not have regard for the connection details—it most certainly does. However,

**Fig. 3—Alternative details for top chord joint.**



these details do not usually play as predominant a role in the selection of a suitable section as is the case with timber members.

For any given design problem an analysis is required to determine the loads which the various members must be able to withstand. Since the stress analysis of a structure is theoretically the same regardless of the material used, it is

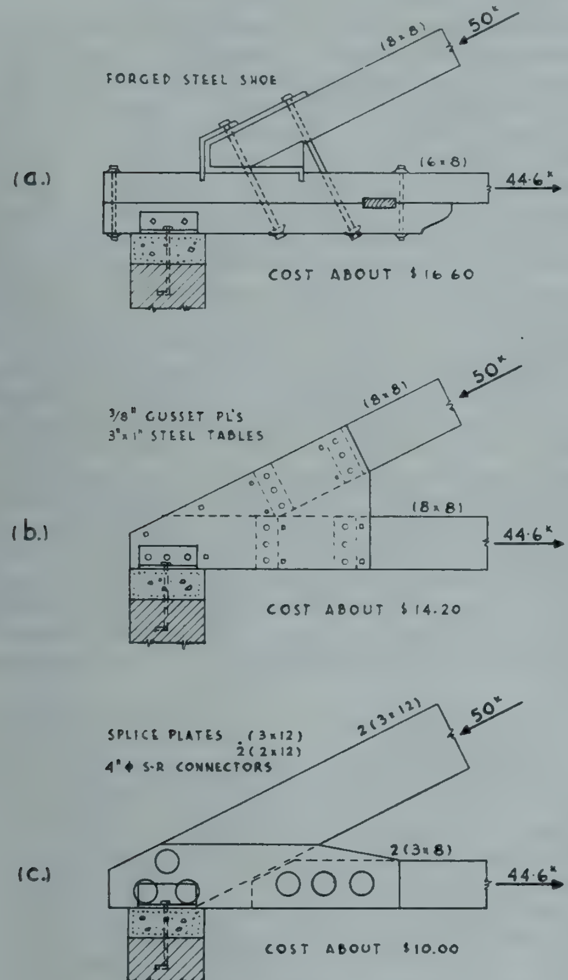


Fig. 4—Alternative heel details.

not peculiar to timber design and will not be discussed in this paper.

Having determined the forces and moments which must be withstood by the members, the next step is to choose the material and the dimensions of the members to withstand these forces and moments—not forgetting the problem of connecting them.

With timber as the material, the design of the joint or the connection of members is a main feature of the problem. Consequently it is desirable to discuss first the design of joints and later certain associated points in connection with the design of the members themselves.

## Design of Joints

Any advance in the technique of joining members together is an advance in structural engineering and this is particularly evident in timber designing. Compared to old style connections the modern timber joint looks and is streamlined for efficiency.

Figure 1 illustrates how timber members are fastened together using split-ring connectors. The adjacent members are drilled for the bolts and grooved for the connectors which are embedded one-half of their depth in each member. The bolts serve to hold the members in contact and

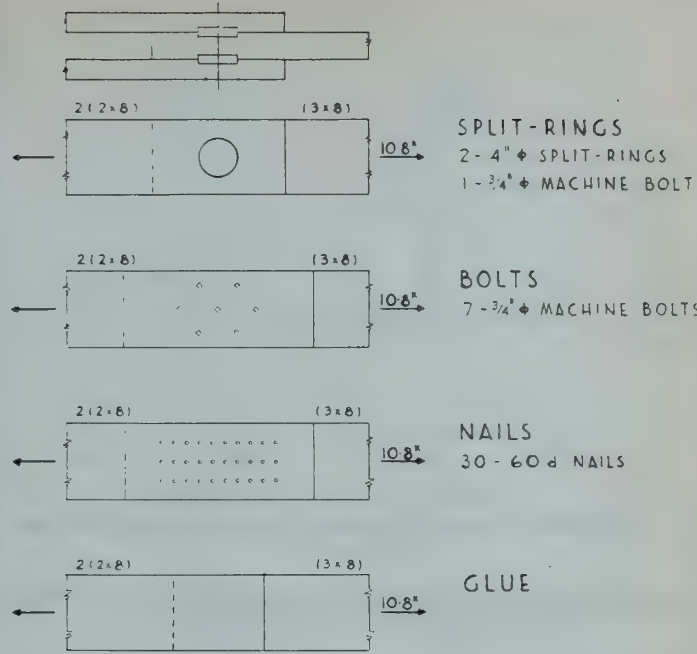


Fig. 5—Different methods of making a three-member connection.

the strength of the connection is developed largely by the bearing of the timber against the ring. One of the reasons why the split-ring connector is such a successful device is this simplicity of fabrication compared to previous types of shear developers and compared to other methods of making connections. The required drilling and grooving can be done accurately and economically with relatively simple equipment. When a connection is required between a timber member and a steel member or gusset plate, flush-typeshear plates may be used. The shear plate is embedded in a precut groove in the timber member and the load is transferred from the shear plate to the gusset plate by shear on the bolt. Figure 2 shows a close-up of a column base with shear plates embedded in the timber.

In the usual timber trusses the members are subjected to direct stress in tension or compression and the connection problems accordingly are to make tension or compression connections. Even before the use of the present day timber connectors, the compression joint was easy to arrange as it was simply a question of one piece bearing against another, usually at an angle inclined to the grain. The tension members, particularly web members, were often made of threaded steel rods. By passing the rod through the member to which it was to be connected the connection was made with a washer and nut. In this way the tension

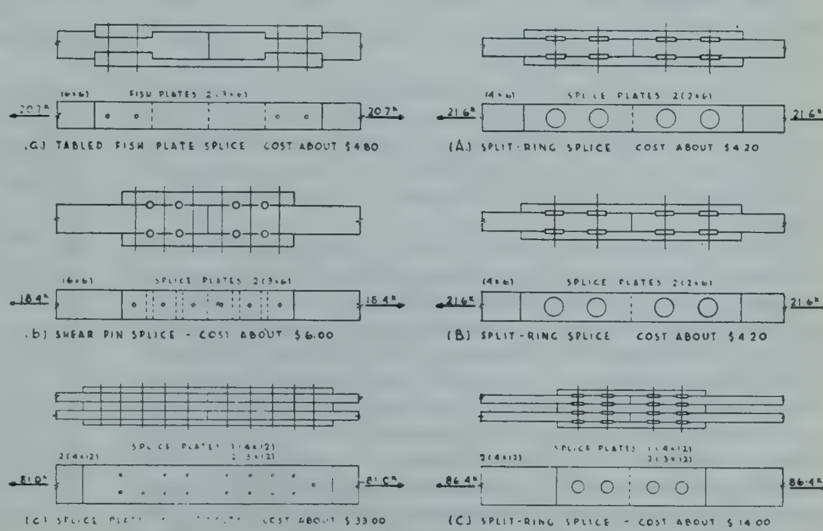


Fig. 6—Tension splices with a comparison of costs.

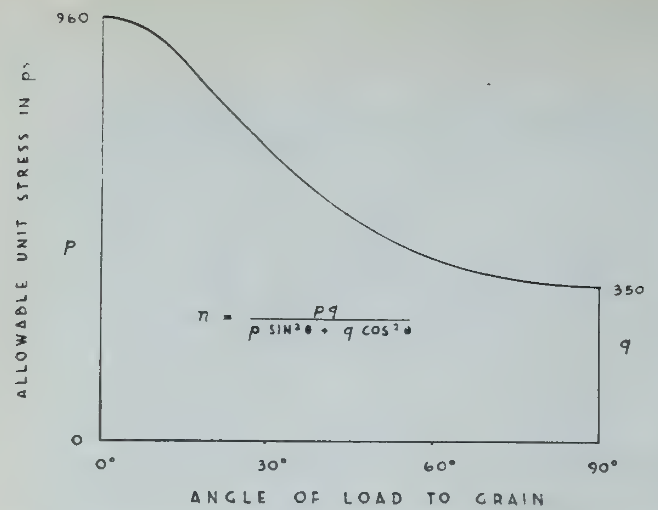
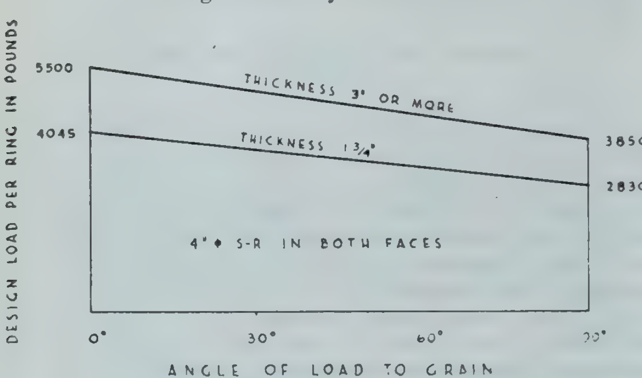



**Fig. 7—Permitted stress on a surface inclined to the direction of the grain.**

$$n = \frac{pq}{p \sin^2\theta + q \cos^2\theta}$$

**Fig. 8—Design loads for a split-ring as affected by angle of load to the grain and by lumber thickness.**




connection was obtained by developing compression between the washer and the timber member. This was a satisfactory solution except for cost, appearance and difficulty of fabrication.

Figure 3 shows a typical top chord joint for a triangular Howe truss; (a) using a steel rod tension web member with the compression member notched into the top chord and (b) using split-ring timber connectors.

Figure 4 shows alternative heel details, with approximate costs, for a 48 ft. span truss, (a) using a forged steel shoe and tie bolts, also a bolster and key; (b) using steel gusset plates with tables dapped into the chord members; (c) using timber splice plates and split-ring connectors.

Details (a) and (b) in Fig. 4 are similar to examples in "Timber Design and Construction" by Jacob and Davis, and are still considered by some engineers as standard designs for heel arrangements.

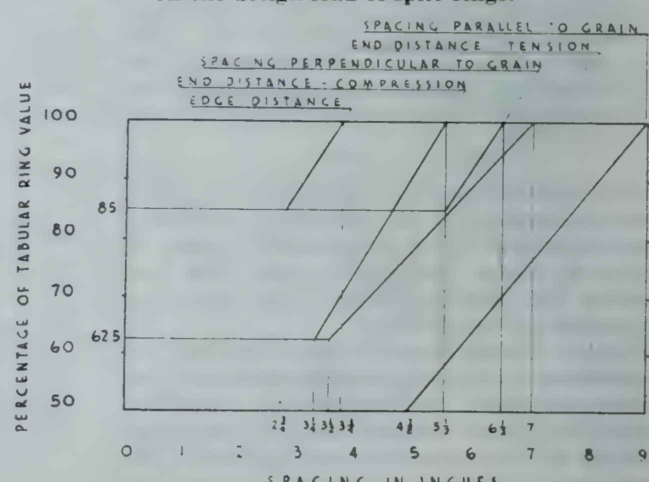
A different problem arises in splicing the tension chord of a truss, when this member is made of timber. This used to be solved in many different ways, each of which was in effect a shear splice: that is, a transfer of the tension load into shear and back into tension again at the other side of the splice.

Figure 5 shows a comparison of various methods of making a three-member connection. Each of the splices has a capacity of 10.8 kips and was designed using permitted stresses deduced from the results of experiments conducted at the Forest Products Laboratory at Madison, Wisconsin. The timber considered was structural grade Douglas fir. Somewhat different values apply when other timber is used but the comparison is much the same. It is obvious from these examples that the split-ring connection is much simpler and cheaper than connections using bolts or nails. Special mention should be made of the glued joint. The length of lap for a connection having a capacity of 10.8 kips was not shown in Fig. 5 as this would depend upon the quality of workmanship and the method employed. Using a permitted stress in shear on the glued joint of 75 per cent of the stress permitted in shear parallel to the grain, the required lap would be 9½ in. For a glued joint subjected to a pressure of from 100 to 200 lb. per sq. in., while the glue is setting, this is the design stress recommended in "The Glued Laminated Wooden Arch" a publication of the United States Department of Agriculture.

While there have been outstanding achievements in the Canadian aircraft industry using glued laminated construction, the techniques used in this industry are not suitable in building construction. To date very little has been done in Canada in the gluing of timber in the construction field, on account of the equipment needed and because of the requirements of a satisfactory fabricating technique. However, it may be expected that this phase of the Canadian construction industry will develop along the lines that it has in Europe and in the United States, where there have been so many fine examples of the use of glued laminated arches for long clear spans. Figure 6 shows details with approximate costs for tension splices using (a) tabled timber fish plates, (b) shear pins, (c) bolts; and the alternatives (A) (B) (C) using split-ring connectors. It should be noted that two distinct savings result from the use of split-rings for the tension splices. In the first place the simplicity of fabrication allows a saving in the cost of the splice itself. Secondly, since this connection involves a smaller loss of section, lighter main members may be used as for instance in examples (A) and (B) where a 4 x 6 provides ample net cross-sectional area while a 6 x 6 is required due to the greater loss of section in (a) and (b). Splices (a), (b), and (c) are the same as examples in "Structural Problems" by C. R. Young, except for minor changes in detail.

The design and layout of a joint using split-ring connectors are in many ways similar to the design and layout of a riveted steel connection. The number of rings required is obtained by dividing the load to be connected by the safe load on one ring just as the number of rivets required for connecting a certain load in a steel member is the load divided by the strength of a rivet. Here it should be emphasized that while in the case of structural steel detailing it is possible to extend the gusset plate to accommodate more rivets where they are required at a connection, in the case of connecting one timber member to another there is generally no gusset plate to extend and the space available for bolts and connectors is fixed by the dimensions of the members. Compared with the minimum connection of two rivets in structural steel detailing, it is usual and desirable to use a single bolt and the accompanying rings wherever possible for a joint in timber truss connections. This results in a very simple joint detail.

**Fig. 9—The effect of spacing, edge distance, and end distance on the design load of split-rings.**



The rules for spacing, end distance and edge distance required for timber connectors are more involved than the rules for the details of structural steel riveted joints. Some of these rules and their effect on joint design will now be considered. The "Manual of Timber Connector Construction" (hereinafter referred to as the Manual) published by the Timber Engineering Company, contains complete information regarding safe loads on rings under various conditions, also spacing and other requirements. This information is based on extensive tests conducted in the Forest Products Laboratory at Madison, Wisconsin.

Figure 7 is a graph of the generally accepted Hankinson formula for safe stress in bearing normal to a surface inclined to the grain. The angle of load to the grain also affects the ring capacity and Fig. 8 shows the variation in ring capacity with change in angle of the load to the grain and also the effect of variation in lumber thickness. The values shown in both figures are for structural grade Douglas fir.

Figure 9 shows how the safe load on a ring is affected by variations in spacing parallel to the grain, spacing perpendicular to the grain, edge distance and end distance. This chart was developed from data in the Manual and is submitted as an illustration of the influence of the various factors affecting the connector capacity. They must all be considered.

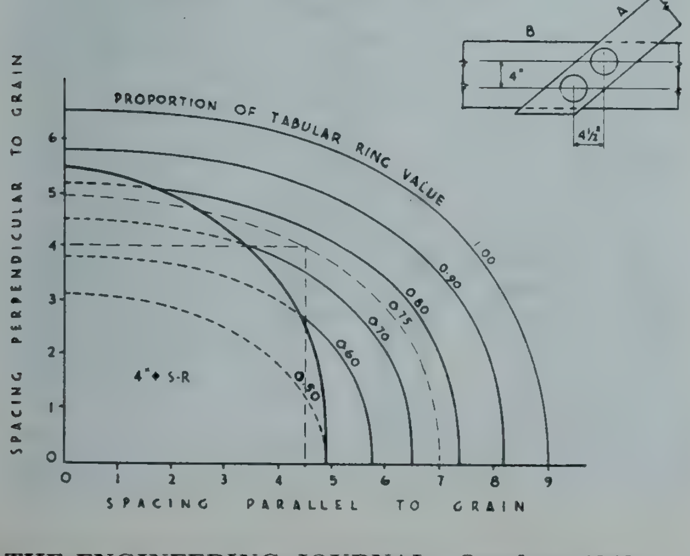
For spacing closer than the standard, the Manual recommends that one ring or assembly of rings be considered as 100 per cent effective and that the rings on other bolts be taken at a reduced value depending on the spacing. Some comment is desirable regarding this point.

Consider values for 4 in. dia. split rings in structural grade Douglas fir 3 in. thick with the load acting parallel to the grain. Two rings spaced 9 in. apart would each have a capacity of 5,500 lb. for standard end distances; this gives a capacity of 11,000 lb. for the 2-ring connection. The same 2 rings spaced 6¼ in. apart would have capacities (calculated as recommend in the Manual), of 5,500 lb. (100%) and 3,300 lb. (60%) or a capacity of 8,800 lb. for the connection. It could be argued that the load on each ring would be 4,400 lb. (90%) for a total capacity of 8,800 lb. In many instances it would make no difference whether the joint capacity is calculated as 5,500 lb. plus 3,300 lb. or 4,400 lb. plus 4,400 lb. as the answer is the same in both cases. However, a consideration of the end distance requirement indicates some difference between the two. If one ring carried a load of 5,500 lb. a tension end distance of 7 in. would be required, while a tension end distance of 3½ in. would be ample for the other ring carrying 3,300 lb.

For this simple example, it appears more reasonable to consider that each ring carries a load of 4,400 lb. with a corresponding tension end distance of 5¼ in. required. For more than two rings at substandard spacing the analysis requires a more involved argument.

Instances where rings are placed at substandard spacing on a line inclined to the grain should also be investigated. This influence is additional to the effect on the ring capacity of angle of load to grain and of substandard spacing parallel to the grain and/or perpendicular to the grain. Figure 10 shows a proposed method of determining the appropriate proportion of tabularring values to be used for any spacing of rings between the standard 9 in. and the minimum 4⅞ in. parallel to the grain and the standard 6½ in. and the minimum 5½ in. perpendicular to the grain. The tabular value refers, of course, to the value listed in the Manual for a ring with the load acting at the appropriate angle to the grain. This factor takes into account only the effect of crowded spacing of the rings and due consideration should also be given to any substandard edge or end distance condition and a consequent reduction should be made to the tabular ring value for these effects.

**Fig. 10—Capacity of rings at sub-standard spacing on a line inclined to the direction of the grain.**



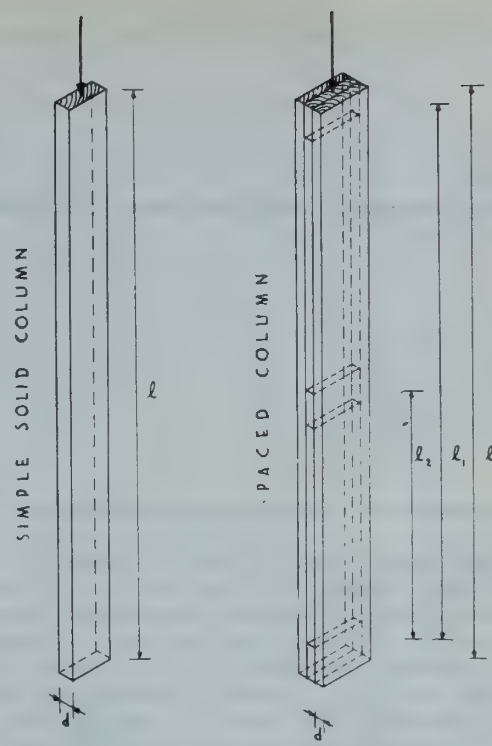
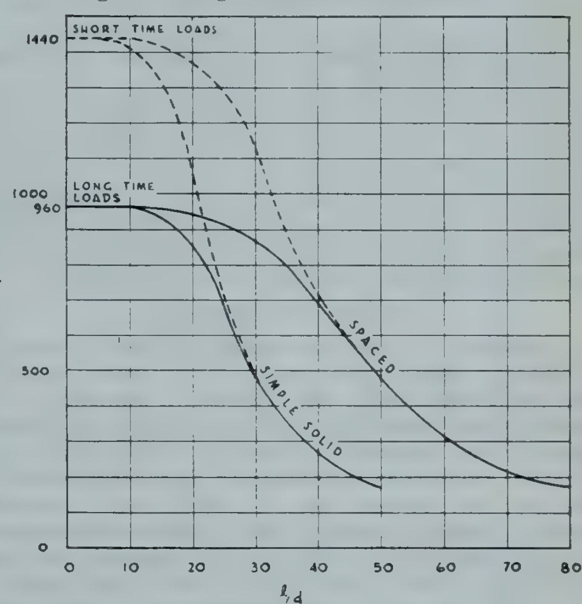




**Fig. 11—Types of timber columns.**

**Fig. 12—Design stresses for columns.**



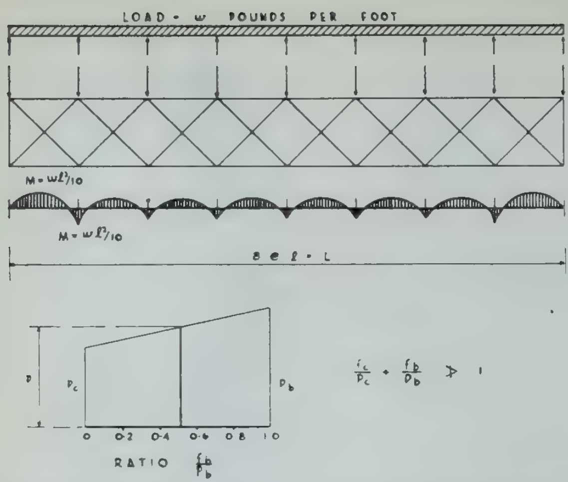



**Fig. 13—Members subjected to both axial and flexural loading.**

Consider the joint shown in Fig. 10 using 4 in. dia. split rings B group lumber not less than 3 in. thick and standard end and edge distances. In member A the load is acting parallel to the grain and the rings are spaced 6 in. apart. The Manual shows the tabular ring value to be 5,500 lb.—100 per cent to be allowed on one ring and 63.6 per cent to be allowed on the other for a spacing of 6 in. This shows the safe load on the rings embedded in A to be 5,500 (1.636) = 9,000 lb. No mention is made of a method of computing the safe load on the rings embedded in B beyond the fact that the load is acting at an angle to the grain (40 deg. in this case with a corresponding tabular ring value of 4,770 lb.) The diagram in Fig. 10 shows the fraction of tabular ring value to be used in this case as 75 per cent for all except one ring which should be taken at 100 per cent. This shows the safe load on the rings embedded in B to be 4,770 (1.75) = 8,350 lb. which is critical. The tabular ring values would be affected by a decrease in thickness of the members and any decrease of end or edge distances below standard would have a weakening effect on the joint which would have to be considered in the usual manner.

## Design of Members

It is essential in structural design to know the quality of the material used. Faulty material will result in a faulty structure whether using steel, timber or concrete.

Many factors affect the physical properties of timber and therefore it is necessary to classify it with regard to these factors in order that the designer may be assured of the quality of the material to be used for any structure, or structural element. Specifications stipulate standards for the grading of timber and in this way the designer may proceed on the basis of the physical properties of the grade to be used for the structure under consideration. This grading is a classification of the material in accordance with the extent of the imperfections (knots, shakes and slope of grain). As an illustration consider eastern hemlock with a basic stress, for clear material, of 1466 lb. per sq. in. for extreme fibre in bending. Timber having imperfections such that 75 per cent of the strength of a member is retained is graded as "select structural" and for this grade the permitted design stress is $0.75 \times 1466 = 1100$ lb. per sq. in. When the imperfections are such that the loss in strength of a member is more than 25 per cent, and not more than 40 per cent, the timber is graded as "structural" and the design stress is $0.60 \times 1466 = 880$ lb. per sq. in. The above stresses are from C.E.S.A. Specification A43-1937 as amended 1940.

In fabricating any structure, care must be taken to have adequate inspection so the engineer will be assured that the material used is actually what is specified. This requirement is not peculiar to timber designing.

### TENSION MEMBERS

Most current specifications, when mentioning the permitted stress in timber tension members, state that the stress permitted in tension shall be the same as is permitted in flexure. Whether this refers to the stress on the gross section or on the net cross-sectional area is not always stated. This matter merits investigation. Weakening of the section due to imperfections is taken into account in arriving at the permitted stress for any grade of timber. It is improbable that the reduction in area due to bolt holes and grooves will be any greater than has already been considered in establishing the permitted stress. On this account it seems reasonable to design using a stress on the gross section equal to the permitted stress in flexure specified for the grade of material used and using a much higher permitted stress on the net section, i.e., the basic stress for clear material for extreme fibre stress in bending. This considers that the grooves and the imperfections will not occur at the same cross section of the member, which is in accordance with good fabricating practice. Constants for determining the net area required which appear in the Manual are based on the foregoing considerations.

This point should be covered more explicitly in specifications.

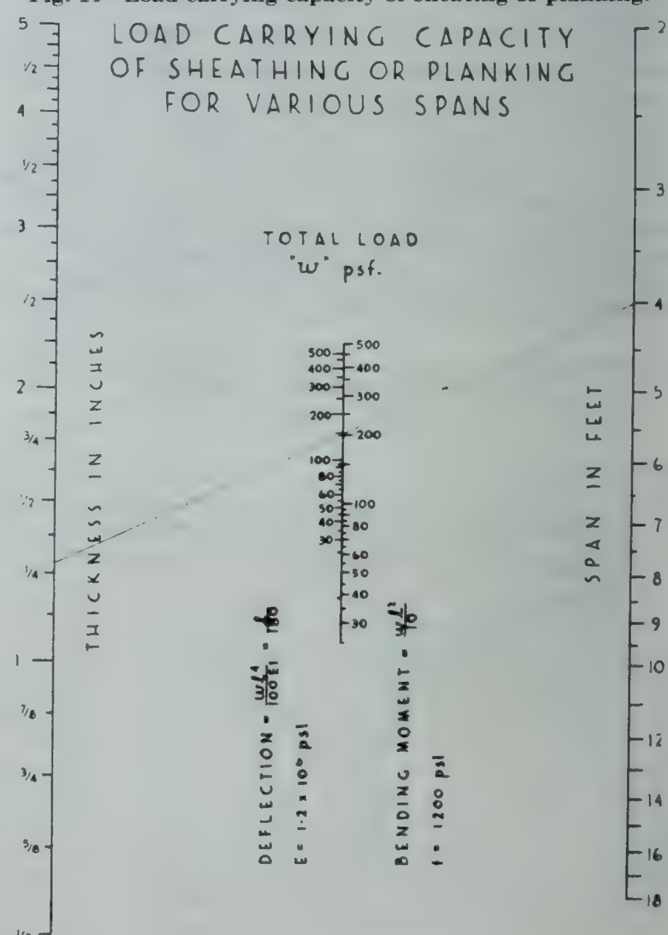
### COMPRESSION MEMBERS

The timber connector has brought to the fore a new type of column known as the "spaced column connector joined." This is a built up member, and the resulting column is stronger than the sum of the strengths of the separate parts acting as "simple solid" columns.

Supplement No. 4 to "Wood Structural Design Data" published by the National Lumber Manufacturers Association gives design data based on tests made on this type of member.

Figure 11 illustrates the simple solid column and also the spaced column. Figure 13 shows safe $\frac{P}{A}$ values for both types of columns. Note here that the $\frac{l}{d}$ to be used for a

**Fig. 14—Load carrying capacity of sheating or planking.**



"spaced column" is the length of the built up section divided by $d$ the least lateral dimension of one of the components. This method of presenting the problem shows a higher safe $\frac{P}{A}$ in a "spaced column" than for a "simple solid" column, having the same $\frac{l}{d}$. While this indicates a stronger column as it should, it would appear to be more satisfactory to compute an "effective $d$" for the spaced or built up column which would be greater than the $d$ of one of the components. The permitted stress or safe $\frac{P}{A}$ could then be determined on the basis of the length divided by this "effective $d$" rather than the $\frac{l}{d}$ for an individual member. Such a method is particularly desirable in cases of a member composed of more than two spaced elements.

For short-time loads, Fig. 12 indicates a permitted increase of 50 per cent of the stresses permitted for long-time loads for $\frac{l}{d} = 0$ and a gradual decrease from this 50 per cent to 0 for an $\frac{l}{d} = 30$ for simple-solid columns and for an $\frac{l}{d} = 45$ for spaced-columns. It is of interest to compare these specifications for short-time loading with those of the National Building Code published by the National Research Council of Canada, where an increase of 25 per cent in stress is permitted for short-time loading, and with the specifications of the American Institute of Steel Construction, where an increase of 33⅓ per cent is permitted.

### FLEXURAL MEMBERS

Tables are available giving the capacities of laminated mill floors of various thicknesses and with different permitted stresses for different spans but tables for material less than 2 in. thick are not readily available. With this in mind, the alignment chart in Fig. 14 has been developed. This gives the capacity of sheathing and flooring from ½ in. to 5 in. thick for spans varying from 2 to 18 ft. The capacity as dictated by stress in bending is given as well as the safe load as limited by a deflection of $\frac{l}{180}$. The chart was drawn using $M = \frac{wl^2}{10}$ and $\triangle = \frac{wl^4}{100\,EI}$ which recognizes a continuity in the span and using $p_f = 1200$ lb. per sq. in. and $E = 1.2 \times 10^6$ lb. per sq. in.

For any different permitted stress or modulus of elasticity of material, the same chart may be used by applying a factor to the total load $w$, as a straight line relation exists between stress and load and between deflection and modulus of elasticity. Similarly a factor may be used to adjust $w$ for a condition where $M$ differs from $\frac{wl^2}{10}$ as it does in the case of no continuity or where $\triangle$ differs from $\frac{w\,l^4}{100\,EI}$, as in the case of no continuity, or if the permitted $\triangle$ differs from $\frac{l}{180}$.

Example: (1) As shown in Fig. 14

$w = 150$ lb. per sq. ft; $l = 4$ ft.; $p_f = 1200$ lb. per sq. in; $E = 1.2 \times 10^6$ lb. per sq. in.; $M = \frac{wl^2}{10}$; $\triangle = \frac{wl^4}{100\,EI}$ not to exceed $\frac{l}{180}$. $t$ req'd. $= 1.27$ in.

Use material having an actual thickness of 1⅜ in., if available, or the thinnest material providing $t = 1.27$ in. which is available, or perhaps it would be desirable to revise the layout of supporting members to suit the thickness of sheathing available.

Example: (2)

$w = 160$ lb. per sq. ft.; $l = 6$ ft.; $p_f = 1600$ lb. per sq. in; $E = 1.6 \times 10^6$ lb. per sq. in.; $M = \frac{wl^2}{8}$; $\triangle = \frac{5\,wl^4}{384\,EI}$ not to exceed $\frac{l}{250}$.

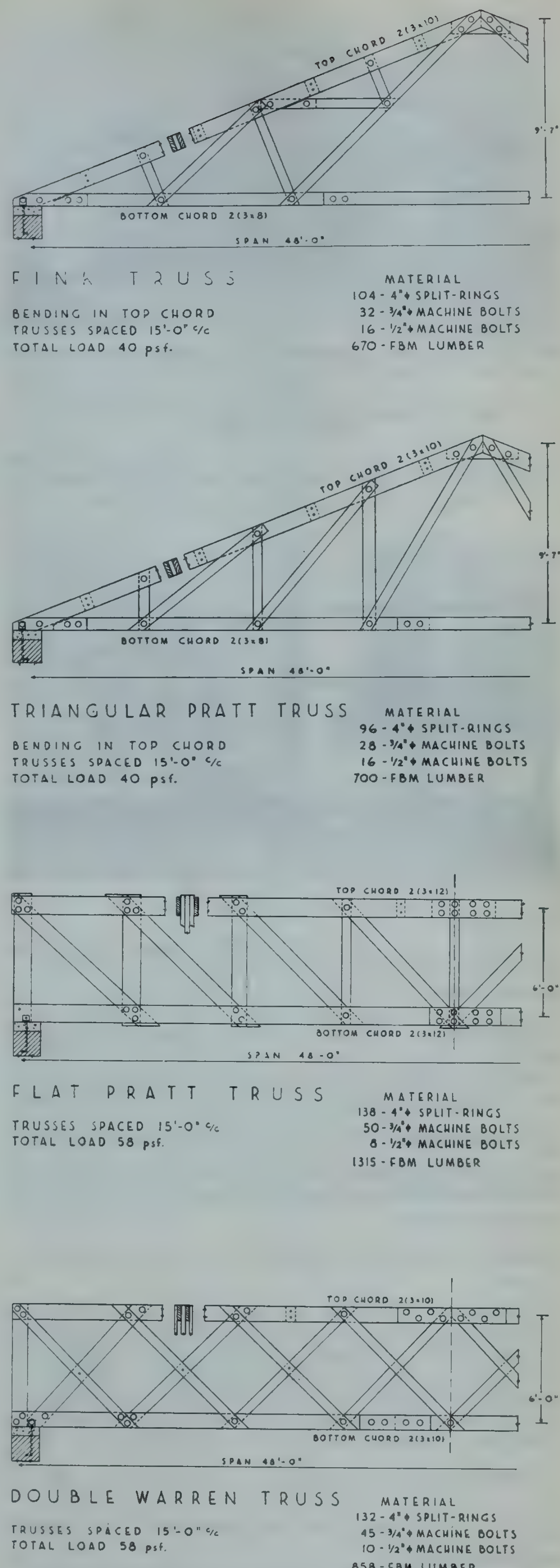



**Fig. 15—Comparison of material required for different types of roof trusses.**

**Fig. 16—51 ft. span triangular Pratt trusses which support a roof over a storage building for Fairchild Aircraft Ltd., near Montreal.**

***Trusses designed, fabricated and erected by V. H. McIntyre, Ltd.***

**Fig. 17—Erection view of a 112 ft. span hangar for the R.C.A.F. Note the twin-leaf columns with spacer blocks.**

***Photo courtesy Canada Creosoting Co. Ltd.***

For bending,

$$\text{equivalent } w = 160 \times \frac{10}{8} \times \frac{1200}{1600} = 150 \text{ lb. per sq. ft.}$$

For deflection,

$$\text{equivalent } w = 160 \times \frac{100 \times 5}{384} \times \frac{250}{180} \times \frac{1.2 \times 10^6}{1.6 \times 10^6} =$$

217 lb. per sq. ft.

The chart shows that as dictated by bending stress a $t = 1.65$ in. is required, whereas to limit the deflection to $\frac{l}{250}$ as specified, a $t$ of 2.17 in. would be required. The thinnest material providing this thickness would be used or the layout might be revised to suit the available material with beneficial results.

### MEMBERS SUBJECTED TO FLEXURAL AS WELL AS DIRECT STRESS

In many instances the top chord of a truss is subjected to bending as well as axial loading and this condition must be considered in selecting a suitable member. This point is not covered in most specifications on timber design but the design rule used in the A.I.S.C. specifications and also in the National Building Code of Canada for steel structures, provides a satisfactory solution to the problem.

Defining $f = \frac{P}{A}$; $f_b = \frac{M}{S}$; $p_a$ = safe $\frac{P}{A}$; $p_b$ = safe $\frac{M}{S}$; $f = f_a + f_b$; $p$ = safe $f$, the rule states that $\frac{f_a}{p_a} + \frac{f_b}{p_b}$ should not exceed unity.

The diagram in Fig. 13 is a graphical illustration of this relation presenting it in terms of a permitted value for the total stress $f = \frac{P}{A} + \frac{M}{S}$ intermediate between $p_a$ and $p_b$ depending upon the ratio $\frac{f_b}{p_b}$. For a study of the rule it appears desirable to consider the value permitted for total stress while for use in design it is recognized that the equation $\frac{f_a}{p_a} + \frac{f_b}{p_b} \not> 1$ is easier to operate.

It should be noted that the joists or decking which produce bending in the member also provide restraint against lateral buckling and that consequently the appropriate value of $p_a$ is that for a short column.

With load applied to the top chord of the truss continuously, rather than at the panel points only, the top chord members must be able to resist the moment as well as the axial stresses produced by this loading. It is recommended that these moments be determined by considering the top chord as a beam continuous over several spans, the supports being the truss panel points. In accordance with usual moment coefficients in reinforced concrete specifica-

**Fig. 18—View of 134 ft. clear span hangars at an airport in Eastern Canada. These have the longest span timber roof trusses in Canada.**

***Hangars designed under the direction of Mr. John Schofield, Architect. Trusses and columns fabricated by Canada Creosoting Co. Ltd. and erected by V. H. McIntyre, Ltd.***

**Fig. 19—An interesting design for trusses using a combination of timber and steel. The outstanding feature of the design is the use of steel rods for tension diagonals in roof trusses which support saw-tooth roof frames. With this scheme the obstruction of light through the sash is reduced to a minimum, resulting in a much more useful roof than would be obtained using timber diagonal members. Steel diagonal rods are welded to gusset plates which are connected to the timber members by shear plates. Note verticals extend below bottom chord to provide for connection of saw-tooth frames.**

***T. Pringle and Son Limited, Consulting Engineers, are responsible for this outstanding design. Trusses were fabricated by Canada Creosoting Co. Ltd.***

tions the moment is taken as $\frac{w\,l^2}{10}$ in the end span and at the first interior support for a uniformly distributed load as shown in the figure.

### Examples of Truss Designs

Figure 15 shows four designs for a 48 ft. span roof truss. Two of the designs are peaked roof trusses while the other two are flat roof trusses. A bill of material accompanies each design to enable an easy comparison of the different types of truss.

No great difference is seen between the triangular Pratt and the Fink: the former requiring slightly more lumber but less hardware and somewhat simpler fabrication. In the structural steel field the Fink is a very popular truss but in timber designing the triangular Pratt has been used much more extensively due to the simpler fabrication.

In comparing the flat Pratt and the double Warren there is a decided advantage in favour of the latter. The reason for this is simple: in the double Warren the shear in any panel is divided between the two diagonals in that panel, resulting in less load in each diagonal and as a result simpler joint details. The 3 by 10 in. chord members have ample strength to resist the axial load in the top chord of the truss and they also provided sufficient area to connect the maximum diagonal load in the double Warren. Although in the flat Pratt 3 by 10 in. chord members would provide sufficient strength for the axial load, the face of the member is not suitable for a connection of the web members and for this reason the 3 by 12 in. chord members were used.

The device of dividing the shear between the two web systems and thereby reducing the load on the maximum web connection is responsible for the great popularity of the double Warren truss in timber engineering.

Figures 16 to 21 are illustrations of different examples of timber structures.

**Fig. 20—120 ft. clear span glued laminated arches being used for the auditorium of the United States Naval Training Station at Camp Bainbridge, Md. The section of the arch is 30 in. deep by 7½ in. wide. Sheathing ⅞ in. thick was used on 2 in. x 10 in. purlins. Note the brace frames and struts between the arch ribs.**

***Photo courtesy of Eggers and Higgins, New York, who were the architects-engineers for the project.***

**Fig. 21—A 150 ft. guyed radio tower. The mast consists of three 3½ in. x 11½ in. timber pieces which are connected, by bolts and shear plates, to steel plate diaphragms, spaced about 7 ft. apart. The guy connection and the base detail are shown in the close-up views. This design was developed by the author and results in a tower which performs the required function in a very efficient and satisfactory manner.**

# THE ENGINEERING INSTITUTE OF CANADA AND THE PROVINCIAL ASSOCIATIONS OF PROFESSIONAL ENGINEERS

## Foreword

During the past ten years notable progress has been made in clarifying the position and functions of the various provincial associations of professional engineers, in relation to each other and to The Engineering Institute of Canada—the body to which the associations owe their inception and much of their development.

All members of the engineering profession in Canada are naturally concerned with the inter-relation of the activities of our various professional and technical organizations. The present situation is sufficiently complicated. Among distinctively technical societies we have, to begin with, The Engineering Institute of Canada, a Dominion-wide Canadian organization, which includes engineers of all branches of the profession. Another Dominion-wide organization, the Canadian Institute of Mining and Metallurgy, ably represents the mining industry as well as the professional mining engineer. Further, there are in Canada a number of active branches or sections of American engineering societies which deal with specific subdivisions of engineering work. Their members naturally look to the United States rather than to Canadian sources for technical guidance.

With aims distinct from those of the voluntary bodies just named, eight provincial associations of professional engineers have been created to deal with questions regarding the licensing of engineers and the protection of the public against incompetent practitioners. Membership in them, in most cases, is compulsory, their activities are regulated by provincial enactments, and they now exist in all the provinces of the Dominion except Prince Edward Island.

The difficulties arising from this complex structure have, for many years, received consideration from the Council of The Engineering Institute, and there has developed a general desire for progress towards an ideal condition in which the activities and requirements of all these bodies will be mutually co-ordinated. Many have expressed the hope that eventually engineers will not be faced with the necessity of belonging (and contributing) to a multiplicity of entirely independent organizations.

The recent conclusion of agreements between the Institute and four of the Associations, providing for joint membership and a considerable measure of co-operation, gives a fitting opportunity to present the following record of the events which have led up to this desirable achievement, and the activities of the Institute regarding them.

In its present form the account is due to the kindness of S. G. Porter, who was president of the Institute in 1931 and vice-president of the Association of Professional Engineers of Alberta, in 1923. Much of it is based on material which has already appeared in *The Engineering Journal*.

## Professional Organization Begins in Canada

The first movement towards the formation of an engineering society in Canada appears to have been set on foot before Confederation by Sandford Fleming, who, with other prominent engineers, endeavoured to interest members of the profession in the advantages of such an association. The regulation of professional activities, as well as the dissemination of professional knowledge, was desired by the men who sponsored these early efforts. It was not until considerable engineering development had taken place in the west, that conditions enabled a society to be organized with success.

An early attempt at the legal regulation of civil engineers in Ontario was made in February 1881, when "an act respecting civil engineers" was introduced in the Legislative Assembly of that province. However, the bill did not commend itself to the Legislature, or, indeed, to all of the engineers named in it, and it never became law.

## Formation and Growth of the Canadian Society of Civil Engineers

About this time, the authorities of Toronto and McGill Universities realized the importance of having educational facilities for training engineers, and the advantages of having an association with which to co-operate, if such could be formed. Further, Montreal, Toronto and Ottawa were the cities most frequented by the profession, and conditions suitable for the formation of a society were gradually developing at these places.

During this period the idea of a Canadian engineering society was in the minds of many members of the profession, and the scheme was thoroughly canvassed both in Ontario and Quebec. Among the men who were active in this matter, and who later became officers or prominent members of the society they were proposing to form, may be mentioned Alan MacDougall, C. E. W. Dodwell, T. C. Keefer, Sir Sandford Fleming, J. L. P. O'Hanly, S. Keefer, Frank Shanley and Kivas Tully. As a result, meetings took place in Toronto, Ottawa and Montreal. Perhaps the most important of these was that held in Montreal on the fourth of March, 1886, of which the manuscript minutes have been preserved. Alan MacDougall was in the chair, and P. W. St. George acted as secretary. On the motion of H. D. Lumsden, seconded by P. A. Peterson, it was resolved that

> "A Society of engineers in Canada be formed, comprising *all branches of engineers*, and that a committee be appointed to meet the other committees of engineers from other cities and then to arrange and form a preliminary constitution, which . . . shall be sent around to those gentlemen who send in their names as being willing to form such a Society . . ."

A similar local committee had been acting in Toronto and also appointed delegates to confer with those from Ottawa and Montreal.

Discussions continued until a provisional committee was chosen. At its meeting on December 9th, 1886, it was decided to call the proposed society the Canadian Society of Civil Engineers, and to send out a circular regarding membership, together with a copy of the constitution proposed for the new body. Applications for membership were numerous, the Society was formed, and a charter of incorporation was applied for in due course. That charter received Royal sanction on June 23rd, 1887.

The objects of the Society, as set forth in its Act of Incorporation were "to facilitate the acquirement and interchange of professional knowledge among its members, and more particularly to promote the acquisition of that species of knowledge which has special reference to the profession of civil engineering . . ." The Society was also given power to make regulations and by-laws "including all rules that may be deemed necessary for the maintenance of the honour and dignity of the profession." These aims, as defined and expanded in the by-laws, have remained unchanged to the present day.

The by-laws of the Society made it clear that the term 'civil' engineering, used in the Act, had reference to all types of engineering activity other than military.

It should be remembered that in 1887 mechanical, chemical, mining, electrical and other specialized branches of engineering as we now know them, were only in process of development in Canada. It was, therefore, natural that most of the early members of the new organization should be men engaged in railway surveys or construction, in contracting for public works, or in municipal or governmental service. The founders of the new body could not possibly foresee the extent of future development of all branches of engineering work in Canada, but they saw the trend and, accordingly it was provided that its membership should include every branch of the profession.

In drawing up these by-laws it was realized that the membership of such a Dominion-wide body would necessarily be scattered geographically, so that a decentralized type of organization was adopted. For this purpose the formation of local branches was authorized; later, geographical districts and provincial zones were provided for. The first branch was formed in Toronto in 1890; the second in Cape Breton in 1905. By 1912 branches had been formed in Quebec, Winnipeg, Ottawa, Vancouver, Kingston, and Victoria, and others followed as opportunity occurred, until to-day there are twenty-five, located in the principal cities of the Dominion from Sydney, Cape Breton, to Victoria, Vancouver Island. These branch organizations perform an indispensable function, giving the Institute, as it now exists, a local habitation in every important centre, and stimulating there an appreciation of the engineer and his work, both in a personal and a professional sense.

Growth in numbers was accompanied by a corresponding increase in the diversity of the branches of engineering followed by the members. This soon resulted in the formation of four sections, general, electrical, mechanical and mining. After about ten years of the Society's existence it was felt that the term 'civil' engineering had come to be generally used in a much more restricted sense than that in which it had been employed at the time of the Society's foundation; this feeling was later to be one of the motives leading to a change in the Society's name and the extension of its activities.

Among the members there were always many who felt that in addition to promoting the dissemination of professional knowledge, the new body should take steps to enable the public to distinguish between qualified and unqualified engineers. At the Annual Meeting of 1896 a committee was appointed to consider the question of professional status. In consultation with provincial subcommittees a draft act of provincial incorporation of the Society was prepared, which, with some modifications, became law in Manitoba in 1896, and in Quebec in 1898, limiting the practice of 'civil' engineering to the members. These enactments, however, did not prove satisfactory in operation, and further legislation was not attempted at that time. But it was then realized that provincial (not federal) legislation had to be secured, the protection of the public, as provided in the British North America Act, being essentially a provincial and not a federal responsibility.

### The Can. Soc. C. E. Becomes The Engineering Institute of Canada

During nearly thirty years of healthy growth of the Society, Canada's industrial development and the accompanying tendency towards greater specialization in the profession made it evident that some changes in organization were desirable to increase and extend the Society's usefulness.

Accordingly, a Committee on Society Affairs was formed; its report, presented to the Council in October, 1917, proposed a revision of the by-laws and recommended that the name of the Society be changed to "The Engineering Institute of Canada" as being more expressive of the functions which the organization was performing. This revision was approved, and by Dominion Act of April 15th, 1918, the Canadian Society of Civil Engineers became "The Engineering Institute of Canada."

Under its new and comprehensive charter, the national organization of the profession was further developed. A permanent secretariat was provided and, in 1918, the *Journal* of the Institute was established.

The First Professional Meeting of the Institute was held in Toronto on March 26th-28th, 1918. Mr. H. H. Vaughan, in his presidential message, pointed out that "The change in name implies the attempt to unite all engineers in Canada, to whatever branch of the profession they may belong, into one society."

### The Institute Approves a 'Model Act'

At the Second General Professional Meeting of the Institute, which was held in Saskatoon, on August 10th, 1918, a paper was read by Mr. F. H. Peters, which drew attention to the benefits to be derived by the profession through legal enactments regulating professional practice, discussion of this matter having been introduced by a resolution passed by the Calgary Branch during the summer of 1917. It will be recalled that at this time there was in force in the province of Quebec an act respecting the practice of engineering passed in 1898, and revised in 1900, and in the province of Manitoba an act passed in the year 1896, incorporating the Canadian Society of Civil Engineers in that province.

The sentiment throughout the profession that the engineer would benefit by the legal establishment of his professional rights found further expression at the Institute's Annual Meeting in Ottawa, on February 12th, 1919, in the formation of a committee for the purpose of drawing up a Model Act* for submission to the various provincial legislatures. Prompt action followed, and this act served as a basis for legislation which was obtained shortly thereafter, establishing associations of professional engineers in nearly all of the provinces of the Dominion. It is to be noted that no provision was made in the Act to relate these new legal organizations to the Institute in any way.

At its meeting of September 23rd, 1919, Council approved the proposed legislation, encouraged the Branches and Provincial Divisions to co-operate in the promotion of provincial enactments, and gave Council's moral support to this movement. On the ballot which approved the Model Act, seventy per cent of the votes cast by Institute members were in the affirmative.

The Model Act defined the "practice of a Professional Engineer" and described the powers and duties of a provincial association of professional engineers. It covered the admission of candidates to the study and practice of the profession as members of such an association, regulate their government and discipline, and provided that only registered members or licensees of the association could use the title "professional engineer." Suitable provision was made for administration by a president and council, penalties were prescribed for unauthorized practice, and methods of registration and examination were indicated.

The functions of a provincial association under such an act would therefore be to regulate admission to the profession and to administer the provincial law regarding its practice.

In March 1920, Council appointed a committee to report on the question of the remuneration of engineers, a matter very much to the fore in the profession at that time. In fact, reactions in this regard were largely responsible for the great activity in the promotion of provincial enactments which was then manifest.

### Associations Established by Provincial Legislation

During 1920 provincial acts based on the Model Act were obtained in British Columbia, Quebec, Manitoba, Alberta, New Brunswick and Nova Socotia. The Ontario Act followed on June 5th, 1922.

Thus, by 1923, similar legislation had been obtained in all the provinces except Prince Edward Island and Saskatchewan. An act was obtained in the latter province in 1930.

It should be noted that, in British Columbia, the passing of the act was largely due to the activities of a body formed for that specific purpose, and called the British Columbia Technical Association.

Experience with these enactments soon raised a question as to the definition of the term "professional engineer."**

* See *The Engineering Journal*, May, 1919, p. 411.

** See a comprehensive discussion by Mr. A. D. Flinn, of the American Engineering Council in *The Engineering Journal* 1929, p. 387.

Further, the acts, though they were all based on the Model Act, were not alike in all their provisions. Thus the legal powers of the various associations differed in degree, and from time to time amendments to several of the acts, tending to emphasize this lack of uniformity, have caused difficulties. On the whole, however, the main lines of the Model Act have proved to have been correctly drawn.

In some cases a tendency developed for the new provincial organizations to function in a manner contrary to the idea which prompted their formation, and certain representations having been received from the west, the Council of the Institute at its meeting in February 1923, unanimously adopted the following resolution:—

"Whereas it is the opinion of the Council of The Engineering Institute of Canada that all technical matters in connection with engineering should be the function of The Engineering Institute of Canada, and that the various Corporations and Associations of Professional Engineers in the different provinces are, or should be, designed solely for the purpose of administering the provincial laws in connection with legislation;

Be it resolved:—That the Council of The Engineering Institute of Canada go on record as approving the above principle and that all possible steps be taken towards the adoption of this principle;

Be it further resolved:—That the Secretary be instructed to write the various provincial bodies calling their attention to this resolution and asking their cooperation to that end;

Also be it resolved:—That the Council of The Engineering Institute of Canada suggest to each of the various provincial bodies that they send one or more representatives to a meeting for the purpose of discussing the relations of those bodies to The Engineering Institute of Canada, to the end that finally an Act may be enacted similar in principle to the Roddick Medical Bill.*

It is unfortunate that the relations of the Institute (a voluntary body) with the new associations (provincially constituted bodies having compulsory membership), could not be clearly defined from the outset, for it soon became evident that such questions as the duplication of fees and the diversity of standards for admission as between the associations and the Institute, and also between the associations themselves, would have to receive consideration.

### The Institute Calls Conference of Association Delegates

On the invitation of the Council of the Institute in December, 1925, a conference of delegates of the provincial professional associations was held at the Institute Headquarters in Montreal in February 1926, in order to consider this situation and other matters affecting the common interests of the associations. The principal item on the agenda of this meeting was co-operation with The Engineering Institute of Canada. The seven associations then existing were represented and the discussions lasted for three days, the resulting recommendations being submitted in due course to the councils of the several professional associations. Although defraying the expenses of the delegates, the Institute was not represented officially at this conference.

After appointing a corresponding secretary, the delegates left with a resolution recording the sense of close association developed by the conference and their appreciation of the courtesy extended to them by the Institute.

### Activities of The Institute Council

At its meeting of January 18th, 1927, Council was advised that, in accordance with its instructions, the secretary of the Institute had written to the secretary of the Corporation of Professional Engineers of the Province of Quebec, requesting him to communicate with the governing bodies of the various provincial associations of professional engineers, with a view to discussions as to the best method to be adopted to bring about substantial uniformity in the requirements for admission by examination to the several provincial associations and to the Institute.

In the same year the Institute's Board of Examiners, on instructions from Council, exchanged views with the Boards of Examiners of a number of the professional associations to see what could be done towards obtaining uniformity in examination requirements. No definite progress in this respect seemed possible at that time without meetings for discussion, but in 1928 a revised examination syllabus of the Institute was prepared and communicated to the associations, as a possible basis for further action.

In October, 1927, the First Plenary Meeting of the Council of The Engineering Institute of Canada took place. The afternoon session of October 11th was devoted to a consideration of the policy to be pursued as regards the Institute's relations with the various provincial associations. The necessity of developing uniform admission examination requirements was stressed and it was resolved "that a standing committee representative of all the interested provinces of the Dominion of Canada be appointed by the Council of The Engineering Institute to study the problems involved in co-ordinating the activities of The Engineering Institute of Canada and the several associations of professional engineers." This committee was called the Committee on Relations of the Institute with the Professional Associations, and its personnel was named at the Council meeting of November 25th, 1927.** It consisted of Institute members from all the provinces.

### Work of The Institute's Committee on Relations

The Committee was unable to commence work for some time and made no report at the annual meeting of February 1928. In June of that year Mr. George McLeod, the chairman, was compelled to resign through pressure of other work and Mr. S. G. Porter was appointed chairman.

The Second Plenary Meeting of Council was held in Montreal on October 15th, 16th and 17th, 1928. At this meeting the chairman of the Committee on Relations was able to present an interim report which stated that this committee was studying the following questions:—

"1. Considering the welfare of the profession in its broadest sense, what relationship should exist between The Engineering Institute of Canada and the various provincial associations ?

2. What obstacles are there in the way of attaining the desired end ?

3. What procedure do you suggest for overcoming them ?"

While the Committee was not yet in a position to make a definite recommendation, it appeared that many of its members believed that the ultimate integration of all the provincial professional organizations was attainable, but the Committee had not been able to define the action which in its opinion The Engineering Institute should take in this movement.

The Committee was continued under the chairmanship of Mr. Porter to report at the next plenary meeting of Council; discussion brought out the suggestion that the provincial associations might possibly function as provincial divisions of the Institute.

At the meeting of Council on January 22nd, 1929, upon the request of the chairman of the Committee on Relations, the secretary was directed to communicate with the council of each of the provincial associations suggesting the appointment of provincial committees to co-operate with the committee of the Engineering Institute. In its report for the year 1928, Council indicated "that some progress had been made towards the establishment of a more uniform standard of requirements for admission to these bodies (professional

*Which provided for Dominion-wide medical registration and qualification.

**See *The Engineering Journal*, November 1927, page 497.

associations) and to the Institute, whether by examination or otherwise."

The Committee on Relations made a report to the Annual Meeting in February, 1929, indicating that this Committee was in active correspondence with members of the provincial associations and stating—"it is felt that events are tending towards the amalgamation of the various provincial associations into some kind of Dominion-wide organization, and that the time is now opportune for the Engineering Institute to offer the benefit of its organization and the machinery to bring all these organizations together... The sentiment for consolidation with the Engineering Institute is favourable among a large body of members of the provincial associations."

In March, 1929, Council appointed a Committee on Policy, under the chairmanship of Dr. O. O. Lefebvre, to investigate and make recommendations as to such changes as seemed desirable in respect of the present classes of membership in the Institute, its organization, publications, and general policy.

At its meeting of September 10th, 1929, on the suggestion of Mr. Porter, Council decided to invite a representative from each provincial association, who was also a member of the Institute's Committee on Relations, to take part in a meeting of that Committee to be held at Headquarters on October 5th, 1929, just previous to the coming plenary meeting of Council.

The Third Plenary Meeting of Council was held in Montreal on October 7th, 8th and 9th, 1929. To this meeting Mr. S. G. Porter presented the report of the Committee on Relations, which was unanimously adopted by the Council. On the motion of Dr. Lefebvre it was unanimously resolved:

"That the secretary renew the invitation sent to each of the provincial associations in February 1929, requesting them to co-operate with The Engineering Institute of Canada, and sending them a copy of the report of Mr. Porter's committee, with the statement that the Council of the Institute had adopted the recommendations contained therein."

This report of the Committee on Relations was presented at the Annual Meeting of February 12th, 1930, and after considerable discussion was adopted, one member dissenting. It dealt with uniformity of requirements for admission; reciprocal registration arrangements; advantages of a national organization to represent the whole profession, especially in connection with legislation and public welfare; and the increased ability to promote the educational function of the profession. Its recommendations were as follows:

1. That this Committee or a similar one be continued.
2. That at least one member of Council in each province be added to the Committee to act during his term of office in all cases where Council is not already represented.
3. That this committee be authorized to appoint a small sub-committee whose duty it shall be to approach the provincial associations and in conjunction with them devise a detailed proposal to bring about a co-ordination of the interests and activities of the various provincial associations and The Engineering Institute of Canada; and further, it is recommended that a sum of $1,800 be appropriated towards a fund to provide for the expense of this work.
4. That The Engineering Institute of Canada, through the *Journal* and otherwise, continue to encourage and support the activities of the provincial associations, and contribute in every reasonable way to their success.
5. That immediate steps be taken to arrive at an agreement among the professional associations, and the Institute, for the adoption of standard uniform requirements for admission to membership, and that these requirements be rigidly adhered to.
6. That upon the acceptance of such standard requirements, the Institute should adopt the policy of accepting membership in a professional association as sufficient evidence of qualifications for admission to The Engineering Institute of Canada.
7. That steps be taken to secure the necessary amendments to the by-laws so that membership or registration in a professional association be one of the requirements for admission to corporate membership in The Engineering Institute of Canada for all applicants residing in a province where an engineering profession act is in effect.

The Committee on Relations was accordingly continued, and at the meeting of Council held on April 11th, 1930, Past-President H. H. Vaughan was appointed chairman in succession to Mr. Porter, and a sub-committee was appointed in accordance with recommendation No. 3 to approach the provincial associations.

At this meeting the Council was informed that the Professional Association of New Brunswick had appointed a committee to consider the question of closer co-operation between the various provincial associations and the Institute.

At this point it is of interest to note that the recommendations of the 1930 report of the Committee on Relations—particularly items 5 and 6—contained provisions which were very similar to those of the agreements now in force or pending between some of the professional associations and the Institute.

### A National Committee Proposed by Institute

At the Fourth Plenary Meeting of Council, held in September, 1930, Mr. Vaughan presented a further report from the Committee on Relations, which recommended that a study of the possibilities in the matter should be made by a national committee nominated by all of the provincial associations and the Engineering Institute. This national committee would be asked to make an analysis and comparison of the various provincial acts and requirements for admission, which it was hoped would lead to the working out of a draft set of by-laws and requirements for membership that could apply to all the provincial associations and to The Engineering Institute of Canada. This work of analysis and drafting was to be done by a sub-committee of three (afterwards changed to four) members of the National Committee, representing the Maritime Provinces, Quebec and Ontario, the Prairie Provinces, and British Columbia respectively. It was thought that when such a draft had been prepared and had been criticized by all members of the National Committee it might then be submitted to the councils of the associations and of The Engineering Institute of Canada for their consideration. This proposal was at once approved by the Institute's Council.

At the Institute's Annual Meeting in February, 1931, the Committee on Relations reported* that the proposals for a National Committee were under consideration by the governing bodies of the professional associations, and that some of these had already approved of the suggestion and had appointed their members on that committee. Ultimately members of the National Committee were appointed by the councils of seven of the eight professional associations, who thus concurred with the course proposed.

At this point, however, the council of one of the provincial associations maintained that co-ordination of all activities of engineering associations throughout Canada might be obtained more readily by developing a plan which would at first apply only to the provincial associations. Definite objection was made to any plan which would at once include The Engineering Institute of Canada. Further, the council in question was unable to approve of the proposed Committee of Four unless its members were accredited by the associations alone, the Institute taking no further active part for the time being.

After due consideration, the president of the Institute and the chairman of its Committee on Relations felt it necessary to allow this objection, and consequently the

*See *The Engineering Journal*, February 1931, p. 102.

matter rested at this stage, awaiting further action by the associations. Meanwhile the Council of the Institute again further expressed its desire to co-operate with the associations in furthering the best interests of the profession throughout Canada.

### Associations Alone Establish Committee of Four

The Committee of Four—all representatives of the provincial associations—was convened in Montreal, August 24th, 1931. The members of this committee were:

J. M. Robertson, M.E.I.C., representing Ontario and Quebec.

C. C. Kirby, M.E.I.C., representing New Brunswick and Nova Scotia.

R. S. L. Wilson, M.E.I.C., representing Manitoba, Saskatchewan and Alberta.

A. S. Gentles, M.E.I.C., representing British Columbia.

Their report, which was made to the councils of the professional associations, was dated September 4th, 1931, and contained recommendations which ultimately gave rise to the present Dominion Council of Professional Engineers.

The opinion of this committee was that "a Dominion-wide body representing the entire engineering profession and embracing all of its activities is a practical ultimate possibility..."

The objective of such a body would be "the co-ordination of all activities permissible under the provisions of the British North America Act."

Thus, in 1931, the professional associations and the Engineering Institute were agreed on the fundamentals of such co-ordination, but it has taken a further ten years to work out details of any practical working agreement.

The Fifth Plenary Meeting of Council was held in Montreal on September 21st, 22nd and 23rd, 1931. At this meeting the report of the Committee on Relations was received which outlined the formation and policy of the Committee of Four of the provincial associations, and stated that to meet the views of the British Columbia Association the Institute had officially withdrawn from deliberations on co-ordination for the time being. The Institute, however, was ready to co-operate in every possible way to promote the work of the Committee of Four.

The Committee of Four reported on September 4th to the professional associations and recommended the formation of a larger body, the "Dominion Council of the Engineering Profession" composed entirely of representatives of the professional associations.

At the Annual Meeting of February 1932, the Institute approved the action of the plenary meeting with reference to the activities of the Committee of Four of the professional associations.

There was little activity in professional engineering legislation in 1932, except that the Ontario Association endeavoured to get an amendment to their act as so to prevent the practice of professional engineering by unregistered persons. Their original act merely prevented the unauthorized use of the title "Professional Engineer." The act in British Columbia had been amended along these lines in 1930.

### Dominion Council Formed by Associations

The provincial professional associations, having appointed representatives to a "Dominion Council of the Engineering Profession" as recommended by the Committee of Four, this Council, beginning as a "Committee of Eight," met in Montreal on February 1st, 1933, and issued a report under date of February 4th, in which it stated, "We believe that there is every reason to expect that the ultimate outcome of such studies will be the complete co-ordination of all activities of the engineering profession in Canada." A proposed constitution for the Dominion Council was drawn up and included in the report. The Committee of Eight held no further meetings, its work having been continued by the Dominion Council.

### Institute Shows Continued Interest

The Maritime Professional Meeting of the Institute which was held at White Point Beach, Nova Scotia, in July 1933 was noteworthy as being the first professional meeting of the Institute to be held with the active co-operation and support of one of the provincial associations of professional engineers. It was in fact a joint undertaking. Some of the sessions were those of a Maritime General Professional Meeting of the Institute; a portion of the time was devoted to a General Meeting of the Association of Professional Engineers of Nova Scotia. The great majority of engineers attending were members of both organizations, so that this arrangement presented no difficulty. It gave an effective demonstration of the way in which the educative and technical work of the Institute could be carried on in conjunction with the official duties of a professional association.

Representatives of all the four Maritime Branches of the Institute were present, as well as members of the Association of Professional Engineers of New Brunswick. The onerous work of preparation for the meeting was actually performed by a joint committee composed of members of the Halifax Branch of the Institute and members of the Association of Professional Engineers of Nova Scotia.

The Sixth Plenary Meeting of Council was held in Montreal on October 30th, 31st and November 1st, 1933. It considered in detail the proposals of a Committee on Development which had been appointed in November 1931 to review the constitution and aims of the Institute. After discussion, the proposals were approved for submission at the annual meeting and subsequent ballot by the membership. The Council placed on record its desire to co-operate in every way with the provincial associations of professional engineers and it was resolved that the Institute should take every opportunity to collaborate with the provincial associations, particularly in endeavouring to secure a generally acceptable uniform scheme of registration of engineers in all parts of the Dominion.

At the Annual Meeting of the Institute held in Montreal on February 8th, 1934, the final report of the Committee on Development, as expressed in a proposed revision of the by-laws of the Institute, was received and caused considerable discussion. It was pointed out that the wording of some of these by-laws would be affected by the policy to be followed regarding closer relationships with the provincial associations, and the suggestion was put forward that it might be wise to forego sending these by-laws out to a ballot of the general membership until further efforts had been made toward closer co-operation between the Institute and the professional associations, which might modify to a considerable extent some of the by-laws proposed. It was found, however, that the regulations of the Institute would not permit this delay. When the ballot was taken, the proposed amendments failed to carry.

At the meeting of Council of June 5th, 1934, a proposal was presented for renewed action by the Institute, looking toward the co-ordination of the profession in Canada, but consideration of this matter was postponed until the fall. This Council meeting decided that the subject for the Past-Presidents' Prize for the year 1934-35 should be, "The Co-ordination of the Activities of the Various Engineering Organizations in Canada."

### Institute Branches Request Further Action

During 1934 Council received a number of communications making suggestions regarding co-operation with the associations. In October, the Halifax Branch forwarded a resolution to Council favouring the consolidation of the profession in each province and throughout the Dominion.

At its meeting of November 16th, Council received a communication from the Vancouver Branch dealing with the future policy and lines of development of the Institute. At this meeting the Council approved certain amendments to the Winnipeg Branch by-laws, which were calculated to facilitate the co-operation of that branch with the Association of Professional Engineers of Manitoba. This meeting of Council also discussed a suggestion from the president of the Association of Professional Engineers of Alberta, that the Institute might act as a clearing house in communications between the associations of professional engineers and the Department of Immigration with regard to applications for admission of foreign engineers to Canada. The suggestion was approved, provided the consent of all professional associations to the arrangement could be secured.

The Montreal Branch, at its Annual Meeting of January 10th, 1935, discussed the question of consolidation, and at a further meeting of January 30th, forwarded to the Council for presentation at the annual meeting, a resolution similar to that of the Halifax Branch.

### Work of The Institute's Committee on Consolidation

At the Annual General Meeting of the Institute held in Toronto on February 7th, 1935, the above resolutions, together with resolutions from the Ottawa Branch, the executive committee of the Quebec Branch, the executive committee of the Border Cities Branch, the Lethbridge Branch and the Association of Professional Engineers of the Province of New Brunswick, were presented, and thus the question of consolidation became the chief business of the meeting. As a result, a Committee on Consolidation was formed, under the chairmanship of Gordon MacL. Pitts, "to develop the possibilities of consolidation of the engineering profession in Canada." This committee was instructed to report its findings through Council to a general meeting of the Institute.

Thus the Committee on Consolidation had necessarily as its principal object the establishment of closer relations with the eight provincial associations of professional engineers, as a first step towards the organization of the engineering profession in Canada on a truly national basis.

It was obvious that the diversity of the interests concerned made the problem difficult of solution. While there are a large number of Canadian engineers who actively support the registration movement by belonging to the associations, there are many who do not do so. Some of the corporate members of the Institute are not registered. As regards non-members of the Institute, some belong to no organization at all, some belong to a professional association, and others have joined non-Canadian engineering bodies.

There seemed to be at least two main schools of thought on this question. On the one hand there was the view that everyone should be registered who is engaged in any kind of engineering work requiring professional training as distinguished from the work of a foreman or skilled craftsman. On the other hand some believed that legal registration as a professional engineer should be required only of those whose work makes them personally responsible for the protection of the public. A totally different doctrine was held by those few who did not believe in registration, and were of the opinion that legal authorization to practice is unnecessary for any engineer, either in his own interest or that of the public.

Any scheme for the better organization of the profession which can commend itself to all, or even a majority, of the holders of these divergent opinions must evidently contain features on which some compromise has been made. In fact, both the engineers whose main interest lies with the legal work of the associations, and those who attach more importance to the technical and educational work of the Institute, would have to give some effective recognition to their opponents' views before any workable plan could be evolved.

In regard to this matter, the attitude of the Council of the Institute has been consistent ever since 1919, when it gave approval to the proposed provincial legislation based on the Model Act prepared by an Institute committee. It is true that at that time no attempt was made to relate the new legal organizations to the Institute, and, in the light of later events this was perhaps unfortunate. It would seem that if the legal and other difficulties involved in forming such a relation had been faced at that time, more rapid progress would have been possible.

The Institute Council, however, has constantly endeavoured to promote closer relations with the provincial associations and thus bring about a measure of unity in the profession in Canada. The history of these efforts was summarized in the report* of the Committee on Consolidation which its chairman presented at the Annual Meeting of 1936.

In this report, prepared after a year of strenuous work, the committee put forward a series of proposals for the amendment of the Institute by-laws, defining the lines along which, in the committee's opinion, the Institute could best co-operate with the associations.

The principal features of the proposals were, the recognition by the Institute of membership in the associations as a qualification for membership, the establishment of a standing committee to be known as the Committee on Association Affairs, representation of the associations on the Institute Council, the abandonment of the grade of Associate Member in the Institute; associations which co-operated with the Institute would be known as Component Associations. In a province where a Component Association existed, membership in that association would in future be essential for admission to the Institute.

After preliminary discussion at the annual general meeting of 1936, these proposals, and in fact the whole relations of the Institute with the professional associations, were the main subjects of debate at the Seventh Plenary Meeting of Council held in Montreal, October 1936.

At that meeting the proposals of the committee underwent some modifications before being approved by Council for submission to the next annual meeting and, if then accepted, for ballot of the membership as required by the by-laws.

During the discussion, Mr. C. C. Kirby, president of the Dominion Council of Professional Engineers, said that he believed the desires of the majority of engineers in Canada were:—

(a) Closer co-operation between the provincial associations;
(b) Some form of alliance with a national body organized so as to avoid the present duplication of fees; and
(c) The national body to be representative of the whole engineering profession.

The idea of creating a new body to implement (a) and (c) was acceptable in some provinces, but unacceptable in others, because the Institute with its history of service to the profession was available. The provinces themselves were not unanimous on the registration movement, and some engineers now members of the Institute were not required by the nature of their employment to become registered. The idea that the associations should also maintain permanently their own Dominion Council had proved unacceptable to some associations. He believed that the proposals of the Committee on Consolidation appeared a practical compromise between all these views.

Mr. Kirby presented a suggestion from British Columbia that all associations should have representation on the Council of the Institute in proportion to the number of their members, provision also being made for accredited substitutes with proxy rights.

Mr. Kirby did not think that such a proposal had ever been made in connection with the Dominion Council, and said that under the committee's proposals every member of an association would be represented on the Institute Council by his own association's appointee.

There was no intention or possibility of transferring any powers legally belonging to the associations to the Institute or its standing committee.

The proposals of the Committee on Consolidation were

* See *The Engineering Journal*, January 1936, pp. 35-39.

duly discussed at the Annual General Meeting in January, 1937, and the proposed revisions to the by-laws were sent forward to ballot by the membership. A difference of opinion between Council and the Committee on Consolidation led to the submission of an alternative proposal by Council in respect to one section of the proposed amendments.

The proposals submitted to the membership were intended to be a compromise to safeguard the interests of all members of the Institute. It was also hoped that the proposals would enable the professional associations to unite in co-operating with the Institute. Such co-operation would make it possible ultimately to build up a Dominion-wide organization which would represent the profession as a whole.

In this connection it must be remembered that apart from the Institute and the professional associations, there exist in Canada a number of important technical societies, some of which are branches of non-Canadian organizations, whose ultimate co-operation would be essential for the full development of the organization movement. As yet it had not been feasible to consult officially with these bodies, since it was first necessary to find a solution for the problem of co-operation with and between the professional associations.

When the ballot was taken in April 1937, however, there was a substantial majority against the amendments which embodied the proposals of the Committee on Consolidation. It seemed evident, however, from the many discussions which had taken place, that most Institute members, while objecting to certain details of this particular scheme, were, nevertheless, sincere supporters of the principle of co-operation between the Institute and the associations.

### Discussions with some Associations Begin

Following the announcement of the results of this ballot, the subject of the Institute's relations with the associations came up at practically every Council meeting during the year. It soon appeared that in certain provinces, particularly Nova Scotia, New Brunswick, Manitoba, Saskatchewan and Alberta, the problem of co-operation might be regarded as comparatively simple. In these instances the number of members involved is not large, and it was felt that working arrangements could be established with some of these bodies if the Council were authorized to enter into agreements with the associations concerned. But as regards the three other associations, the situation seemed different. Their membership is larger and contains a greater proportion of association members who are not in the Institute. There are also a considerable number of members of the Institute who do not belong to those associations. For these and other reasons, the desirable objects, such as common membership, or uniform standards of admission as between the associations themselves and with the Institute, are more difficult of attainment in these cases.

In fact, at its meeting in May 1937, Council was informed that a local committee in Nova Scotia was studying the possibilities of co-operation there between the Institute and the Professional Association. Discussions along similar lines were taking place in Saskatchewan and Manitoba. The president reported in regard to a visit to Winnipeg, which he had made at the request of Council to meet the members of the Winnipeg Branch and the members of the Manitoba Professional Association. He outlined the proposals for co-operation between the Institute and the Association in Winnipeg which had been under consideration there. It was reported that the Council of the Association of Professional Engineers of New Brunswick was also considering the matter. In compliance with a suggestion from Halifax, Professor H. W. McKiel and Mr. C. A. Fowler were appointed to represent the Institute Council in the Nova Scotia discussions.

### The Council Forms Committee on Professional Interests

The Eighth Plenary Meeting of Council was held in June, 1937. At this meeting, Council discussed the relations of the Institute with the professional associations in Nova Scotia, New Brunswick, Manitoba and Saskatchewan, and a resolution was unanimously passed expressing Council's desire to co-operate with all the associations. After discussion, it was decided to appoint a Committee on Professional Interests under the chairmanship of Past-President F. A. Gaby, with Past-President O. O. Lefebvre and Councillor F. Newell as members. Its duty would be to deal *inter alia* with matters involving negotiations with the professional associations, without prejudice, however, to the negotiations in Nova Scotia, and working with the aid of provincial sub-committees.

In October 1937 a number of proposals for the amendment of the Institute by-laws were received from thirty-one corporate members for submission to Council. These were based on some of the important provisions submitted by the Committee of Consolidation in 1936. They proposed the retention of the class of Associate Member; the automatic admission of corporate members of the professional associations, subject to classification by Council; the establishment of Component Associations, and of a Committee on Association Affairs; the payment by a Component Association annually to the Institute of a fee of 50 cents for each member of a Component Association licensed to practise; the payment by a Component Association whose corporate members are admitted as members of the Institute of a *per capita* annual fee to be determined by the Council, which would include the *per capita* fee of 50 cents referred to, and an annual subscription to the *Journal;* the recognition of a new class of non-corporate membership to be called "Provincial Associates" which would comprise those members of an association who do not become members of the Institute; the compulsory investigation by Council of the conduct of any member who might be expelled from a Component Association; the fixing of the entrance fee of the Institute for all corporate members at $15.00.

At the October meeting of Council, Messrs. McKiel and Fowler attended and presented their report on the situation in Nova Scotia, outlining a scheme for co-operation which had been endorsed by the Council of the Association and by the Institute branches in Nova Scotia. They recommended that Council express its willingness to enter into an agreement with the Association whereby the Institute would accept all members of the Association as corporate members of the Institute, while the Association would collect a single fee from all of its members, covering the annual fee to the Institute, a sum for the operation of the Institute branches in Nova Scotia, and the annual fee to the Association. This arrangement would be conditional on all members of the Association joining the Institute.

After discussion, the scheme was approved in principle, and it was directed that a letter ballot of Council should be taken as to Council's willingness to enter into such an agreement. It was noted that as the proposal would involve a change in the schedule of fees for Nova Scotia members, it would be necessary to obtain an amendment to the by-laws empowering Council to enter into an agreement of this kind.

At the same Council meeting, the proposals of the thirty-one corporate members for the amendment of the Institute by-laws, which had been sent in on October 1st, were submitted for Council's consideration in accordance with Section 75 of the by-laws.

Council was of the opinion that in view of the report just received from Nova Scotia and the activities of the Committee on Professional Interests, it would be desirable to suggest to the representatives of the thirty-one proposers either the withdrawal of their proposals and the substitution of an amendment legalizing Council's action regarding the Nova Scotia agreement, or some modification of their proposals which would bring them more in line with Council's views as developed during the year. With this in mind a committee consisting of the president, Past-President Shearwood, and the presidential nominee, J. B. Challies, was appointed to confer with representatives of the proposers.

In Council's view, the length and apparent complexity of the proposals of the thirty-one members, as well as the retention of many points of similarity with the consolidation proposals which had been so recently rejected on ballot, would make it very difficult to secure their acceptance by vote of the general membership, whereas a briefer and broader proposal would have a much better chance of obtaining the necessary majority. Further, these proposals might tend to confuse the promising negotiations presently in hand with several of the associations.

After discussion, the representatives of the thirty-one proposers felt that, without consulting their principals, they could not undertake to withdraw the proposals. Such consultation would take place as quickly as possible.

At the Council meeting held in November, it was reported that on letter ballot a majority of councillors thought that Council should express willingness to enter into an agreement with the Nova Scotia Association. No negative votes were cast.

A similar request having been received from New Brunswick it was decided to take similar action in that case and to notify our representatives in both provinces of Council's favourable decision in both cases.

In regard to by-law amendment, the president submitted three sections drafted as a compromise and reported that they had not been acceptable to the representatives of the thirty-one proposers. On the other hand, after a full discussion, Council felt unable to accept the new sections put forward by the thirty-one proposers.

### New By-Law Enables Council to Negotiate Agreements

The members of Council present then agreed on the draft of a new by-law merely enabling Council to co-operate with any of the professional associations and enter into agreements with them in furtherance of the mutual interests of the members of the Institute and of the associations, and in particular respecting the admission of their members to the Institute and the amount and method of collection of fees. It was directed that this draft should be submitted to all members of Council for approval by letter ballot before being put forward as a definite proposal of Council.

It was the opinion of Council that the situation arising from the rejection of the proposals of the Committee on Consolidation would be met most effectively by this simple by-law, giving Council the power to enter into agreements with the associations. When this was explained to the representatives of the thirty-one corporate members, they accepted the suggested by-law in lieu of their proposals, an action which was appreciated, since it opened the way for immediate action on co-operative agreements with several of the associations.

Accordingly, the proposed new by-law (now Section 78) was presented by Council, and discussed at the Annual Meeting of 1938; it was then accepted for ballot. When voted upon in March, the membership approved it by an overwhelming majority.

### Meeting of Dominion Council in Montreal

An event of interest to the Institute as well as to all association members was a meeting of the Dominion Council of Professional Engineers, held in Montreal in April 1938, and attended by representatives of seven of the provincial associations.

The principal business before the meeting was consideration of the differences between the various provincial associations of professional engineers in respect to charters, by-laws and methods of procedure, with special reference to those features governing interprovincial practice.

### Discussions With Nova Scotia

In 1938 the first draft* of a proposed agreement between the Institute and the Association of Professional Engineers of Nova Scotia had already been under discussion for some time by accredited representatives of both bodies. After publication in the *Journal* it had been approved almost unanimously by letter ballot of the Institute Council, and by vote of corporate members of the Institute resident in Nova Scotia. Definite action on the part of the Nova Scotia Association did not follow immediately, however, some doubt having arisen as to the Association's legislative authority to complete the agreement in the precise form which had then been negotiated.

### Agreement with Saskatchewan Association

During the winter of 1937-38 a committee of the Saskatchewan Branch of the Institute had been studying the possibility of co-operation in that province, and had prepared a draft agreement. The relations of that Branch with the Association of Professional Engineers of Saskatchewan have always been cordial; in fact, it had been the regular practice to hold joint meetings and functions. The executive committees of the Branch and of the Association jointly considered the draft and approved it with minor amendments on April 22nd, 1938. It was published in the *Journal* in August.** In September it was approved by ballots of the Institute Council, of the Institute's corporate members resident in Saskatchewan, and of the members of the Association. Thus it was possible to arrange for the formal signing in Regina on October 29th, 1938, of the first co-operative agreement between The Engineering Institute of Canada and one of the provincial associations of professional engineers. The president of the Institute, the general secretary and the chairman of the Institute's Committee on Professional Interests journeyed to Regina for this important ceremony. Addresses marking the occasion were delivered by the president of the Institute, Dr. J. B. Challies, and by the president of the Association, Mr. J. W. D. Farrell; the proceedings were broadcast from coast to coast.

The main purposes of this agreement for the co-operation of the two bodies may be stated as:

(a) Common membership in the province of the Institute and the Association,
(b) Simplification of arrangements for the collection of fees,
(c) Reduction in total fees payable by those who are members of both bodies,
(d) Management by a common executive.

Under the Saskatchewan agreement all registered professional engineers in the province, not already members of the Institute, became corporate members without entrance fee. The Association's "Engineers-in-Training" became Juniors of the Institute.

Thus the Saskatchewan Branch of the Institute now consists of all members of the Institute resident in Saskatchewan and all members of the Association.

The Association collects one joint annual subscription from each of its members, from which an agreed sum is paid to the Institute in lieu of its ordinary membership fee.

The officers and council of the Association become the officers and executive committee of the Saskatchewan Branch and are responsible for its financing and management.

All meetings are announced as meetings of The Engineering Institute of Canada and the Association of Professional Engineers of Saskatchewan.

The tangible results of this agreement, which has now been in operation for five years, are the best evidence of the benefits accruing to the engineering profession in a province by the consummation of such an agreement. During the first year forty-eight members of the Saskatchewan Association, who were not previously members of the Institute, joined the latter body, and thirty-three members

*Published in *The Engineering Journal*, March, 1938, p. 247.

**See *The Engineering Journal*, August 1938, p. 396.

of the Institute became members of the Professional Association. In addition fifty-four members of the Association automatically became members of the Institute with the signing of the agreement in 1938.

### Agreement with Nova Scotia Association

As regards Nova Scotia, discussions on the draft agreement prepared in 1937-38 continued for some time, while efforts were made to remove or avoid certain technical difficulties. It was not until 1939 that a revised proposal[1] was ready for submission to ballot. The qualified voters, both of the Association and the Institute, approved it, and it was formally signed in Halifax on January 25th, 1940. The Institute was represented at the ceremony by President H. W. McKiel and the general secretary. The president—S. W. Gray—and the registrar signed on behalf of the Association. Thus the seal was set on the result of discussions which had commenced as early as 1934.

The Nova Scotia Agreement, while not identical with the Saskatchewan document, contains many similar provisions. It places the management of the joint affairs of both bodies in the hands of a Joint Finance Committee. A single fee is paid by members to the treasurer of the Association, from which the necessary payments to the Institute and its Nova Scotia branches are made.

### Agreement With Alberta Association

By January 1940 the discussions regarding co-operation between the Institute and the Association of Professional Engineers of Alberta had enabled the joint committee—which represented both bodies—to draw up a draft agreement. This draft received the general approval of the Association at its Annual Meeting in March, after similar approval had been given by the Institute Council.

After discussion with the officers of both bodies, and following a conference with two headquarters representatives of the Institute's Committee on Professional Interests who went to Calgary for the purpose, the joint committee completed a final version of the agreement, which, after being accepted by the Council of the Association, was ready in August for formal approval by both bodies. This approval involved the publication of the agreement[2] and its submission by ballot to the members of the Association and to the members of the Institute.

These ballots were overwhelmingly in favour of the agreement, which was accordingly signed in Calgary on December 14th, 1940, by President T. H. Hogg and the general secretary for the Institute, and by President H. J. McLean and the registrar for the Association.

This agreement is generally similar to that with the Saskatchewan Association. As in the case of Nova Scotia, the Alberta Agreement states that to promote close co-operation between the two bodies, the objects are:

(a) A common membership in the province of the Institute and the Association.

(b) A simplification of the existing arrangements for the collection of fees.

### Agreement with New Brunswick Association

In New Brunswick, conferences on co-operation between the Institute and the Professional Association began in 1937, and discussions continued for some time.

As a result a draft agreement was prepared during 1941 following the general lines of those already in force, but with some modifications to meet local conditions.[3] It was then duly approved by the Institute Council, by the two Institute Branches in New Brunswick, and by an almost unanimous ballot of the members of the Association.

The ceremony of its signature took place in Saint John on the evening of January 12th, 1942, at the time of the Annual Meeting of the Association. The signing officers were Vice-President K. M. Cameron and the general secretary of the Institute, together with the president of the Association, G. L. Dickson, and its secretary.

Thus there are now four provinces in which the provincial body and the Institute have come to a working arrangement whereby the benefits of each become available to the other.

### Manitoba

Discussions initiated in 1934 have also been proceeding with the Association of Professional Engineers of Manitoba. After some unavoidable delay, a draft[4] was arrived at in 1942 and is now (September 1943) being voted upon by the Association membership and by the Institute membership in Manitoba, having been approved by the Institute Council at its February meeting.

### Present Situation

The foregoing review of the various events which have led to the results already achieved, gives some idea of the difficulties which have had to be surmounted in each case by the give-and-take of the representatives of the contracting parties. The situation is complicated, not because of unwillingness or animosity, but largely because of the diversity in the character of the professional engineer's work in the different provinces, the preponderance of one or more branches of engineering in a province, or the association's general policy as determined by industrial or economic conditions in the province concerned.

The cordial relations existing between the Engineering Institute and the Dominion Council brighten the prospect for an eventual solution of the engineering registration problem in Canada. In the Dominion Council the profession has an influential body which can do much to secure the necessary uniformity in the professional requirements and legal regulations obtaining in our different provinces.

In The Engineering Institute of Canada there is available a Dominion-wide organization of recognized standing admitting members of all branches of the profession, and promoting united action as regards technical matters, professional information, and the general welfare of its members.

---

[1] Published in *The Engineering Journal*, December 1939, p. 534.

[2] See *The Engineering Journal*, September 1940, p. 403.

[3] See *The Engineering Journal*, November 1941, p. 549.

[4] See *The Engineering Journal*, September 1943, p. 535.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## PROFESSIONAL ENGINEERS

From *The Engineer* (London, Eng.), August 20, 1943.

The world is hearing a great deal about the so-called "working classes" of society. Their welfare is a prime preoccupation of economists. All Governments are concerning themselves with measures for improving their health, increasing their education, ensuring employment for them, and removing from their shoulders responsibilities and anxieties. Whether all this is really for the best is a sociological question that is more likely to be answered by posterity than by the arguments of philosophy. Our concern at the moment is not with it, but with a correlated problem that is receiving far less sympathetic attention. Broadly speaking, there are, in peace, some fifteen million artisans or manual workpeople—male and female—in the United Kingdom. That leaves about thirty million non-artisans, of whom twenty million, say, are children and juveniles. Of the ten million that remain one-half, or thereabouts, are housewives or engaged in household duties, leaving, after allowing a little for "terminological inexactitude," some five million for the thousand and one occupations which are required by a society in a high state of civilisation. If we deduct from these the "upper ten thousand" there remains the great middle-class with its subdivisions into upper and lower. It is by this class that the bulk of the taxes are paid, directly and indirectly, and it is to this class that by far and away the largest number of great thinkers and organisers belong. From it are drawn directors and managers of industry, as well as those engaged in professional occupations. It may be said, in fact, that the middle class is the brains and enterprise of society. But principalities and powers have rarely shown any interest in it save as a milch cow, whilst it has often been anathematised and even murdered by the working classes under the hated epithet of "bourgeoisie."

It is to this often maligned class that professional engineers belong, and there is unquestionably a growing demand, particularly amongst younger men, that they should be represented by some corporate organisation that would watch over their interests, and save them from the neglect and indifference of the powers that be. The position is one of some delicacy. The great institutions can do little to help them. By tradition and by the terms of their charters they are required to restrict their energies strictly to the dissemination and advancement of scientific and technical knowledge. They may not concern themselves with anything that touches upon the remuneration of engineers or upon other matters associated with the conditions of their employment. Powerful as they might be in approaching the Government, or some lesser authority, on purely technical or scientific subjects, it would be outside their province to concern themselves in any way with the sociological problems of professional engineers. So conscientiously have they adhered to their established position that when the Engineers' Guild was founded some years before the war, they refused to give it their official countenance, although the individual sympathy of some of the members in office was not withheld. One of their major objections was that any organisation of the kind would inevitably acquire a savour of trade unionism and, stoutly as the Guild might protest that it was not, and had not the slightest intention of being a trade union, the fear was enough to alienate the good wishes of the institutions. Is, we may ask, this a case of giving a dog a bad name and hanging him ? With the increase of co-operative activities much that is done under the name of trade unionism must be done by associations that do not represent trades and that could not and would not desire to employ some of the practices of trade unions. If engineers could borrow from the medical profession—which has its British Medical Association—some such title as the British Association of Professional Engineers, the attitude of the great institutions might be modified.

Views have changed so greatly within the last few years that what would once have appeared undesirable and improper is now just as likely to be regarded as not only proper and desirable, but essential. Many of those who were brought up in the old school will still oppose a change from traditional practice, but the younger engineers will see the world in the light of their own day and will wish to accommodate themselves to the environment of their era. It may be regarded as a certainty that they will insist on the formation of some organisation, be it the Engineers' Guild or another, that will attend to aspects of their professional life which fall outside the proper scope of the chartered institutions. May we suggest to the great institutions that they would do well to assist by sympathy and advice in the building up of an association whose work would not compete with theirs in any respect, but would be complementary to it ?

## MOTOR SHIPBUILDING

From *Trade and Engineering* (London, Eng.) August, 1943

### Variable-Pitch Propeller

Although they cannot for the most part be placed in service until after the war, large motor-ships are being turned out by the Swedish shipyards at about the same rate as in normal times. The work on hand is sufficient to keep the whole shipbuilding industry occupied for the next three years, for it is understood that the vessels definitely contracted for amount to about 350,000 tons gross. Among recently constructed motor-cargo liners are some interesting vessels, and in certain cases innovations are being adopted which may have a marked influence upon the future of shipbuilding. In at least two of the leading Swedish yards riveting has now been displaced almost wholly by electric welding.

The most important Swedish ship lately launched is the *Suecia*, the delivery of which is expected in the course of the next month or so. She is by far the largest vessel to be equipped with variable-pitch propellers, and it is interesting that this should be the case since she bears an historic name. The original *Suecia* was the first motor-ship built to sail under the Swedish flag, and was sunk last year after 30 years' service. The owners, the Johnson Line, of Stockholm, will be able to ascertain the true value of variable-pitch propellers under normal sea-going conditions, since a sister ship, the *Argentina*, was completed a few months ago and will trade on the same route—namely, to South America.

Both these vessels are 452 ft. long, and in addition to carrying about 10,000 tons of cargo have accommodation for a number of passengers. The beam is 56 ft. 6 in., and the two Götaverken single-acting two-stroke engines of 3,500 b.h.p. are of sufficient power to give a normal speed of 16¾ to 17 knots fully laden.

The reversible propellers were built by A. B. Karlstads Mekaniska Werkstad and are known as the Kamewa type. They have three blades with a diameter of 13 ft. 9 in. There is a neutral position, so that while the ship is being manoeuvered the engines may continue to run at ordinary speed. One of the advantages claimed is that the frequent starting and stopping of the propelling engine in the normal ship is avoided, and this should lead to reduced liner wear. Moreover, the pitch may be set to give maximum efficiency according to the conditions of service. The engines are of the non-reversible type. The operating mechanisms is placed within the propeller hub, and the control is carried out electrically from the bridge. The principle of action of the propeller is based upon that of the well-known Swedish Kaplan water turbine, which has been built in powers up to 60,000 h.p. The Kamewa reversible propeller has already been installed in a number of smaller ships, but in no case has the power exceeded about 500 h.p. per shaft.

NEW CARGO TONNAGE

When oil-engine propulsion became widely adopted most shipowners in the Netherlands and Belgium had their new motor-vessels built in their own countries, while Norwegian owners usually went to Sweden and Denmark. Contracts were seldom placed in this country, mainly on the score of higher prices. Now that new British ships are being delivered to Netherlands, Belgian, and Norwegian account to replace tonnage sunk by war action, owners of these nationalities will, in many cases for the first time, have experience of the operation of British-built oil-engined ships.

A description of one of these ships lately delivered to the Belgian Ministry of Marine has been published in *The Motor Ship*. The vessel carries 9,600 tons of cargo and is equipped with four-stroke Harland-B. and W. machinery arranged amidships. A tank between No. 2 hold and the forward bulkhead of the engine-room carries over 900 tons of fuel oil, and in addition about 800 tons are carried in the deep tank. With all the tanks full the quantity of oil will give the ship a radius of action of some 30,000 sea miles. There are two holds forward and two aft of the engine-room, the total cargo capacity being 522,690 cu. ft.

One of the motor-ships recently built in this country and allocated to the Norwegian Shipping and Trade Mission is somewhat larger. In her a standard Barclay, Curle-Doxford opposed piston engine is installed, and whereas in the Belgian ship 10 3-ton electric winches are fitted on deck, in the Norwegian vessel the 12 5-ton winches are all driven by steam engines. The exhaust gases from the propelling engines pass through a composite boiler and raise sufficient steam for the operation of the steam-driven auxiliaries needed at sea. Doxford-type machinery is installed also in one of the new British-built cargo liners for the Netherlands Shipping and Trading Committee. Incidentally, the American Government is handing over to the Norwegians some new ships built in the United States, and among them are two of the C1 class of motor-ship with geared Diesel machinery. The vessels will remain the property of the American Government during the war, but will sail under the Norwegian flag with a Norwegian crew.

## "AND A GOOD JUDGE TOO!"

From *Manufacturing and Industrial Engineering*, (TORONTO, ONT.), AUGUST, 1943.

For several years past, there has been a growing tendency on the part of governments and public bodies to appoint commissions and committees of investigation of which the chairman is almost invariably a judge. While we appreciate to the full the high calibre of the Canadian judiciary and recognize the advantages of a judicial approach to the solution of most problems, we submit that many of the latter are of such a nature that they cannot be handled satisfactorily by men who have had the semi-classical training of lawyers. Frequently they have neither the ability nor the inclination to appreciate the scientific or technical viewpoint and their reasoning, however logical it may be, cannot lead to a correct conclusion if it is based on faulty premises. As a consequence, matters which are of relatively minor importance may be magnified to major proportions by interested parties and really important matters may receive scant attention. Such instances occur frequently in law courts when technical evidence is being presented. In a welter of expert evidence, mostly contradictory, many judges must be guided rather by their appraisal of the experts themselves than by the evidence which they can only understand to a limited extent.

Cases of this kind should be appraised by independent technical experts who would be appointed to assess the technical evidence, the judges being the arbiters in points of law.

Committees and commissions have semi-judicial functions to perform and the members should have some degree of familiarity with the matters at issue. In dealing with labor, for example, many factors which are vitally important can only be properly appreciated by those who have worked in factories and have first-hand knowledge of the subject. If this be true of committee members, it applies with greater force to the chairman, whose activities and opinions are frequently dominant.

There are some judges who have the requisite learning and experience but they are few in number and are seldom appointed to these chairmanships. The difficulty might be avoided by the appointment of a technical judiciary, if there were enough judges of this kind available and if the appointments could be free from political influence, (perhaps a vain hope!)

If it be maintained that a lawyer is the best kind of mediator in technical disputes, why not expand the idea and ask doctors to adjudicate on tenders for work and dentists to decide on the relative merits of competitive schemes. We may (or may not) agree with W. S. Gilbert that:

"The law is the true embodiment of everything that's excellent. It has no kind of fault or flaw,"—(Isolante) but even lawyers have their limitations. In any event, the present situation is often Gilbertain.

## GLIDER CROSSES ATLANTIC

From *Trade and Engineering* (LONDON, ENG.) August, 1943

### FUTURE POSSIBILITIES

Enormous new possibilities for the future are opened up by the achievement of the R.A.F. Transport Command in towing a fully laden glider 3,500 miles from Montreal across the Atlantic to Great Britain. A number of important lessons have been learned from the experiment, and if it is possible to accomplish such hazardous undertakings under war conditions it will obviously be possible to go even farther when peace restores a world-wide weather intelligence service and permits of wireless contact throughout the journey. The glider, which was loaded with medical and war supplies for Russia and Great Britain, was towed across by a twin-engined American-built Dakota transport aircraft, which has also been used as a troop carrier, and the distance was covered in stages in a total flying time of 28 hours. This was the first time that such a trip had been made across the Atlantic or any other ocean, and it established a record for the distance covered by a towed glider carrying freight.

Credit for the experiment belongs to Air Chief Marshal Sir Frederick Bowhill, A.O.C.-in-C., R.A.F. Transport Command, who, while commanding the North and South Atlantic Bomber Ferry from Canada, instituted cautious experiments with a view to collecting exact information about the ultimate possibility of an Atlantic "air train" service. The test was made as a foundation for further work to be carried out by the technical research branch of the Command.

THE GLIDER

The glider used is of special interest. It is a type C.G. 4A, with a wing-span of 84 ft., designed by the Waco Aircraft Company and built by a piano manufacturer in New York. The freight load is 1½ ton. For the flight it was equipped with rubber dinghies, ordinary ocean emergency equipment carried by bombers crossing the Atlantic, and flotation gear. The steel attachments for towing the glider were designed to take a pull of 20,000 lb., and the tow-rope was made of £80 worth of nylon. The glider is loaded and unloaded through a hinged nose; which opens and closes like a jaw.

On such a journey the glider must be flown manually all the time; there is no automatic pilot. The pilot must keep his eyes constantly on the towplane or the tow-rope if the tug aircraft is invisible in cloud or darkness. Special care must be taken at night or in cloud, for the pilot of the glider must judge his position in relation to the aircraft pulling him by the angle of the tow-rope, known as the "angle of dangle." The glider must be flown at about 20 ft. above the towplane. The take-off is the most difficult part of the flight. The wing loading of the glider is less than that of the tug aircraft and consequently it takes off at a lower speed, so that it is airborne while the tugplane is still on the ground. Should the pilot allow the glider to get too high before the tug has taken off, its tail could be pulled up so that no take-off at all would be possible. In flight it is essential not to let the glider get too low, otherwise the tail of the tug would be pulled down and the aircraft would stall in too steep a climb. In clear weather without an horizon the glider pilots take spells of about an hour; in clear weather with an horizon, two hours; but in bad weather the captain may have to stay at the controls for hours at a stretch. Noise complicates life for the glider pilots. Without a power unit though it is, the air pulses "like a goods train on worn tracks, a steady beating of wheels over joints" in one of the pilots words. The noise does not diminish until the glider speed falls below 70 knots. For communication between glider and tug wireless is used, using ordinary earphones and throat microphones. When not in use the glider switches off to save the batteries; if the pilot of the tug wishes to speak to the glider crew he waggles his wings as a signal. Change of temperature must be allowed for. There is no heating system in the glider. Out of the sun, in cloud or snow, the outside temperature can drop to 30 deg. below zero, and snow and ice can form inside the fuselage. Yet in clear sunshine, regardless of outside temperature, the glider is as hot as a glass-house; the celluloid cockpit concentrates the sun's rays.

THE TOWING AIRCRAFT

For the Atlantic crossing modifications were made to the towing aircraft. These included special tanks for extra fuel, tanks so made that they could be jettisoned intact, with their contents, should the need arise. Petrol could not be jettisoned loose, as it would spray back on to the glider and atmospheric electricity might ignite the petrol and set fire to the glider. A knife was carried in the aircraft to cut the fuselage open in case of emergency. The whole flight was made without incident, however. On the whole the weather was favourable, although conditions sleep was sometimes curtailed. The glider and its tug reached an aerodrome in this country exactly at their estimated time of arrival.

Before the actual ocean crossing a non-stop record flight had already been made by Squadron Leader R. G. Seys, D.F.C. of the R.A.F. captain of the glider, who began the experiments about six months before the crossing was attempted. All trials were carried out with the glider fully laden, to test the possibilities of a passenger, freight, military, or commercial "air train" service across the Atlantic. The first major achievement was a triangular flight from and back to Montreal, by way of Newfoundland and Labrador. The last leg of this flight, 820 miles, set up a record for a glider fully laden with freight, beating the American record of 670 miles. Longer flights followed. On one, southwards, from Canada, 1,177 statute miles were covered non-stop at an average speed of 150 m.p.h. This flight provided the data required for the Atlantic venture.

## MEDIUM ARTILLERY WITH DUAL SERVICE CARRIAGE

From *The Engineer* (London, Eng.) August 27, 1943

At the beginning of the war the Germans outclassed us in medium artillery. Steps taken to redress this situation were well under way when Dunkerque came. After that event the British Army had to be almost completely re-equipped with field artillery. Second place had to be allotted to medium artillery for the time being. Then followed the opening of the air attack on Britain, making even more pressing demands for anti-aircraft weapons. Ultimately it was found possible to give further careful study and to carry out exacting experiments, which resulted in the production of the 4.5/5.5 medium gun carriage. The details of these weapons can now be disclosed.

The first of the guns, the B.L. 4.5 in., has a high muzzle velocity and at ranges up to 20,500 yards with a projectile of 55 lb. it is highly effective, both as a lethal instrument and against earthworks. Mobility being an essential factor, the weight was kept down as low as possible consistent with strength. It weighs 16,048 lb. for gun and carriage. The comparable German weapon has now lost its prestige, for its performance consists of the projection of a 35.5-lb. shell at a range of 20,800 yards and its weight is only a fraction less than that of the British weapon. The second piece, the B.L. 5.5 in. gun, can throw a 100-lb. projectile to a maximum range of over 8 miles, exceeding its German counterpart by nearly 1,500 yards.

Conservation of material had also to be carefully maintained, and presented another obstacle. Guns could be destroyed in war with their carriages left intact, or *vice versa*. Ordnance experts therefore set themselves to the task of designing a carriage which would be equally available for either the B.L. 4.5 in. or the B.L. 5.5 in. howitzer gun. This was no easy problem, for a common factor had to be arrived at between the actions of two pieces of ordnance. The dual-service carriage, fully pneumatised, finally passed its tests, and it then became possible to go ahead with its production on the scale necessary to equip our Army and our Allies with suitable medium artillery.

## PLASTICS

### New Material for Castings

By Dr. V. E. Yorsley, F.I.C.

From *Trade and Engineering* (London, Eng.) August, 1943

No. 69 Grenade

Details have recently been published in America of the plastic unit long known as "No. 69," a hand grenade used for training in Canada and filled there to be shipped for offensive operations. No. 69 is a concussion grenade, filled with high explosive which is detonated by percussion when it lands, and thus contrasts with the Mills grenade of the last war, which was a fragmentation weapon made of cast iron operating on a time principle.

The No. 69 grenade, together with the No. 247 fuse, is moulded of medium impact cotton flock and woodflour filled phenolic, and as is usual with all war materials, has to conform to a rigorous specification. The material used must be dimensionally and physically stable over a range of temperature usually −40 deg. F. to + 170 deg. F. Not only must the material be unaffected by the explosive materials used in the grenades, but it must be totally inert to the action of weather, water, and mud.

The grenade itself consists of four separate moulded units, which are assembled with a phenolic impregnated paper tube and cemented together. The fuse has three moulded parts and five metal parts. As every plastic piece of both the grenade and fuse has at least one thread, the permitted tolerances are very close indeed, and rigid inspection is carried out as a matter of routine on all raw materials, and intermediate and finished mouldings. Sixteen moulds in all are employed for the production of the plastic parts in No. 69 and No. 247. It is stated that the weapon is almost an exact duplicate of the piece designed and produced in this country, the materials and the methods of manufacture of the Canadian grenade being developed in the Dominion.

# From Month to Month

News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers

### REMUNERATION OF ENGINEERS IN THE CIVIL SERVICE

Once again the Institute has made a try to assist those engineers who for so long have had to subsist on the meagre salaries afforded by the Civil Service. Following will be found a letter addressed to the Minister of Finance, Mr. Ilsley, in which the situation is reviewed, and the request made that in the national interest something should be done for these underpaid groups.

The Institute committee, consisting of N. B. MacRostie, chairman, and deGaspé Beaubien, along with the general secretary, called on Mr. Ilsley in September to present the letter and to urge that further thought be given to some means whereby the departments may attract to them young and competent engineers.

One argument used against raising the income of this engineering group is that it is contrary to the legislation. The wage ceiling legislation provides that adjustments may be made in the wages of groups which are abnormally low. To any person familiar with the subject this group certainly qualifies in the class for which adjustments are provided.

So far as can be discovered, the government has not yet altered the basic scale of any group in its service since the commencement of the war. However, this is not a sound reason for refusing to do anything for the engineers. Other expedients have been found for other groups. Why can't one be found for this ? A substantial change in the basic scale is what is required before the condition will be corrected satisfactorily, but other means of meeting the situation temporarily could be devised if the authorities really gave thought to it.

The government should lead in fair and wise treatment of employees, not drag behind, but a great change will have to be made as far as engineers are concerned before that desirable condition can be realized.

Montreal, September 17th, 1943.

The Hon. J. L. Ilsley,
Minister of Finance,
Ottawa, Ont.

Dear Mr. Ilsley,

It has come as a shock and disappointment to members of The Engineering Institute of Canada to find that the Treasury Board has not seen fit to revise the scales of remuneration which are now being received by engineers in the Civil Service, and which are being offered to prospective professional employees by the Service.

The committee which has been set up by the Council of the Institute to present to the Coon committee the case for the engineers was so well received by that committee that Council felt encouraged to believe that some relief would follow. In the light of this reception and the self-evident justification of the appeal, it is difficult to understand the Treasury Board's failure to bring about any amelioration of the conditions.

The Council of the Institute has been encouraged by the announcement that you would reconsider some of the points upon which the Treasury Board made no recommendation. Although the press announcement does not indicate which points you are reconsidering, it is hoped and can be reasonably presumed that the case of the engineers is one of them. It is upon this assumption that the Institute's committee now approaches you.

It appears to be a reasonable statement that the business of government is at least as important as that of private enterprises. In the post-war period great burdens of expenditure will continue to fall on both these employers. In this modern world so much of the responsibility for the economic spending of money falls on the engineer, that, to-day, his is perhaps the scarcest of all services. There is more competition for engineers than for any other group of citizens, because to them belongs principally the task of producing efficiency and avoiding waste.

Surely the government is interested in these two things as much as is industry. How can the government departments compete with private enterprise when they offer wage scales frequently less than half of what industry finds necessary and justifiable ? How can the departments hold their professional staffs when industry is searching for more men ? How can they recruit badly needed assistance when the basis of remuneration is so painfully inadequate ?

It is recognized that the government now has in its employ many senior engineers who accept the modest remuneration available to them. It is not fair to continue to use their sense of loyalty and devotion, to the disadvantage of themselves.

As citizens of Canada interested primarily in the welfare of the country, this committee urges that you consider the future of those departments which are so largely dependent upon engineers. The post-war period will be serious for government institutions. Nothing should be left undone which will aid in producing during that period, as well as for all time, efficiency, economy and good management. This committee feels that these things are based largely upon the work of the engineer.

In order that you may appreciate the non competitive and inadequate scales of wages now available to engineers in the Civil Service, we are attaching a copy of the brief which was presented to the Coon committee by the Institute*. On the graph you can see at a glance that the government as an employer pays far below the other groups. Does this seem to you to be fair or business-like ? Does this seem to you to put the government in a position to meet the future with confidence and enthusiasm ? It is significant that by wages paid through Crown Companies, the government acknowledges the inadequacy of the Civil Service scales for engineers.

A good staff cannot be built quickly; therefore, it is essential that conditions of employment be made sufficiently attractive now that departments of government may have some chance of planning ahead in a practical manner to meet exacting conditions which are bound to develop shortly.

We respectfully urge that after you have had an opportunity to familiarize yourself with the conditions of which we complain, you take the action necessary to overcome them. We cannot over-emphasize the need of being ready for the shock of post-war problems which are just as real as the war itself.

The committee offers to you its services, as it did to the Coon committee, if assistance or advice is desired in establishing suitable wages for this group.

Respectfully submitted on behalf of
The Engineering Institute of Canada
by the
Committee on the Engineer in the Civil Service,

N. B. MacRostie, M.E.I.C.
*Chairman*

*See *The Engineering Journal*, March 1943, p. 145-146

## THE HISTORY OF THE REGISTRATION MOVEMENT

The attention of members is called particularly to an article on page 568 of this number of the *Journal.* This article has been written with the idea of placing before all members of the profession in Canada a rather complete and exact history of the various steps which have been taken in establishing the legislation and the responsible bodies for the control of the practice of engineering in Canada.

In recent years, short histories have been written that have dealt primarily with the developments in a particular province. All these have been very good, but the thought has been expressed many times that it would be interesting and perhaps helpful if the complete story was presented in one article.

Actually this history was inspired by an address made by Mr. S. G. Porter, past-president of the Institute, and past-vice-president of the Association of Professional Engineers of Alberta. The address was made before a joint meeting in 1940 at the time of the signing of the co-operative agreement between the Association and the Institute.

Mr. Porter's address was so interesting and so illuminating that he was asked if he would prepare it for printing in *The Engineering Journal.* The present article was not written by Mr. Porter, but is based on the manuscript which he used in his address and follows carefully the references which he supplied at that time. The article has been submitted to Mr. Porter and he has approved it. Accordingly it appears herein with his sanction. We believe that such an article could not appear under better auspices.

Many engineers who will read this article have lived through all or some of these developments. To the others who read it it will be readily apparent that a considerable debt is owed by the profession to the group which so stalwartly advanced the registration movement and establish it on such firm foundations. Fortunately, many of them are still with us, and therefore have the gratification of knowing that their labours were not in vain.

This history is published largely as a tribute to these people who have created it, not least of whom is the man under whose aegis it appears.

## WILLIAM LOREN BATT, HON. M.E.I.C.

For the first time the Council of the Institute has awarded an honorary membership to an American engineer. It is a happy circumstance that in thus widening its distribution of honours it could select as the initial recipient such a distinguished gentleman as William Loren Batt.

It was unfortunate that Mr. Batt could not be present at the joint meeting, in Toronto, of the American Society of Mechanical Engineers and the Institute to receive his certificate from the hands of President K. M. Cameron. Business of considerable importance required him to be in England at that time, and he chose Mr. Robert M. Gates, president-elect of the A.S.M.E., as his representative to receive the certificate.

In a field that is crowded with eminent personalities, Mr. Batt has won great distinction. In his services to the nation all engineers have reason to be proud. Not many members of this profession have distinguished themselves so honourably in this field. This attainment has been marked conspicuously by the recent award of the Bok Medal and the prize of $10,000 which was presented to him in 1943. "The award is made annually to the citizen who, in the opinion of the trustees of the award, performs or brings to its culmination in one year 'a service calculated to advance the best and larger interests of Philadelphia.' Mr. Batt's work on behalf of the war effort was the basis on which the award was made to him."

Besides his public services, Mr. Batt has been a leader in all things that are good for the profession. He supports professional societies; he interests himself in engineering education; he is at once a student and a teacher in industrial management and industrial relations. In both these fields he has broad conceptions of what can and should be done.

The following chronological biography is but a cold account of a lifetime that has been crowded with achievements and success. It is doubtful if many members of our profession have more completely met the requirements of a profession as described by Dr. Vannevar Bush as "a simple ministry to the people."

Born at Salem, Indiana.

1907 —Graduate, Mechanical Engineering, Purdue University, Lafayette, Indiana.

1922 —President, S-K-F Industries Inc., Philadelphia, Pa.

1933 —Honorary Degree, Doctor of Engineering, Purdue University.

1936 —President, American Society of Mechanical Engineers.

1938 —Chairman of the Board, American Swedish Historical Museum, Philadelphia, Pa.

Sept., 1938—President, International Committee of Scientific Management.

Jan., 1940—Chairman of the Board, American Management Association.

Jan., 1940—Chairman, Business Advisory Council for Dept. of Commerce, Washington.

Jan., 1940—Chairman, Engineering and Industrial Divn. National Research Council.

W. L. Batt, Hon.M.E.I.C.

June, 1940—Member, National Defence Advisory Commn. Raw Materials Divn. (later—Deputy Commissioner).

Jan., 1941—Deputy Director, Production Divn., Office of Production Management (O.P.M.).

Later 1941—Director, Materials Division — O.P.M.

Sept., 1941—Member, President Roosevelt's Committee to Russia.

Jan., 1942—Head of Anglo-American Canadian Raw Materials Committee.
Member, Society of Automotive Engineers.

June, 1942—Doctor of Engineering, Stevens Institute of Technology.

Mar., 1945—Received Bok Award "as being the citizen of Philadelphia who had accomplished the most for his city or country."

1943 —Chairman, Combined Raw Materials Board—United States and Great Britain.

At present Vice-Chairman, War Production Board, Wash.

Members of the Institute will welcome Mr. Batt to their company. It is sincerely hoped that many may have the privilege of knowing him, and of discovering for themselves the excellent qualities which have made him outstanding and which have prompted Council to include him in its list of Honorary Members.

## A. G. L. McNAUGHTON, Hon.Mem.A.S.M.E.

At the joint meeting held in Toronto with The American Society of Mechanical Engineers, early this month, an exchange of honours took place at the dinner on Friday, October 1st.

W. L. Batt, vice-chairman of the War Production Board at Washington and president of SKF Industries, Inc., Philadelphia, was made an honorary member of the Institute. The American Society of Mechanical Engineers, on the same occasion, presented to Lieutenant-General A. G. L. McNaughton an honorary membership certificate which was received by Dr. C. J. Mackenzie.

The following citation was read by President H. V. Coes of the A.S.M.E.:

General McNaughton, a graduate in electrical engineering from McGill University in 1910, and M.Sc. from the same university, also holds honorary degrees from McGill, Bishop's University, Queen's University and the University of Birmingham. He served throughout the first World War, was wounded at Ypres and incapacitated for six months, and again suffered wounds at Soissons. He was three times mentioned in dispatches and was awarded the D.S.O. and the C.M.G. He was promoted to Lieutenant-Colonel in March, 1916.

On returning to Canada in 1919 he was appointed a member of the committee for the reorganization of the Canadian military forces. His promotion to the rank of Major-General came simultaneously with his appointment to the highest military post in Canada, Chief of the General Staff. He continuously stressed the rapidly increasing importance of the engineer in modern warfare and the necessity of a broad knowledge of engineering and science in general.

In 1935 he became President of the National Research Council and so directed its activities that he won the support of industrial and scientific leaders throughout the Dominion. He developed the cathode ray direction finder, in co-operation with Colonel W. A. Steel. Science and engineering,—signals, radio, aircraft, artillery and mechanization—have been his chief interests.

At the outbreak of the war, he was recalled to active duty. He was appointed General Officer Commanding, First Division, Canadian Active Service Forces. In 1940, he was chosen to command a new corps, including certain British formations, as well as the First Canadian Division and its ancillary units, and was promoted to Lieutenant-General. On the formation of the Canadian Army Overseas, he was made General Officer commanding the new unit.

In recognition of General McNaughton's attainments as a renowned scientist, engineering leader, and distinguished soldier, the American Society of Mechanical Engineers has conferred honorary membership upon him.

The following letter from General McNaughton addressed to Mr. Coes was read by Dr. Mackenzie in acknowledgment of the honour:

Dear Mr. Coes: September 8, 1943.

Your letter of 24th August, 1943, is very deeply appreciated, and I can assure you that it is a very high privilege indeed to have been elected an honorary member of The American Society of Mechanical Engineers. It is an added pleasure to learn that this great distinction is to be given me at a joint meeting of the American Society and the Canadian Institute in which I have been a member for many years, and that my membership will be received by my old friend Dean C. J. Mackenzie of the National Research Council of Canada.

My recent visit to Sicily gave me the opportunity of seeing something of the work of engineers of both United States and Canada, and to examine the remarkable projects of reconstruction which they are undertaking, and particularly the effective application of power equipments, the design of which, as well as the development and manufacture have come from the North American continent. These equipments are quickly overcoming the very formidable obstacles placed in our way by the enemy's considerable demolitions which were impeding seriously the advance of the forces of the Allies. Full credit must rest with members of The American Society of Mechanical Engineers for the development of these machines and for the many excellent motorized, mechanical and amphibious equipments which were used there. A debt of gratitude is owed by all of us who have the duty of employing this equipment in the Armed Forces for the important contributions to the conduct of the war which members of the American Society have made already.

There is no doubt in our minds also that you will solve one of our key problems which is the transfer of large tonnage in landing operations across beaches. This will be a matter of very real and vital importance when the time comes for the attack on North-West Europe in the final advance upon the Capital and beyond.

Again, let me express my deepest appreciation for the great honour which has been done to me, and with best wishes,

Very sincerely yours,

(Signed) A. G. L. McNaughton.

## E.C.P.D. COMMITTEE ON PROFESSIONAL TRAINING

On October 22nd and 23rd, the annual meeting of the Engineers' Council for Professional Development will be held in New York City. At this time reports are made from all committees, and it is proposed to reprint the essence of these reports in *The Engineering Journal* from time to time.

Herewith is an abridgement of the report of the Committee on Professional Training, upon which the Institute's representative is Dean C. R. Young of Toronto.

The report of the Committee on Professional Training for the year ending September 30th, 1942, ends with the following conclusion:

The war has naturally prevented the normal amount of time being given to the work of the Committee. Several of the members have entered into Service. But on the part of those remaining, there is the definite conviction that helpful service may be rendered in the future by such application as is possible towards the attainment of our stated objectives, and thus all possible application is being made. The writing of the Manual for Junior Engineers will not be an easy task, but such assembling of a proper statement for the guidance of the junior engineer and his associate should be worth many times the effort.

To the writing of the Manual for Junior Engineers and the continuation of the projects helpful to the younger engineer in his professional training, the coming year of the Committee on Professional Training is dedicated.

The press of the war activities has been great, but even with this, three meetings of the committee have been held, together with the members of the Junior Committee, with all possible in attendance.

The Manual for Junior Engineers, progressed last year to a position where it was ready to be written, has received our first attention. The obtaining of an author was the main objective of the committee. A thorough search was made. The best available were considered. The committee is the most happy to report that Dr. W. E. Wickenden, fellow engineer, educator of renown, counselor of men, has accepted the authorship of the Manual for Junior Engineers and is now writing it.

To keep complete the General Reading List for Junior Engineers, the Junior Committee have planned for evaluation of old and new material by having junior groups actually read the various available books and report on same. The Junior Committee have not been able to progress this important activity to the extent desired, but with the return of opportunity this project will be advanced.

## NEWS OF MEMBERS ON ACTIVE SERVICE

With so many interesting things happening to our members in all parts of the world, it is desired to present to the membership as much information of this kind as possible. Some of the most interesting personals in the *Journal* are those that tell of the activities of our men in uniform. There must be a lot of this information in the hands of relatives and friends that never reaches Headquarters.

When someone you know has arrived overseas, or has moved to another part of the world, or has been promoted, or decorated, or has participated in some important or interesting activity, why not let the *Journal* know about it ? All readers will be interested in learning these things, and you in turn will read news of persons you know which otherwise may not have come to your attention.

Relatives, particularly parents, are in the best position to supply these pieces of news. Remember that lots of people know these boys besides yourself and would be glad to know something about their service experiences. There is not much chance of aiding the enemy with such news. By the time the letters and cables get to you they have been pretty well scrutinized by one or more censors, and you can be satisfied that they are not part of a secret and confidential file.

The *Journal* would be glad to publish such items and the readers will be glad to see them, but there is almost no source of supply except through relatives and friends.

## MONTREAL HIGH SCHOOL CENTENNIAL

Former pupils of the Montreal High School are being traced by a large committee of prominent Old Boys, so that they may join in a fitting celebration to be held November 26th, 1943. Plans are well advanced and include among other things the compilation of a Book of Remembrance, containing the names of all who have ever attended Montreal High School. This is to be installed in a Memorial Room to be constructed after the war, in honour of Montreal High boys who gave their lives for Canada in the last and present wars. Scholarships are also to be set up in the names of the fallen ones. The complete project will be presented at a dinner to be held in Montreal on November 26th. Throughout the week of November 21st to 27th, special events will be held at the school and in Montreal on the occasion of the 100th Anniversary of the founding of the School.

The school is anxious to obtain the present address of all those who attended the School at any time, and it is suggested that former pupils write to Thomas Sommerville, M.A., Rector, High School of Montreal, 3449 University Street, Montreal, Que.

## LIST OF NOMINEES FOR OFFICERS

The report of the Nominating Committee, as accepted by Council at the meeting held on September 11th, 1943, is published herewith for the information of all corporate members as required by sections 19 and 40 of the by-laws:

List of Nominees for Officers for 1944 as Proposed by the Nominating Committee

| | | |
|---|---|---|
| President | deGaspé Beaubien | Montreal |
| Vice-Presidents: | | |
| *Zone "B" (Province of Ontario) | J. M. Fleming | Port Arthur |
| *Zone "C" (Province of Quebec) | E. B. Wardle | Grand'Mère |
| *Zone "D" (Maritime Provinces) | G. L. Dickson | Moncton |
| Councillors: | | |
| †*Victoria Branch* | A. G. S. Musgrave | Victoria |
| †*Calgary Branch* | James McMillan | Calgary |
| †*Lethbridge* | Wm. Meldrum | Lethbridge |
| †*Winnipeg Branch* | H. L. Briggs | Winnipeg |
| †*Sault Ste. Marie Branch* | Carl Stenbol | Sault Ste. Marie |
| †*Toronto Branch* | W. S. Wilson | Toronto |
| †*Hamilton Branch* | Alex. Love | Hamilton |
| †*Niagara Peninsula Branch* | A. W. F. McQueen | Niagara Falls |
| †*Peterborough Branch* | H. R. Sills | Peterborough |
| †*Ottawa Branch* | G. H. Ferguson | Ottawa |
| ‡*Montreal Branch* | R. S. Eadie | Montreal |
| | P. E. Poitras | Montreal |
| †*Quebec Branch* | P. E. Gagnon | Quebec |
| †*Moncton Branch* | E. B. Martin | Moncton |
| †*Halifax Branch* | P. A. Lovett | Halifax |
| †*Cape Breton Branch* | J. A. Russell | Sydney |

*One vice-president to be elected for two years.
†One councillor to be elected for two years.
‡Two councillors to be elected for three years each.

## WASHINGTON LETTER

One of Lord Tweedsmuir's favourite subjects of conversational debate is said to have concerned the internal combustion engine. Did it hold for the world more promise of harm than good ? Typical of his out-reaching faith and optimism, he held for good. Speaking of the aeroplane, he says, in "Pilgrims Way," that man may use the machine to carry him "beyond the pale of the Machine" and "thereby pass out of a narrow world into an ampler ether." The destructive power of the aeroplane is all too obvious. However, the bringing of all mankind within the range of a few short hours' journey may eventually result in a growth of sympathy and understanding which will far outweigh the potential danger.

This increase in sympathy and understanding is a constantly intriguing field of speculation. Statesmen, soldiers, scientists and businessmen may now be personally acquainted with their associates and with working conditions all over the world. They may know the man—his voice, his smile, his idiosyncrasies, his associates; they may know the strip of territory, the plant, the lab, the machine. No one will ever know just how much the world owes to the fact that Churchill and Roosevelt are such close personal friends.

The other day, I was talking to Judge Patterson, Under-Secretary for War. We called upon him on his return from a visit to Australia and the Southwest Pacific. Here is an Under-Secretary of War who has seen conditions for himself. He could tell us in great detail the difficulties of jungle fighting. He knew the Kakoda Road and could describe the strategic terrain of Buna or Moresby. General Knudsen and General Wright also made the trip with him. A few short weeks ago we had seen General Wright and answered his questions about Australia. This time *he* answered *our* questions. He had come to know in a personal and intimate way many Australians and much about Australian conditions. Australian officials had become our mutual friends and we quizzed each other regarding this or that person and this or that town or place or scene.

* * *

There is a growing body of opinion which holds that food is becoming the most important single strategic factor. Very shortly food may be more important than guns and planes and tanks. The movement of food may be more needed than the movement of troops. Reserves of food may have more strategic significance than reserves of man-power and munitions. These factors will become increasingly obvious as both occupied and enemy countries are liberated. As far back as August, 1940, Mr. Churchill noted the strategic significance of a large stockpile of food. The huge stocks of surplus wheat which are now piling up as the result of the International Wheat Agreement signed in April, 1942, by the United States, the United Kingdom, Canada, Australia and Argentina, are the backbone of this most important weapon. While Germany uses the threat and practice of starvation to hold conquered peoples in time, we must be in the position to hold out the promise of plenty. Perhaps the difference of the two worlds is here thrown into focus.

In the endeavour to produce munitions in quantities which would not be "too little and too late" (to hark back to an old phrase), two of the mistakes now appear to have been the too drastic cutting back of farm implement and tractor production and the lack of attention to farm man-power. Both are being rectified. In Australia, farm equipment is being looked on as an implement of war and production and maintenance responsibility have actually been vested in the Directorate of Ordnance Production under the Ministry of Munitions. Food processing and food canning projects take precedence over new munitions projects. Similar measures are being adopted throughout the United Nations.

In regard to the extremely complicated problems of distribution and administration much preliminary work is being done. In Great Britain, experts of the Inter-Allied Committee on Post-War Requirements (the Leith-Ross Committee) have been studying the food requirements of Europe and conferring with governments-in-exile. In the United States, Governor Lehman's Office of Foreign Relief and Rehabilitation moves forward in goodly company. It is expected that the United Nations Food Conference held at Hot Springs last May will be followed by further meetings to deal with more specific and short term problems.

Apart from problems of production and distribution, many other interesting aspects obtrude. One of these is what might be called "the calories versus vitamin controversy." There is one school of thought which maintains that relief food should relieve not only hunger but also malnourishment. Another school argues that the primary task is to relieve hunger, leaving the question of malnourishment as one for medical attention. Proponents of this school maintain that food could be spread on a wider basis and that such sporadic outbreaks of scurvy or pellagra as might occur could be cured by medication and special diets, rather than prevented by the distribution of an inadequate diet to millions of people. Another interesting problem has to do with the use of concentrated and dehydrated foods which lend themselves particularly to the storage and transportation problems involved.

* * *

In recent months, a film has been in the course of preparation depicting some of the supply problems in connection with the Southwest Pacific. A number of sequences showing some of our Washington activities were recently "shot" in the movie studios of one of the American information agencies. It was an extremely interesting experience to take part in this venture. The studio itself was named the Wesley Barry Studio and Wesley Barry himself was in attendance. He told us that about 90 per cent of Hollywood technicians and actors were in some way or other contributing to the war effort. In spite of all one has heard, it is still very surprising to experience the elaborate preparations and the meticulous care which must be exercised in shooting the simplest scene. After adjusting numerous banks of lights and issuing minute instructions to all and sundry, the cry of "Cameras, Lights, Sound—Roll 'em!" is followed by the sharp click of the scene and take board and the action is on—usually followed almost immediately by the director's impatient "Cut!"—and the scene is gone through once again until he is satisfied.

* * *

One of the items of outstanding interest in Washington these days is the War Show which has been set up on "The Mall" about the Washington monument in connection with the present War Loan Drive. No doubt is left in the mind of the visitor as to the complications and the expense of modern war. On the other hand, the show is a great tribute to the ingenuity and organizing ability of modern military authorities. One is particularly impressed by the measures which have to be adopted to ensure the mobility of modern armies. In this connection, Mr. Churchill is said to have indulged in an amusing discussion at a recent Washington luncheon. He opined that the infantry no longer walked. Not only, said he, do our soldiers now ride to the scene of battle in char-à-bancs but the very tanks themselves ride to war on tank transporters!

E. R. Jacobsen, M.E.I.C.

## MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Hotel London, London, Ont., on Saturday, September 11th, 1943, convening at two o'clock p.m.

*Present:* President K. M. Cameron (Ottawa) in the chair; Past-President C. R. Young (Toronto); Vice-President L. F. Grant (Kingston); Councillors H. E. Brandon (Toronto), E. V. Gage (Montreal), R. E. Heartz (Montreal), N. MacNicol (Toronto), G. M. Pitts (Montreal), H. R. Sills (Peterborough), J. A. Vance (Woodstock), and General Secretary L. Austin Wright.

There were also present by invitation—Past-President O. O. Lefebvre (Montreal); Past-Vice-Presidents de Gaspé Beaubien (Montreal), E. V. Buchanan (London), R. L. Dobbin (Peterborough), and E. P. Muntz (Montreal); Past-Councillors C. G. R. Armstrong (Windsor), H. F. Bennett (London), also chairman of the Committee on the Training and Welfare of the Young Engineer, and W. C. Miller (St. Thomas), chairman of the Committee on Post-War Problems, and as immediate past-president representing the Association of Professional Engineers of Ontario; M. B. Watson (Toronto), secretary of the Dominion Council of Professional Engineers; G. A. Gaherty (Montreal), chairman of the Committee on Western Water Problems; T. S. Glover, chairman of the Hamilton Branch; G. E. Griffiths, chairman of the Niagara Peninsula Branch; T. L. McManamna, chairman, R. S. Charles, vice-chairman, R. W. Garrett, past-chairman, H. G. Stead, secretary-treasurer, V. A. McKillop, member of executive, Lieut. E. Blake Allan and Colonel Ibbotson Leonard of the London Branch.

After welcoming the councillors and guests and expressing his own personal pleasure in holding a regional meeting of Council in the city of London, the president asked each person present to rise, give his name, place of residence and Institute affiliation.

*Sir John Kennedy Medal*—Mr. Brandon and Mr. Heartz were appointed scrutineers to open the ballots for the Sir John Kennedy Medal and the honorary membership. They reported a favourable ballot awarding the Sir John Kennedy Medal to Past-President Dr. Chalmers Jack Mackenzie, acting President of the National Research Council of Canada.

*Honorary Membership for William L. Batt*—The scrutineers reported a unanimous ballot in favour of electing to honorary membership in the Institute William L. Batt, president of SKF Industries, Inc., at present vice-chairman of the War Production Board at Washington, D.C., and a past-president of The American Society of Mechanical Engineers.

Mr. Batt was declared elected an Honorary Member of the Institute and the general secretary was directed to notify him by wire and request his formal acceptance of this distinction, as required by the by-laws. (Note: 15-9-43, Mr. Batt's acceptance has been received.)

*The Engineer in the Civil Service*—The general secretary reviewed briefly the activities of this committee since its appointment by Council, the principal purpose of which was to make representations regarding the engineer in the Civil Service to the Coon Committee set up by the government to examine the conditions of employment and wages in the Civil Service as a whole.

A comprehensive report had been prepared and had been presented to the Coon Committee by a delegation consisting of members of the Institute's committee, and a representative of the Association of Professional Engineers of Ontario. The delegation had been very well received, and the Coon Committee had agreed that something should be done with regard to the remuneration of the engineer in the Civil Service. In due course the Coon Committee had presented its report to the Treasury Board, but when the Treasury Board made its report to the government no mention was made of conditions affecting the engineer.

Shortly after receiving the report, Mr. Ilsley had stated that certain parts of the report would be re-considered, and the Institute's committee had felt that further representations should be made directly to Mr. Ilsley. Accordingly, a brief has been prepared and Mr. Ilsley has agreed to meet the committee as soon as possible and it was expected that a convenient date would be arranged next week.

*The Engineer in the Active Services*—On behalf of the committee the general secretary reported that the committee was continuing its investigations, and expected to hold another meeting in the near future when final arrangements would be made regarding the presentation of a report to government authorities.

The committee had had difficulty in preparing a final report as no one was willing to be quoted as having made complaints regarding the present set-up in the technical branches of the services. However, the committee was definitely of the opinion that strong representations should be made to the government regarding the status of the engineer in the services and hoped to present a final report at the next meeting of Council.

*Committee on Post-War Problems*—Mr. Miller, chairman of the Committee on Post-War Problems, presented a progress report.

As president of the Royal Architectural Institute of Canada, Mr. Pitts presented to the Institute copy of a booklet entitled "Planning the Canada of Tomorrow" which had been prepared by the R.A.I.C. and circulated in connection with a memorandum which had been submitted to the government. Copies have already been sent to members of the Institute's committee. Among other things it suggested that the Minister of Finance be instructed to allow certain firms to use a portion of their excess profits, free of taxation, for the development of post-war plans. In Mr. Pitts' opinion this was a suggestion which could very well be supported by the Institute.

The president explained that at the time it was established it was agreed that the Institute committee should not prepare or announce any programme of its own but that the subject should be studied carefully with the expectation that the committee would co-operate with other government organizations such as the James Committee in the preparation of their material and in carrying out their proposals if such co-operation were required. The indications are that the James Committee will make its final report shortly and it is impossible to foretell what the future of that committee will be, but in the absence of any clear leadership from government bodies he thought the Institute's committee should now be empowered to proceed with its own plans and proposals.

Following the president's recommendation it was moved and unanimously agreed that the committee be authorized to proceed along the lines outlined, (including a reference to deductions from excess profits to assist in meeting the expenses of post-war planning), to the end that a brief might be prepared for presentation to the House of Commons committee under the chairmanship of Mr. Turgeon.

It was suggested by Councillor Vance that Mr. Miller might call a meeting of his committee in order to facilitate the preparation of a plan and a brief. Mr. Miller suggested, as an alternative, that he might be allowed to set up a smaller group as an executive committee which might meet for this purpose. This was approved, and the suggestion was made that, if necessary, the expenses of a meeting of such a group be met by the Institute, as well as the expenses of a delegation presenting the brief to the House of Commons Committee in Ottawa.

The report of the committee was adopted, which includes the appointment of Mr. H. G. Welsford as a member of the committee.

*Committee on the Young Engineer*—Mr. Bennett, chairman of the Committee on the Training and Welfare of the Young Engineer, presented a progress report in which he touched on the following subjects:

*Booklet—"The Profession of Engineering in Canada"*—There are only nine hundred copies of the English edition on hand. A revision is being prepared for the Publication and Finance committees with the object of printing a second edition.

*Literature for Senior Students*—A booklet entitled "Standards of Professional Relations and Conduct" by Dr. D. W. Mead, past-president of the American Society of Civil Engineers, had been distributed to the senior students in all engineering faculties in Canada. These pamphlets were presented to the Institute by the author. Expressions of favourable reaction were received from many of the universities.

*Undergraduate Engineering Societies*—The report recommended that serious thought be given to establishing closer relations between the Institute and the undergraduate societies, recommending specifically the possibility of aiding undergraduates by financial assistance, library donations, scholarships, and visits from leading members of the Institute.

*Wartime Bureau of Technical Personnel*—The Bureau had requested the Institute, together with the Canadian Institute of Mining and Metallurgy and the Canadian Institute of Chemistry, to assist in finding suitable candidates for financial assistance necessary to acquire an engineering training. The three institutes accepted the Bureau's proposal and were prepared to take the necessary action right across Canada. Some delay had been caused by possible changes in the universities training programmes.

*Engineers' Council for Professional Development*—The Committee on Student Selection and Guidance, in company with the Society for the Promotion of Engineering Education and the Carnegie Foundation, was undertaking an experimental project on measurement and guidance in engineering education, involving the examination of four thousand students. None of this work would be done in Canada at the present time. This promises to be a very important project and the Institute's committee will keep closely in touch with it through the Institute's membership in the Engineers' Council for Professional Development. The report was discussed at some length and finally a motion to accept the report and thank the committee for its excellent work was approved.

*Committee on Professional Interests*—The president pointed out that a very important and far-reaching proposal was being made by the Committee on Professional Interests. Copies of the proposal had been sent in advance to all councillors and it was the business of this meeting to decide whether or not to accept the committee's recommendations as outlined on page four of the report.

Past-President Lefebvre, vice-chairman of the committee, gave an account of events which had led up to this report. He explained that the committee had studied the subject for several months and was convinced that the procedures recommended would go a long way towards advancing the welfare of the profession right across Canada.

Mr. Gaherty, a member of the committee, supported Dr. Lefebvre in his explanation and recommended strongly that the proposals be approved.

In discussing the wording of the proposed new by-law Mr. Pitts called attention to the bracketed section of clause (a) and recommended that the last part of the sentence be eliminated so that the section would read as follows:

> (a) The admission and classification as members of the Institute, in accordance with the foregoing by-laws, of all applicants for membership in the Institute who are members of the Society.

This was approved.

In Section 2 (a) of the recommendations it was agreed that the word "corporate" should be inserted before the word "member" so that the phrase would read "who is also a corporate member of the Institute."

Mr. Sills suggested that branch organizations, where the membership exceeded two hundred, might be divided into sections with a councillor for each section, namely, electrical, mining, civil and mechanical, etc. It was his thought that such sections could co-operate with sister societies specializing in the same branch of engineering, thereby providing a basis for complete co-operation wherever it was desirable.

In the discussion which followed the opinion of Council was expressed as believing that such a breakdown might result in a substantial increase in the numbers on Council and in some confusion in branch management. Eventually it was decided that no steps should be taken along this line at the present time but that this proposal could be considered later if conditions warranted it.

After a further discussion of several details of the recommendations it was moved and unanimously carried that the entire recommendations of the committee be approved.

*National Construction Council of Canada*—The president outlined a proposal of the National Construction Council of Canada for the preparation of a post-war plan for the construction industry. A copy of the complete report had been sent to every councillor and the business of this meeting was to determine whether or not the Institute would endorse the programme as requested by the N.C.C. There was a very long discussion on the subject, touching principally upon the possibility of the work duplicating work done by other organizations, including government agencies, but finally it was moved and approved unanimously that the Institute endorse the programme and, within its limitations, support the Council in carrying out the work.

*Wartime Bureau of Technical Personnel*—In accordance with the instructions of Council a copy of the draft memorandum regarding the compulsory transfer of technical personnel, which the Wartime Bureau had suggested should be sent to the Minister of Labour, had been submitted to all councillors with a request for comment. Since the last meeting of Council the general secretary had had conversations with several councillors and had received communications from other councillors which indicated that the Council of the Institute would not support the Bureau in submitting such a memorandum to the Minister of Labour. Following some discussion, on the motion of Mr. Heartz, seconded by Colonel Grant, it was unanimously resolved that the draft memorandum, as submitted by the Wartime Bureau of Technical Personnel, be not endorsed by the Council of the Institute. It was the opinion of Council that while conscription is a desirable regulation it should not be made to apply to any one group and not to all.

*Technical Books for the Library*—On the motion of Mr. Gage, seconded by Mr. Heartz, it was unanimously resolved that the recommendation of the Finance Committee be approved and that $200.00 be made available annually for the purchase of new books for the library.

*Admission of Polish Engineers*—Attention was drawn to the fact that there are in Canada, at the present time, a large number of Polish engineers with whom the Institute has been in close contact. They have been invited to branch meetings and have been receiving complimentary copies of *The Engineering Journal* until paper restrictions have made it necessary to take their names off the mailing list. Many of them would now like to join the Institute, but are unable to submit documentary evidence of their educational qualifications. All these engineers came out under guarantees of the Polish and British Government and it has been suggested that the Institute might accept confirmation of their academic standing and professional experience from the Association of Polish Engineers in Canada and the Wartime Bureau of Technical Personnel.

Past-President Young stated that he had had a lot to do with these engineers, and felt that the Institute could rely very definitely on the word of the Polish Association.

Following some discussion, it was unanimously agreed that the Institute would accept from the Association of Polish Engineers in Canada confirmation of the educational qualifications of any of their members who desire to join the Institute.

*Elections and Transfers*—A number of applications were considered and the following elections and transfers were effected.

**Bicknell,** A. Bertram, B.A.Sc. (Univ. of Toronto), engineer-purchasing agent, Canadian Gypsum Co. Ltd., Toronto, Ont.

**Brereton,** Charles Herbert, B.Sc. (Univ. of Man.), radio engr., RCA Victor Ltd., Winnipeg, Man.

**Fee,** Howard Russel, B.Sc. (Univ. of Alta.), system operating engr., Saguenay Transmission Co. Ltd., Arvida, Que.

**Flett,** Frank Parkin, B.Sc. (Univ. of N.B.), district mgr., Truscon Steel Co. of Canada, Ltd., Toronto, Ont.

**Graham,** Walter Peter, lubricating engr., Imperial Oil Ltd., Moncton, N.B.

**MacKenzie,** Ray Elliott (North Carolina State College), principal engr., U.S. Army Engineers, San Francisco, Calif.

**McLaughlin,** Roland Rusk, M.A.Sc., Ph.D., (Univ. of Toronto), Professor of Chemical Engrg., University of Toronto, Toronto, Ont.

**McRoberts,** Donald, engr. i/c shipyards, Department of Munitions & Supply, Ottawa, Ont.

**Sheets,** William Elmer, B.Arch., M.Sc. (Univ. of Man.), designing dftsmn., Hydraulic Dept., Hydro Electric Power Commission of Ontario, Toronto, Ont.

**Trudeau,** Roger T., B.A.Sc., C.F. (Ecole Polytechnique), divn. engr., Department of Roads, Prov. of Quebec, Papineauville, Que.

**Wilson,** Robert (Royal Tech. Coll.), telephone engr., Northern Electric Co. Ltd., Montreal, Que.

*Juniors*

**MacLean,** Donald Wilbur, B.Sc. (Forestry) (Univ. of N.B.), instr'-man., Dept. of Transport, Air Services Branch, Waterville, N.S.

**McHenry,** Gordon Morris, B.A.Sc. (Univ. of Toronto), asst. to switchgear engr., Canadian General Electric Co., Peterborough, Ont.

*Affiliate*

**Hand,** George William, B.A. (Acadia Univ.), asst. office mgr., Works & Bldgs., (Naval), Ottawa, Ont.

*Transferred from the class of Junior to that of Member*

**Haines,** Neil St. Clair, B.A.Sc. (Univ. of Toronto), asst. engr., Hydraulic Dept., Hydro Electric Power Commission of Ontario, Toronto, Ont.

**Hershfield,** Charles, B.Sc. (Univ. of Man.), senior asst. engr., Department of National Defence (Naval Service), Works & Bldg. Branch, Ottawa, Ont.

**MacNeil,** Duncan Paul, B.Sc. (N.S. Tech. Coll.), asst. purchasing agent, Aluminum Co. of Canada, Ltd., Arvida, Que.

*Transferred from the class of Student to that of Junior*

**Girouard,** Laurent Jean-Baptiste, B.A.Sc., C.E. (Ecole Polytechnique), engr., Marine Industries, Ltd., Sorel, Que.

**Tanner,** William John, B.Eng. (McGill Univ.), engr., gas scrubbing plant, Aluminum Co. of Canada, Ltd., Shawinigan Falls, Que.

*Students admitted*

**Evans,** Robert Edward (Univ. of N.B.), 839 Charlotte St., Frederic ton, N.B.

**Hershfield,** Allan A. (Univ. of Toronto), 804 Manning Ave., Toronto, Ont.

**Guttormson,** Baldur F., B.Sc. (Univ. of Man.), Sub-Lieut. "E", R.C.N.V.R., H.M.C.S. Captor II, Saint John, N.B.

As councillor for the London Branch Mr. Vance expressed appreciation to Council for holding a meeting in London, in reply to which Mr. Cameron stated that the meeting was, in a measure, an expression of appreciation of the consistent effort which Mr. Vance had made on behalf of the Institute during his many years as councillor for the London Branch, and of the work of Mr. Harry Bennett.

On the motion of Mr. Sills, seconded by Mr. Brandon, it was unanimously resolved that a sincere vote of thanks be extended to the London Branch for the courtesies which they have extended to visiting councillors and guests, and to the City of London for the use of its excellent facilities for the Council meeting.

Before the meeting adjourned, Mr. Beaubien expressed to the meeting his appreciation of the honour which he felt had been done him in submitting his name for the presidency of the Institute for the year 1944.

# THE 1943 JOINT MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS AND THE ENGINEERING INSTITUTE OF CANADA

The undoubted success of this three-day meeting, which has just been held in Toronto, was largely due to the foresight of the officers of the two societies, who planned a programme devoted entirely to engineering questions vital to the war effort of the United Nations. In contrast to the usual practice, all available time was occupied by technical papers, discussions, and conferences; social functions were conspicuous by their absence. It is true that there were three luncheons and a dinner, but even at these the speakers dealt with such topics as weapon maintenance, war production, and industrial relations—all of particular value at this stage of the war.

In spite of the difficulties and inconveniences of present day travel, more than eight hundred members and guests of both societies registered in the foyer of the convention floor of the Royal York. The American delegation was headed by the president and president-elect of the Society, who were supported by an impressive contingent of past-presidents, vice-presidents and managers. The Institute was likewise well represented by its officers. The smooth running of the meeting was facilitated by the excellent arrangements made by a local joint committee, consisting of the chairmen of the Ontario Section A.S.M.E. and the Toronto Branch of the Institute, together with prominent members of those two local organizations.

Under present conditions, hotel operation is not an enviable occupation. It seems now to have become a struggle to provide sustenance and shelter for an endless stream of travellers. Our compliments are certainly due to the hotel for its success in coping with the difficult conditions now existing, and giving such adequate service to our large convention. Actually we have had few (if any) meetings at which events ran more smoothly. Weather conditions were ideal. The choice of Toronto as a meeting place was amply justified; it was selected because of travelling convenience, good hotel facilities, and accessibility to members of the two organizations.

The original plans for the meeting, which were duly carried out, called for six main sessions dealing with engineering problems related to the production of war material. It was arranged that as far as possible the time available should be divided between speakers presenting the Canadian and United States points of view and experience in regard to each topic.

Provision was also made for a series of conferences in closed session, at which industrial experts exchanged ideas regarding production methods in metal cutting, shell forging, the use of modern steels in heavy industry, fuel substitutes, plastics, synthetic rubber, and powder metallurgy. Admission to these conferences was by invitation card only.

As the various sessions were not held concurrently, there were occasional welcome opportunities for greeting and informal discussion outside the meeting rooms—a feature always appreciated when old friends and new acquaintances assemble from widely separated parts of the country. Though but little time was available for these exchanges of views and personal conversations, there is no doubt that they did much to cement the cordial relations which have so long existed between the Institute and the Society, and which are typical of the industrial co-operation between the two countries. This was evident throughout the meeting.

Many of the sessions were of marked interest because they made it possible to compare the ways in which a given technical problem is solved in the United States and in Canada. Further, the proceedings helped all of us to realize:

First, the vastness of our combined war effort.

Second, the variety of the topics treated, and the authoritative character of the addresses which were such that every one could carry away something of value to him in his war work.

Third, the interconnection of the war activities in the United States and Canada, and the similarity of many of the problems arising in the two countries.

Finally, the importance of such a gathering as regards pooling information and data, and the desire, evident on all sides, to take full advantage of this mutual aid.

This is the second occasion on which members of The American Society of Mechanical Engineers and The Engineering Institute of Canada have held joint deliberations, and, as in 1936, the cordial relations between the two organizations which have existed for so many years were fully emphasized. It was gratifying also that the many mechanical engineers in the Institute had such an excellent opportunity to meet their American confrères.

### Steam Power Development

After the necessary registration formalities had been carried out on the morning of Thursday, September 30th, a large audience assembled under the chairmanship of Professor A. G. Christie, Past-President A.S.M.E., for a session on Steam Power. The speaker was E. G. Bailey, vice-president of the Babcock-Wilcox Co., New York. His address was entitled "Steam Generation for Marine and Stationary Service in the U.S., 1939-43." The chairman first gave an outline of Mr. Bailey's well known achievements in steam engineering, including the development of the steam-meter, automatic boiler control and improvements in furnace design. Mr. Bailey spoke of the changes in steam generation equipment and methods brought about by the war, involving such matters as the general adoption of welding, advances in steam temperature control, the use of higher steam temperatures and pressures, economies in the use of steam, and problems in converting boilers from oil burning to coal burning or vice versa.

Active discussion followed, in which, among other speakers, G. N. Martin of the Dominion Bridge Company brought up the question of forced-circulation boilers, and M. G. Saunders of the Aluminum Company of Canada spoke of the many improvements which have been made to existing plants, the use of low-grade fuels, and the difficulties of maintaining automatic boiler control under widely varying loads.

### Weapon Maintenance in Battle

A past-president of the Institute, Dean C. R. Young, of the University of Toronto, took the chair at the first luncheon on Thursday. In welcoming the American delegation to Canada, President K. M. Cameron of the Institute expressed the pleasure felt by all Canadians in attending such a joint convention. It was gratifying that the speaker at the first luncheon of the meeting should be an officer of

**Brigadier-General MacMorland discusses weapon maintenance with Colonel George W. Beecroft of Ottawa and Dean C. R. Young of Toronto.**

*Left:* **J. T. Bain of T.C.A. calls for aircraft design which will facilitate maintenance.**

*Below:* **Chairman C. P. Edwards of Ottawa and speaker Charles I. Stanton of Washington.**

the United States Army, who would discuss a subject of vital importance in the mechanized warfare of to-day, namely "Weapon Maintenance in Battle."

Brigadier-General E. E. MacMorland, Head of the Maintenance Division, Ordnance Department, U.S. Army, addressing an audience of more than 200, then described the organization in that service which provides fòr the maintenance of weapons of all kinds in the field. It was pointed out that under present day conditions, any failure to maintain such equipment may destroy the effectiveness of the best troops.

### The Future in Transportation

After luncheon many of the members left the hotel and proceeded to the water front, where, by the courtesy of the deHavilland Aircraft of Canada, Limited, a demonstration flight of a Mosquito bomber was made over Toronto harbour. This event was greatly appreciated by the party, who found the performance of the aircraft in diving, climbing, manoeuvring and flying on one engine most impressive.

Transportation was the subject which received attention in the afternoon. Lieut.-Commander C. P. Edwards, Deputy Minister, Department of Transport, Ottawa, presided. The first speaker was Lawford H. Fry, Director of Research, The Locomotive Institute, New York, who remarked that during the war no revolutionary changes have been made in locomotive design, the aim being to conserve engineering man-power. He believed that remarkable developments would take place after the war, however, utilising gas-turbines and other new types of power units. Mr. Fry was followed by F. L. C. Bond, general manager, central region, Canadian National Railways, Toronto, who described the difficulties and achievements of Canadian railways thus far in the war, and sketched a general view of post-war transport conditions as he saw them.

Next came Charles I. Stanton, Administrator of Civil Aeronautics, Department of Commerce, Washington. He had kindly consented to take the place of Edward Warner, Chairman of the U.S. Civil Aeronautics Board, who at the last minute found it impossible to come to Toronto. Mr. Stanton spoke on "Post-War Air Traffic" and the vexed question of co-operation or competition. He gave an admirable review of the progress already made by air transport and its suitability for traffic of various kinds. He believed that after the war there would be at least half a million aircraft in the United States.

J. T. Bain, Superintendent of Engineering and Maintenance, Trans-Canada Airlines, Winnipeg, discussed the probable effect of post-war conditions on aeroplane design, although he admitted that any predictions regarding this would be difficult. He thought preference would be given to designs permitting of quick and easy replacements of parts or even whole sections of standardised aircraft.

### Ordnance and Aircraft Production

The evening session was devoted to Production Engineering. A. R. Stevenson, Jr., Assistant to the Vice-President, General Electric Company, Schenectady, N.Y., was chairman. L. E. Carr, Technical Director, British Ministry of Supply Mission, Washington, said that if the tank is to survive as a weapon of war its future will depend on its ability to stand punishment—this being more important than speed. His topic was "Comparison of Riveting, Casting and Welding Tank Hulls." A large audience listened with interest to his remarks on the effect of various projectiles on tank hulls, the replacement of riveting by welding in scout and reconnaissance cars and light tanks, and the recent development in cast steel hulls for the heavier tanks.

The use of plastic plywoods in aircraft construction was outlined by R. D. Hiscocks of the Aeronautical Laboratory, National Research Council, Ottawa.

Mr. R. B. McIntyre of the deHavilland Aircraft of Canada, Ltd., Toronto, spoke on the "Design Features of the Mosquito Aeroplane," the aircraft which many of his hearers had seen in flight during the noon recess.

### Conservation of Materials

At Friday morning's session, J. G. Notman, of the Dominion Engineering Company, Montreal, was in the chair. The topic was the "Conservation of Materials."

The first speaker, C. B. Stenning, Canadian chairman of the Joint War Production Committee, took "Stretching Our Resources" for his text. He described and illustrated many cases in mass production of machine parts where the use of simpler processes and substitute materials had led to great economies in labour and materials.

Howard Coonley, chairman of the conservation division of the War Production Board, Washington, spoke on the "Continuing Need for Conservation of Resources." He urged that conservation of materials, not only by avoidance of waste but also through modifications in design, substitute materials, simplification and standardization of design, should be carried on until every Axis nation is subdued. Even then, he pointed out, there will remain the problem of furnishing materials to feed, clothe and shelter nearly all mankind. Actually these do not lie ready for our immediate use.

### Canada's War Production

At the luncheon on Friday the presiding officer was J. W. Parker, Past-President A.S.M.E., of the Detroit-Edison Company, and the speaker was H. J. Carmichael, Co-ordinator of Production, Department of Munitions and Supply, Ottawa. His subject was "Canada's War Production."

Mr. Carmichael told an attentive audience that Canada this year produced fifty per cent more machine guns and small arms than last year, and intimated that Canada's production of munitions is now approaching its peak. The country has undergone a wartime industrial revolution—a

**Description of the Mosquito plane was most interesting. The naval officers are Captain (E) A. C. M. Davy, R.C.N., and Engineer Rear-Admiral G. L. Stephens, C.B.E.**

transformation that would have taken a quarter of a century under normal conditions. The percentage distribution of the war supplies produced by Canada is: to Canada 30 per cent; to the United Kingdom and other Empire countries 48 per cent; and to the United States about 22 per cent. The total value of contracts for war materials awarded by the Department, said Mr. Carmichael, is now nearly nine billion dollars; this exclusive of food and raw materials. One million Canadians are engaged in the war programme; twenty-five per cent of them are women.

### Man-Power Utilization

The session on Friday afternoon dealt with "Man-Power Utilization." The chairman was A. C. Streamer of the Westinghouse Electric & Manufacturing Company, Pittsburgh.

To begin with, A. L. Ainsworth, vice-president and general manager of the John Inglis Company, Toronto, gave his own company as an instance of the kind of expansion that Canadian industry has undergone since the outbreak of war, for it now employs 17,000 workers instead of 500. The original Bren gun contract called for 12,000 guns to be delivered over a period of five years. Their present capacity is over 12,000 per month. Sixty per cent of the plant's production machines are operated by women. Less than four per cent of the employees are on military deferment.

He cited many cases where conservation measures had saved direct labour, due to improvement in methods, process changes, and dilution. He was of the opinion that in every plant there should be an officer attending to suggestions, new ideas, process changes, and other questions of possible labour economy.

Mr. Ainsworth's address served as an excellent introduction to that of the next speaker, Lawrence A. Appley, Deputy Director, War Man-Power Commission, Washington, who pointed out that man-power is still a thorny problem in the United States and Canada, even though both governments have worked actively at its solution. He thought that the human element in production had not been dealt with so skilfully as the material side. Like Mr. Ainsworth, he felt that the true answer depended on the relations between managers, foremen, supervisors and workmen. In fact man-power utilization needed co-operation among all of these, and on the part of management a real interest in the treatment of the personnel.

In the United States, nine million men had been withdrawn from industry for the armed forces. Labour turnover and absenteeism in many plants had crippled their efforts. How can these losses be replaced, asked the speaker. He described a plan which had proved of great value in Buffalo, and had revealed many of the reasons why men do not stay in their jobs.

A large audience greatly appreciated these two thoughtful addresses.

### Exchange of Honours

Advantage was taken of the dinner on Friday evening to perform two interesting ceremonies; the presentation of certificates of honorary membership by The American

**Associate Deputy Minister W. S. Woods of Ottawa; William A. Hanley of Indianapolis; and Professor J. C. Cameron of Kingston.**

***Left:*** **H. J. Carmichael lauds the engineers.**

***Right:*** **Lawrence A. Appley of Washington discusses man-power utilization. The chairman is A. G. Streamer, vice-president of Westinghouse Electric & Mfg. Co., Pittsburgh.**

Society of Mechanical Engineers to Lieutenant General A. G. L. McNaughton, General Officer Commanding, Canadian Army Overseas; and by The Engineering Institute of Canada to W. L. Batt, Past-President of the A.S.M.E., and vice-chairman War Production Board, Washington.

The former honour was accepted on behalf of General McNaughton by C. J. Mackenzie, Acting President, National Research Council, Ottawa; the latter in the unavoidable absence of Mr. Batt was received for him by Robert M. Gates, president-elect of The American Society of Mechanical Engineers.

### Production Paces the War

Past-President Mackenzie officiated as toastmaster at the dinner, and introduced the speaker of the evening, Charles E. Wilson, formerly president of the General Electric Company, Schenectady, and now vice-chairman of the War Production Board, Washington. His subject was "Production Paces the War."

Sounding a note of warning, Mr. Wilson called on the people of the United Nations to look at their maps before letting optimism run away with them. These show that the hardest and costliest part of the job lies ahead. No cheering news from the battlefield can lighten the responsibility of the engineers and technicians, he said, for the pace of the war is set by production, and the pace of production depends on ingenuity, resourcefulness, inventiveness and unflagging competitive spirit.

Mr. Wilson observed that we had had world leadership but had failed to exercise it, although our countries to-day are measurably close to doing so. They are beginning to find their own strength, and use their vast resources. The pattern which is being set to-day in the unending struggle to find new ways of making better things in greater quantity, must be carried on after the war is won, in order to make the peace secure.

In expressing the thanks of the appreciative audience to Mr. Wilson for his outstanding address, J. B. Carswell, Director General, Washington Office, Canadian Department of Munitions and Supply, referred to the enormous task of repairing the loss and destruction which the war will have caused. Only if the needs of humanity can be met, can a peace be built which will last.

### Post-War Planning

The morning session of the third day of the meeting dealt with "Post-War Planning." The chairman was William A. Hanley, past-president A.S.M.E., of Indianapolis.

Ralph E. Flanders, past-president A.S.M.E., of Springfield, Vt., spoke on the application of engineering principles to social problems, particularly those arising after the war. He thought that in particular the relations to be established between the United States, Britain and Russia would prove to be the dominating features in post-war international policies. The civilised world must develop its own ideology, and aim at high standards of living.



**_Below:_ Presidential-nominee de Gaspé Beaubien of the Institute; President-elect R. M. Gates of A.S.M.E.; Lt.-Colonel F. S. Milligan; Past-President J. W. Parker of A.S.M.E. and Past-President G. A. Walkem of the Institute.**

**_Above:_ President-elect R. M. Gates of A.S.M.E. receives from President Cameron the honorary membership certificate in the Institute on behalf of W. L. Batt. _On the right:_ V. H. Coes, President A.S.M.E.**

**_Above:_ The guest speaker, Charles E. Wilson of W.P.B.**

The economic side of post-war reconstruction was stressed by W. A. Mackintosh, Canadian chairman, Joint Economic Committee (Canada-United States) who is also vice-chairman of the Advisory Committee on Economic Policy. Dr. Mackintosh pointed out that Canada is essentially dependent for prosperity on her exports—chiefly to the United Kingdom and the United States. The war has given her even a larger dependence on the outside world, hence wider markets are needed, not merely restricted regions.

In the past, various efforts to remove trade restrictions have failed, owing to the beggar-my-neighbour policies of certain countries. To avoid this, special post-war monetary measures would be needed, Dr. Mackintosh believed, including a central fund or endowment for impoverished countries, so that they can invest in, as well as buy from, other regions. Contributions to this fund would have to be carefully planned, not haphazard.

The third speaker was W. S. Woods, Associate Deputy Minister of Pensions and National Health, Ottawa. His subject was "Rehabilitation." Having just returned from England, Mr. Woods said he had been able to talk with many Canadians in the armed forces as to their hopes and aims when the war ends. Nearly all would ask first for a job and next for the opportunity to make a home. The rehabilitation policy of the Canadian government is already in operation along these lines. Its benefits are available to all returning men, and the experience now being gained will be applied when peace comes and its working has to be expanded to meet greater needs.

### Industrial Relations

At the luncheon on Saturday, the speaker was Professor J. C. Cameron of the School of Commerce and Administration, Queen's University, Kingston. The chairman was deGaspé Beaubien of Montreal, past vice-president E.I.C. The speaker's subject was "Trends in Industrial Relations."

Professor Cameron was of the opinion that industrial relations could be greatly improved if progressive employers would combine to formulate and adopt a comprehensive code, clearly outlining their own responsibilities to their employees and also making clear the responsibilities of employees to their employers, managers and supervisors. He submitted a draft of such a code or charter, and felt confident that the workers concerned would welcome and adhere to an understanding of this kind, if obtained after full discussion.

### Quality Control

The concluding technical session on Saturday afternoon took up the important subject of "Statistical Control of Quality," and attracted a large audience. J. Manuele, Director of Quality Control, Westinghouse Electric and Mfg. Co., Pittsburgh, Pa., took the chair.

The first speaker was Professor A. I. Peterson of the College of Engineering, New York University. He gave an introductory explanation of the technique of statistical analysis of inspection results, noting that it should be applied first to those critical features in the product which are economically important—the possible causes of trouble in respect to these features must be considered and inspection procedure devised so as to detect them—then statistical analysis of the inspection results could begin. The address was illustrated by many actual examples of successful application of this modern method.

The inspection problems discussed by the next speaker, H. H. Fairfield of the Department of Mines and Resources, Ottawa, were of a somewhat different kind, for as a metallurgist Mr. Fairfield dealt rather with inspection of such items as quality, hardness, tensile strength, yield point and chemical composition. His address followed the general lines of his recent paper on the subject (which appeared in the September issue of *The Engineering Journal*) and served as an excellent supplement to the remarks of the previous speaker. Both addresses should do much to dispel the mystery which, in the minds of many, appears still to surround the subject of statistical control.

This session was the concluding feature of a meeting which required a conscientious member to devote three whole days of steady application to the pursuit of knowledge and information. But it is doubtful whether the Institute has participated in any meeting where there was so rich a harvest of fact and theory to be reaped in so short a time. Nor have there been many meetings where international contacts have been so pleasant and so timely.

**_Right to left:_ John E. Armstrong, Montreal; George A. Stetson of New York; W. A. Mackintosh of Ottawa; Ralph E. Flanders, Springfield, Vt.; and Professor A. I. Peterson, New York.**

**S p e e d  t h e  V i c t o r y**

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.**

**Brigadier Christopher Vokes,** M.E.I.C., of the Royal Canadian Engineers, has been awarded the D.S.O. for his part in the Sicilian campaign with the First Canadian Division.

Brigadier Vokes was educated at the Royal Military College, Kingston, Ont., where he graduated in 1925 and at McGill University, Montreal, where he secured his degree of B.Sc. in civil engineering in 1927. He was then commissioned in the Royal Canadian Engineers, Permanent Force. He attended the School of Military engineering at Chatham, England, from 1927 to 1929. In 1931 he was appointed district engineer Officer, Military District No. 12 at Regina, Sask. In 1934 he went to England to attend the Staff College at Camberley where he graduated in 1935.

Upon his return to Canada he went to the Department of National Defence Headquarters, Ottawa. He went overseas in December, 1939. Before his promotion as Brigadier, in June 1942, he was G.S.O. 1 at a Canadian Divisional Headquarters.

**Major James Blair,** M.E.I.C., of the Royal Canadian Engineers was reported severely wounded in the Sicilian campaign. Before going into active service, Major Blair was plant engineer, Imperial Oil Refinery at Calgary, Alta. He has been overseas since early in 1941.

**Lieutenant William Kenneth Heron,** S.E.I.C., of the Royal Canadian Engineers has been awarded the Military Cross for his participation in the Sicilian campaign with the First Canadian Division. Before enlisting at the outbreak of war, Lieutenant Heron was employed with Canadian Johns-Manville, Asbestos, Que.

**Lieutenant J. A. Savory,** R.C.N.V.R., M.E.I.C., has been awarded the O.B.E. (Military Division) for his part in salvaging the merchant vessel, *Matthew Luckenbach,* which had been rammed. The vessel with its valuable cargo, was sinking when *H.M.C.S. Columbia* of which Lieut. Savory is chief engineer, went to the rescue. A boarding crew under the local officer took over the damaged vessel after its own crew had abandoned the ship. Working desperately and keeping the pumps operating in a heavy gale and high sea, they succeeded eventually in reaching a Canadian port. Born in Hamilton, Ont., Lieut. Savory enlisted with the R.C.N.V.R. after graduating from Queen's University with the degree of B.Sc. in 1941. He was aboard the cruiser *Devonshire* when her guns sank a German armed merchant raider in November 1941.

**McNeely DuBose,** M.E.I.C., vice-president of the Aluminum Company of Canada, Limited, has been placed in control of all company operations in the Saguenay district with headquarters at Arvida, Que. He is also president of Saguenay Electric Company and vice-president of Aluminum Power Company, Limited, the Saguenay Transmission Company, Limited, and the Alma and Jonquière Railway Company. Mr. DuBose is a past vice-president of the Institute.

**M. W. Maxwell,** M.E.I.C., former chief commissioner of development and natural resources of the Canadian National Railways has been appointed to head the development branch in the reorganization which was recently made and as a result of which the Department of Research and Development was divided in two branches.

**Colonel H. R. Lynn,** M.E.I.C., who was recalled from command of an engineer unit overseas to take the position of G.S.O. 1 Weapons at National Defence Headquarters, Ottawa, early this year, has now been transferred to Washington as technical and military advisor to Sir William Wiseman, British Petroleum Warfare Department representative in the United States. Colonel Lynn is president of Lynn-McLeod Engineering Limited and Steel Foundries, Thetford Mines, Que.

**Past-President G. A. Walkem,** M.E.I.C., of Vancouver has been appointed to succeed the late H. H. Vaughan of Montreal, also a past president of the Institute, as chairman of the Canadian Advisory Committee of the Institution of Mechanical Engineers of Great Britain.

**Air Vice-Marshal E. W. Stedman,** M.E.I.C., director general of air research for the R.C.A.F. has been appointed a member of council of the Institution of Civil Engineers of Great Britain for 1943-44.

He succeeds R. J. Durley, M.E.I.C., as Canadian representative of the council of the Institution and by virtue of his new office he becomes chairman of the council's advisory committee in Canada. Air Vice-Marshal Stedman has been an Associate Member of the Institution since 1914 and was elected to full membership in 1929.

**Lieutenant-Colonel E. T. Renouf,** M.E.I.C., of Montreal has returned from overseas and is now on the advisory and training staff of the Artillery Training Centre at Shilo, Man. Colonel Renouf went overseas early in 1940 with the 2nd Montreal Regiment, Royal Canadian Artillery.

**E. J. Davies,** M.E.I.C., has accepted the position of inspector of vocational schools with the Department of Education of the Province of Ontario and now resides at Toronto. Mr. Davies has occupied during the past five years the position of principal of the Technical and Commercial High School at Port Arthur, Ont. He was vice-chairman of the Lakehead Branch of the Institute, when he left Port Arthur.

**R. J. Askin,** M.E.I.C., is now manager of mills with the Abitibi Power and Paper Company, at Toronto.

**Alex. Love,** M.E.I.C., formerly plant engineer of the Hamilton Bridge Company Limited, Hamilton, has recently been appointed mechanical engineer—Structural Division—of the same company. On a recent business trip Mr. Love suffered a heart attack which necessitated his admission to the hospital in Port Hope. He is now back at his home in Hamilton where he is recuperating. Mr. Love was chairman of the Hamilton Branch in 1941.

**Frank Nokes,** M.E.I.C., of the Department of Electrical Engineering at the University of Toronto has joined the staff of the Hydro-Electric Power Commission Laboratories at Toronto. He is a graduate in electrical engineering of the University of Alberta in the class of 1937. He did post-graduate work at Iowa State College in the United States and secured his degree of M.S. and Ph.D. in electrical engineering in 1938 and 1940 respectively.

**George C. Clarke,** M.E.I.C., who was vice-president and treasurer of Fraser Brace Engineering Company Limited, Montreal, has moved permanently to New York where he now holds the position of 2nd vice-president and treasurer of Fraser Brace Company, Inc., New York. Mr. Clarke has been with the company since 1911 when he joined as a director and chief engineer. Born at Pittsburgh, Pa., he received his engineering education at Pennsylvania State College.

**Thomas B. Patterson,** M.E.I.C., has left the Canadian Dredge and Drydock Company Limited, Toronto, to join the Department of National Defence (Navy) at Ottawa, as mechanical engineer.

**H. G. Angell,** M.E.I.C., has been appointed district engineer with the Department of National Defence (Navy) in Newfoundland.

**H. C. Brown,** M.E.I.C., who was formerly with Union Bag and Paper Corporation at Savannah, Ga., U.S.A., is now located with Crossett Paper Mills, Crossett, Arkansas.

**H. A. Wilson,** M.E.I.C., has joined the Consolidated Machine Tool Corporation at Rochester, N.Y.

**D. W. Laird,** M.E.I.C., has joined the Royal Canadian Engineers and is at present stationed at the Training Centre, Chilliwack, B.C. He was previously a designing engineer with C. D. Howe & Company Limited, Port Arthur, Ont.

**Y. R. Anderson,** M.E.I.C., is now located in Montreal where he has taken a position as ceramic engineer with the Canada Firebrick Company Limited.

**J. G. D'Aoust,** M.E.I.C., has left the staff of Price Brothers at Riverbend, Que., to return to British Columbia where he has taken a position as mechanical engineer with Heaps Engineering Company Limited at New Westminster. Before coming east two years ago, Mr. D'Aoust was employed with Powell River Company Limited at Powell River, B.C.

**C. F. Davison,** M.E.I.C., who for the past two years had been resident engineer with Defence Industries Limited, Bouchard Works, Ste-Thérèse, Que., has taken the position of works manager with Sifto Salt Company Limited, at Sarnia, Ont.

**E. W. Dill,** M.E.I.C., has recently taken the position of power plant supervisor with St. Clair Processing Company at Sarnia, Ont.

**Lieutenant-Colonel J. H. Edgar,** M.E.I.C., of the Canadian National Railways, Winnipeg, Man., has been in command of the 10th District R.C.E., Reserve Army, for several years.

**P. W. Greene,** M.E.I.C., has recently taken the position of assistant district engineer, Department of National Defence (Navy), in Newfoundland. Mr. Greene was previously employed on the staff of Dry Dock Engineers, New York, in the capacity of designing engineer.

**J. R. Hango,** M.E.I.C., has been appointed assistant manager of the power department, Aluminum Company of Canada Limited, with headquarters at Montreal. He was previously general superintendent of Saguenay Transmission Company at Arvida.

**C. E. Nix,** M.E.I.C., has taken a position as assistant engineer with Coast Construction Company Limited at Edmonton, Alta.

**F. X. Granville,** M.E.I.C., has gone to Mackenzie British Guiana, S.A., where he is employed with Demerara Bauxite Company. He was previously employed with Defence Industries Limited at Nobel, Ont. Before coming to central Canada, a few years ago, he was employed as an assistant engineer with the Department of Public Works and Highways at Charlottetown, P.E.I.

**J. R. Rettie,** M.E.I.C., has been transferred a few months ago from Fraser Brace Limited, LaTuque, Que., to the staff of United Shipyards Limited, at Montreal.

**Major J. G. Spotton,** M.E.I.C., has returned from overseas and is at present attached to the Directorate of Artillery at National Defence Headquarters, Ottawa.

**L. B. Stewart,** M.E.I.C., of Shawinigan Water & Power Company has been transferred from Rapide Blanc, Que., to Shawinigan Falls where he is field engineer with the power house engineering office.

**W. B. Young,** M.E.I.C., is now managing director of Products and Plastics Limited, Lynnmour, B.C. Mr. Young is a past councillor of the Institute for Vancouver Branch.

**G. Stephenson,** M.E.I.C., who had been on loan for the past fifteen months to Farand and Delorme, Ordnance Division, Montreal, as plant superintendent has now returned to his former employer the E. B. Eddy Company Limited, Hull, Que., where he is mechanical superintendent.

**G. S. Lace,** M.E.I.C., has taken the position of assistant chief of maintenance, B.W.I. Airways at Port of Spain, Trinidad. He was previously chief inspector C. & C. Aircraft and Company Limited at Winnipeg, Man.

**A. W. Sinnamon,** M.E.I.C., has left the Atlas Steels Limited at Welland, Ont., to take the position of tool engineer with Wolverine Industries at Hamilton, Ont.

**James R. B. Milne,** M.E.I.C., has taken the position of production superintendent at the Longueuil plant of the Dominion Engineering Works Limited. He was previously Manager of the Northern Foundry and Machine Company at Sault Ste-Marie, Ont.

**Gordon D. Hulme,** M.E.I.C., assistant manager of the Department of Development, Shawinigan Water and Power Company, Montreal, has been named Officer Commanding of a new air cadet squadron being sponsored by the Young Men section of the Montreal Board of Trade.

**Richard Thorn,** M.E.I.C., has joined the staff of the Barrett Company in Montreal where he is training to take the position of plant engineer.

**P. L. Pouliot,** Jr.E.I.C., is now on the teaching staff of the Ecole Polytechnique, Montreal. He was previously employed with the National Research Council at Ottawa.

**W. E. Taylor.** Jr.E.I.C., is now an electrical engineer with St. Clair Processing Corporation, Sarnia, Ont.

**J. O. Giles,** Jr.E.I.C., has returned from Peru where he was employed with International Petroleum Company, at Talara and is now on the staff of the Imperial Oil Limited, at Sarnia, Ont.

**George Baldry,** Jr.E.I.C., has recently resigned his position of director of the Bureau of Industrial Hygiene for the Province of Manitoba and has engaged in private practice at Winnipeg.

**Yvon Nadeau,** Jr.E.I.C., has left Fraser Brace Company Limited and is now a junior engineer with Marine Industries Limited, Sorel, Que. He graduated from the Ecole Polytechnique in 1940.

**J. Adolphe Martin,** S.E.I.C., has been appointed engineer-representative of Canadian Vickers Limited at the San Diego plant of Consolidated Vultee Aircraft Company. He has been employed as a liaison engineer in the aircraft department of Canadian Vickers, Montreal, since his graduation from the Ecole Polytechnique in 1942.

**Lieutenant Wm. B. White,** R.C.E., S.E.I.C., is at present located at Shilo, Man. He has been on active service for the last two years.

**Florian Leroux,** S.E.I.C., has been granted a scholarship by the provincial government of Quebec and he expects to do post-graduate work in aeronautical engineering at The Massachusetts Institute of Technology, Cambridge. Mr. Leroux graduated from the Ecole Polytechnique last spring. During his course, he was president of the Students Council of the University of Montreal.

**Henri Audet,** S.E.I.C., a graduate of this year at Ecole Polytechnique, Montreal, has been granted a scholarship by the government of the province of Quebec to do post-graduate work in electrical engineering at the Massachusetts Institute of Technology. Mr. Audet was president of the Students' Association at the Ecole last year and he was awarded the Engineering Institute prize.

**Captain F. H. T. Webster,** Affiliate E.I.C., has returned from overseas at the beginning of the year and is at present in the District Engineer's Office, M.D. No. 4, Montreal.

### VISITORS TO HEADQUARTERS

**J. L. Connolly,** M.E.I.C., assistant plant superintendent, Demerara Bauxite Company Limited, Mackenzie, Georgetown, B.G., on August 30, 1943.

**G. T. Gunn,** M.E.I.C., James Stewart Associates Co. Inc., Port of Spain, Trinidad, on September 2, 1943.

**Paul Vincent,** M.E.I.C., chief technical section, Department of Colonization, Quebec, on September 3, 1943.

**Flt. Lieut. E. B. A. LeMaistre,** R.A.F., S.E.I.C., London, England, on September 4, 1943.

**J. J. Freeland,** M.E.I.C., engineer, Canadian International Paper Company Limited, Temiskaming, Que., on September 13, 1943.

**W. S. Black,** M.E.I.C., assistant engineer, Buildings Construction Department, Trinidad Leaseholds Limited, Pointe-à-Pierre, Trinidad, on September 16, 1943.

**J. H. Wilson,** M.E.I.C., electrical superintendent, Quebec North Shore Paper Company, Baie Comeau, Que., on September 20, 1943.

**J. M. Duncan,** M.E.I.C., plant manager, Canadian Liquid Air Company Limited, Hamilton, Ont., on September 23, 1934.

**Colonel G. W. F. Johnston,** M.E.I.C., Department of National Defence, Ottawa, Ont., on September 27, 1943.

**R. Donald McKay,** M.E.I.C., sanitary engineer, Department of Public Health, Halifax, N.S., on September 28, 1943.

**A. L. C. Atkinson,** R.C.N.V.R., M.E.I.C., Naval Service Headquarters, Ottawa, Ont., on September 29, 1943.

**H. F. Bennett,** M.E.I.C., district engineer, Department of Public Works, London, Ont., on September 30, 1943.

**Leslie Charles Turner,** R.C.N.V.R., S.E.I.C., from Halifax en route to Saskatoon, on October 1st, 1943.

**J. T. Thwaite,** M.E.I.C., engineer on switching equipment, Canadian Westinghouse Company Limited, Hamilton, Ont., on October 4, 1943.

**W. O. Scott,** M.E.I.C., plant superintendent, Dominion Bridge Company Limited, Vancouver, B.C., on October 7, 1943.

**J. L. Shearer,** M.E.I.C., city assessor, City of Ottawa, Ont., on October 7, 1943.

### COMING MEETINGS

**Canadian Chamber of Commerce**—Annual Meeting, October 27-29, 1943, Seignory Club, Que., D. L. Morrell, Secretary, Board of Trade Building, Montreal.

**American Society of Mechanical Engineers**—Annual Meeting, November 29–December 3, 1943, Hotel Pennsylvania, New York. C. E. Davies, Secretary, 29 W., 39th Street, New York.

**The Engineering Institute of Canada**—Fifty-eighth Annual Meeting, February 10-11, 1944, Château Frontenac, Quebec. L. Austin Wright, General Secretary, 2050 Mansfield Street, Montreal.

# Obituaries

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

**George Andrew Colhoun,** M.E.I.C., died on August 30th, 1943, at St. Joseph's Hospital, Hamilton, Ont., after an illness of a few weeks. He was born at Sparta, County of Elgin, Ontario, on December 23rd, 1881. He received his primary education in the rural schools of Lambton County, Watford High School, and the Forest Model School. He taught public school for three years before he entered the School of Practical Science at Toronto University where he graduated in 1906. Upon graduation he joined the staff of the Hamilton Bridge Company, at Hamilton, as a draughtsman and he gradually rose to the position of designing engineer which he still held at the time of his death. In this capacity he was associated with the design of several of the Welland Ship Canal bridges, many of the buildings for the large industries in Hamilton as well as several railway bridges, both fixed and movable, throughout the country.

Mr. Colhoun joined the Institute as an Associate Member in 1919, and he transferred to Member in 1934.

**Jean Flahault,** Jr.E.I.C., died at the Royal Victoria Hospital, Montreal, on September 23rd, 1943, after a short illness. Born at Montreal on August 23rd, 1914, he was educated at the Collège Ste-Marie, Montreal, and at the Ecole Polytechnique where he obtained his degree of B.A.Sc. in 1938. He did post-graduate work at the Carnegie Institute of Technology, Pittsburgh, Pa., where he obtained a degree of B.Sc. in metallurgical engineering in 1940.

**Jean Flahault, Jr.E.I.C.**

Early in 1940 he went overseas to join the French Army. He fought in the battle of France in the spring of that year and was taken prisoner by the Germans. Later he managed to escape and after a hazardous trip throughout occupied and unoccupied France and Northern Africa he finally succeeded in returning to Canada in 1941. He then returned to the Aluminum Company of Canada, at Arvida, where he had been employed previously during his summer vacations. At the time of his death he was a pot-room supervisor at Arvida.

During his course at the Ecole Polytechnique he was active in the Junior Section of the Montreal Branch of the Institute and at one time was a member of the executive. Early in 1942 he had delivered an address before the Junior Section relating his experiences as a prisoner of war. He had been married a few months ago to Miss Judyn West, from Pittsburgh, Pa.

Mr. Flahault joined the Institute as a Student in 1936 and transferred to Junior in 1942.

*The following tribute to Mr. Flahault's memory was paid by H. A. Estabrook, on September 30th, at a meeting in Arvida of the newly established Junior Section of the Saguenay Branch. He said (in part)—*

There is a vacant chair at this table to-night—one of our friends has departed. His place in this important war plant and in the social life of Arvida will be hard to fill. He took a prominent part in all of our various organizations. This section of the Institute will be the poorer for his loss. Few had so wide a field of interest as he. To few has it been granted in so great a measure to be the life of the party. Wherever he went there was merriment, humour and fellowship.

To have known Jean Flahault was a privilege.

His death is a cause of deep sorrow to me personally. Our work in Arvida has run a parallel course and our friendship was never marred by the slightest discord. It is with deep emotion that I pay this small tribute to Jean Flahault's memory.

Gentlemen, sportsman, soldier, engineer, Flahault will long be remembered.

To his widow, his parents, his brothers and sisters, on behalf of this Junior Section of the Saguenay Branch of the Institute, I send our deepest sympathy, which mere words are all too inadequate to express.

**Emil Kugel,** M.E.I.C., died on May 19th, 1943, at Montreal, after a long illness. He was born at Trenczin-City, Province of Slovakia, Czecho-Slovakian Republic, on June 12th, 1888, and received his education at the University of Vienna where he graduated as a civil engineer in 1913. After graduation he was engaged for a few years in building and bridge construction work in Vienna. In 1920 he established himself in private practice, as a professional engineer and registered architect in the city of Olmuetz, Czecho-Slovakia, and for the next few years was engaged in the design and construction of buildings and bridges in steel and reinforced concrete.

In 1928 he came to Canada and joined the staff of Harkness, Loudon & Hertzberg, architects and structural engineers in Toronto as a designing engineer. In this capacity he was intimately connected with the design of the Canadian Bank of Commerce building. The following year he came to Montreal and became engineer in charge with Concrete Construction Limited. In 1932 he established himself as a contracting engineer in Montreal and as such was engaged in industrial and residential construction until his death.

Mr. Kugel joined the Institute as an Associate Member in 1929 and he became a Member in 1940.

**Daniel Todd Main,** M.E.I.C., died at his home in Montreal, on September 9th, 1943. Born at Kirkintilloch, Scotland, on June 18th, 1882, he was educated at King William's College, Isle of Man, and at Glasgow Technical College. After serving an apprenticeship in Scotland he came to Canada in 1903 as a draughtsman with McKenzie, Mann & Company, in Winnipeg. In 1904 he joined the Canadian Pacific Railway Company at Winnipeg and in the following years he occupied several mechanical posts on the railway's western lines and in Montreal until he was appointed superintendent of motive power at Montreal, in 1915. The following year he was transferred to Winnipeg as works manager and remained in this position until he left the company in 1920.

During the next two years he was located at Watervliet, N.Y., as vice-president of the Bird Archer Company of New York. In 1922 he returned to Canada as works inspector and sales engineer in charge of the engineering sales department of the National Steel Car Corporation Ltd. at Hamilton, Ont., in 1923 he was appointed Montreal manager of the corporation. He resigned this position in 1932 to become vice-president and secretary-treasurer of Adanac Supplies, Ltd., and vice-president of Canadian Waugh Equipment Co. Ltd., a position which he still occupied at the time of his death.

Mr. Main joined the Institute as a Member in 1917.

**John B. Nicholson,** M.E.I.C., president of the Nicholson Company, engineers and contractors of New York, died at his home in Scarsdale, N.Y., on August 8th, 1942. Born at Hamilton, Ont., on December 5th, 1890, he was educated at the Hamilton Collegiate Institute and at the University of Toronto where he graduated in 1914. Upon graduation he had founded the firm bearing his name and during the

John B. Nicholson, M.E.I.C.

past 28 years he had specialized in concrete storage construction and industrial plants.

Mr. Nicholson joined the Institute as a Junior in 1914 and was transferred to Associate Member in 1917. In 1937 he transferred to Member.

**Brete Cassius Nowlan,** M.E.I.C., sales manager of the Telephone Department of Northern Electric Company, Montreal, died at his home on September 17th, 1943. He was born at Reasnor, in the State of Iowa, U.S.A., on May 28th, 1878. He received his engineering education at the Iowa State College where he graduated in electrical engineering in 1900. He began his telephone career upon

B. C. Nowlan, M.E.I.C.

graduation and was engaged in the erection of small electrical plant units and the erection and sale of telephone plants until 1902 when he joined the Western Electric Company in the United States. From then on he was engaged in the construction of telephone central offices as superintendent until 1911 when he came to Canada in the Telephone Sales Department of the Northern Electric Company. He later became manager of the department.

Mr. Nowlan became a Telephone Pioneer of America in 1928, and in 1934 was elected vice-chairman of the Northern Electric council and chairman for the 1935-36 term, and at the time of his death he was vice-president of the Telephone Pioneers of America.

Mr. Nowlan joined the Institute as an Associate Member in 1921 and he became a Member in 1940.

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## BORDER CITIES BRANCH

W. R. Stickney, M.E.I.C. - - *Secretary-Treasurer*

President K. M. Cameron and General Secretary Dr. L. Austin Wright visited the Border Cities Branch on September 10th. Accompanying the party were J. A. Vance of Woodstock, councillor of the Institute for the London branch, and H. F. Bennett of London, past councillor of the Institute and chairman of the Committee on the Training and Welfare of the Young Engineer.

A dinner meeting was held at the Prince Edward Hotel with the ladies, after which a general meeting of the branch was convened.

Introduced by C. M. Goodrich, the president described the tremendous task which faces Canada in post-war reconstruction. Citing figures showing the number of persons in active service or employed in war industry, he showed that the end of the war would bring an immediate necessity of finding occupations for 1,758,000 persons directly engaged in the war. Among the steps already taken to alleviate unemployment after the war was the compulsory re-employment by employers of men who had enlisted. Another move is the requirement that each member of the armed forces is required to fill out an occupation history form. Unemployment insurance was another benefit. Vocational training is made available to all upon their discharge. Farmers are given aid until they are re-established. Young men who gave up university courses will be maintained at the expense of the government while they complete their courses. Preference is given returned men in work on government contracts and in government departments. The Veterans' Land Settlement Act has been completely revised. A welfare division is associated with local committees to assist members of the armed forces.

"There has been a great deal of advertising of the revolution which is going to take place after the war in science, in engineering, in housing and in other fields, but it is my opinion there will be no revolutionizing of the methods and practice of science and engineering," Mr. Cameron said. "The planning of construction works should not be put aside until after the war with the idea that any plans made now would be outmoded as soon as completed. Such talk only deters people from making plans."

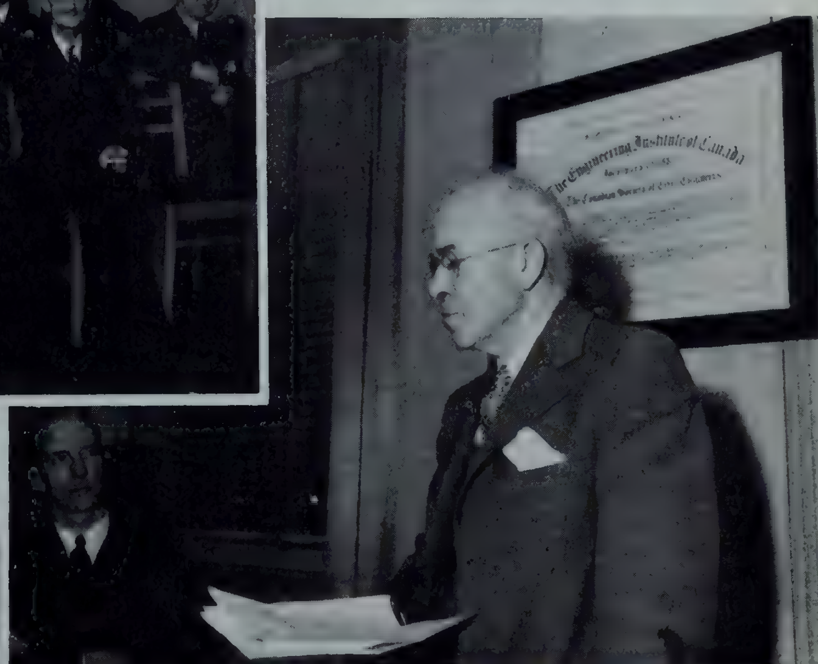
Mr. Cameron pointed out that a works programme can only aid in decreasing unemployment but no such programme could be large enough to cure unemployment entirely.

"If we are going to have any sort of construction programme after the war we must get the physical planning done now since it demands early arranging of technical, legal and financial details," he said.

Two requirements are employment for those who can work and social security for those who cannot.

## THE PRESIDENT VISITS BORDER CITIES BRANCH

***Front row:*** **W. A. Hare, T. H. Jenkins, G. V. Davies, J. Alton, A. H. MacQuarrie, G. P. Griffin.**



***Above:*** **President Cameron speaks on post-war reconstruction.** ***At left:*** **J. B. Dowler, vice-chairman of the branch.**

***Left, front row:*** **President K. M. Cameron, Councillor G. E. Medlar.** ***Back row:*** **A. H. Pask, J. B. Dowler, A. H. MacQuarrie, Councillor J. A. Vance and H. F. Bennett.**

Public works must be productive in nature, he contended, foreseeing also a substantial demand for machines to produce consumer goods.

Mr. Cameron said that following compulsory savings there may be a need for further control of that spending power after the war and that he believed a committee is studying such control.

After the president's address, John Dowler, vice-chairman of the branch who presided at the dinner in the absence of the chairman, introduced Dr. L. Austin Wright, general secretary of the Institute. Dr. Wright outlined some of the special wartime problems facing the Institute. He said special committees had been set up and efforts were being made to obtain better status for engineers in the armed services.

### MONTREAL BRANCH

L. Duchastel, m.e.i.c. - - *Secretary-Treasurer*
H. H. Schwartz, s.e.i.c. - - *Branch News Editor*

On Thursday, September 30th, Mr. H. F. Bennett addressed the first meeting of the season of the Montreal Branch of the Institute on **The Engineer of Tomorrow.** He stated that the engineer should maintain his precedence in industry. The engineer must realize that leadership has associated with it responsibility, and therefore he must be prepared to play a greater role in the life of the community. From this point of view, the personality of the engineer is of as great, if not greater, importance as his technical training.

To-day, the economic position of the engineer is not as secure as it should be, due to the uncertainty of post-war industrial trends. This makes the task of guiding the embryo engineer in the choice of a suitable profession a difficult one. Mr. Bennett, as chairman of the Institute Committee on the Training and Welfare of the Young Engineer, discussed the work he and his committee are doing in this connection.

In the discussion period that followed, Mr. Jacques Benoit, chairman of the Student Guidance Committee of the local branch, mentioned that his committee was active. Pamphlets in both English and French, published by the Institute committee, had been distributed and principals of high schools had been interviewed on the prospects for students in engineering.

Refreshments were served at the close of the meeting.

### SAGUENAY BRANCH

Alex. T. Cairncross, m.e.i.c. - *Secretary-Treasurer*
J. R. Madill, Jr.e.i.c. - *Branch News Editor*

The annual meeting of the Saguenay Branch was held on July 29th at the Arvida Protestant School immediately following an open meeting at which Dr. Haennie, director of Aluminum Laboratories, Kingston, spoke.

The meeting was brief and the retiring Chairman R. H. Rimmer announced the name of the 1943-44 executive, as listed on page 547.

The chairman elect was not present at the meeting and the position of secretary-treasurer was not filled at that time.

Since the meeting Mr. Miller has appointed J. R. Madill, Jr.e.i.c., to act as Branch Editor and Papers Secretary and has asked Alex. T. Cairncross, m.e.i.c., to handle all the other Branch business. If this latter arrangement is satisfactory it will be carried out for the year 1943-44.

# News of Other Societies

**Items of interest regarding activities of other engineering societies or associations**

### ROBERT M. GATES OF NEW YORK NAMED HEAD OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Robert M. Gates, president of the Air Preheater Corporation, New York, and authority on steam generation and industrial management, has been elected president of the American Society of Mechanical Engineers. He succeeds Harold V. Coes of New York.

Four vice-presidents and four managers also were elected, representing the entire slate presented by the National Nominating Committee at a semi-annual meeting of the Society in Los Angeles in June.

Vice-presidents elected are: David W. R. Morgan, Manager, Condenser Pump and Blower Division, Westinghouse Electric and Manufacturing Company, Essington, Pa.; Jonathan A. Noyes, District Manager, Sullivan Machinery Co., Dallas, Texas; Ford L. Wilkinson, Jr., Dean of Engineering, Speed Scientific School, University of Louisville, Louisville, Ky.; and Rudolph F. Gagg, Assistant to the General Manager, Wright Aeronautical Corporation, Paterson, New Jersey.

Managers elected to serve on the Council, governing body of the ASME, are: James M. Robert, Dean, College of Engineering, Tulane University, New Orleans, La.; Samuel H. Graf, Professor and Head of Mechanical Engineering, Oregon State College, Corvallis, Ore.; and Alton C. Chick, Assistant Vice-President, Manufacturers Mutual Fire Insurance Co., Providence, R.I.

The newly elected president, Robert M. Gates, is a Fellow of the ASME, president and director of the Air Preheater Corporation, formerly vice-president of The Superheater Company and its affiliate, Combustion Engineering Company, Inc., all of New York, N.Y. He received the degree of bachelor of science in mechanical engineering in 1907 from Purdue University.

From 1907 to 1909 Mr. Gates was associated with the Browning Company of Cleveland, Ohio, after which he practiced as consulting engineer until 1912 when he became associated with the Thew Shovel Company of Lorain, Ohio. In 1918 he became Eastern manager for the Lakewood Engineering Company of Cleveland, Ohio, and located in Philadelphia, Pa. In 1922 he became associated with The Superheater Company.

Mr. Gates has participated in the design and construction connected with the builders of fuel-burning and steam-generating equipment, including all types of boilers, stokers, pulverized-coal equipment, economizers, air preheaters, and superheaters for stationary, railway, and marine service as well as a wide variety of heavy equipment for the process industries. Outstanding among their installations are the world's largest high-pressure boilers each producing over a million pounds of steam per hour.

### WAR PRODUCTION CLINICS PLANNED BY A.S.M.E.

Plans are being made by the American Society of Mechanical Engineers for war production clinics to be held in about 50 industrial centers in the United States to aid the war effort.

The Society, at the request of the War Production Board, initiated and sponsored the first clinic at Dayton, Ohio, last spring and subsequently entered into a contract with the War Production Board to conduct a series of similar clinics.

These clinics are organized around a panel of competent speakers and their object is the solving of industrial production problems, the exchange of ideas on production methods, and means of increasing production.

Paul T. Onderdonk, of New York, has been assigned by the War Production Board to organize the clinics and assist local groups in holding them.

The following cities are being considered for holding such clinics for the first time: Akron, Ohio, Baltimore, Md., Columbus, Ohio, Denver, Colo., Detroit, Mich., Fort Wayne, Ind., Grand Rapids, Mich., Knoxville, Tenn., Memphis, Tenn., Milwaukee, Wis., Minneapolis, Minn., Pittsburgh, Pa., Portland, Ore., Rockford, Ill., San Francisco, Calif., Spokane, Wash., Springfield, Mass., Springfield, Vt., St. Louis, Mo., Toledo, Ohio, Waterbury, Conn., Worcester, Mass.

Clinics will be repeated in many of the following cities where they already have been held:

Atlanta, Ga., Birmingham, Ala., Boston, Mass., Bridgeport, Conn., Buffalo, N.Y., Chattanooga, Tenn., Chicago, Ill., Cincinnati, Ohio, Cleveland, Ohio, Dallas, Texas, Davenport, Iowa, Dayton, Ohio, Hartford, Conn., Indianapolis, Ind., Kansas City, Mo., Kingsport, Tenn., Los Angeles, Calif., Louisville, Ky., Newark, N.J., New Haven, Conn., New Orleans, La., New York, N.Y., Peoria, Ill., Philadelphia, Pa., Providence, R.I., Rochester, N.Y., Schenectady, N.Y., Seattle, Wash.

The War Production Board, its regional offices, the armed services, industry, and the several technical societies are co-operating in the clinics.

# Library Notes

## Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications

### ADDITIONS TO THE LIBRARY

#### TECHNICAL BOOKS

**Treatment of Experimental Data:**
*Archie G. Worthing and Joseph Geffner. N.Y., John Wiley and Sons, Inc., 1943. 6 x 9¼ in. $4.50.*

**Theoretical Soil Mechanics:**
*Karl Terzaghi. N.Y., John Wiley and Sons, Inc., 1943. 6 x 9¼ in. $5.00.*

**The Machine Shop Yearbook and Production Engineers' Manual:**
*2nd ed. H. C. Town, editor. London, Paul Elek (Publishers) Ltd., 1943. 5½ x 8½ in. 31s. 6d. (post free).*

**Circuit Analysis of A-C Power Systems:**
*Vol. I—Symmetrical and Belated Components. Edith Clarke. N.Y., John Wiley and Sons, Inc., 1943 (General Electric Series). 5½ x 8½ in. $6.00.*

**Structural Frameworks:**
*Clyde T. Morris and Samuel T. Carpenter. N.Y., John Wiley and Sons, Inc., 1943. 5½ x 8½ in. $4.00.*

**Engineering Mechanics:**
*Ferdinand L. Singer. N.Y., Harper and Bros. (c. 1943). 6¼ x 9½ in. $4.00.*

**Fluid Mechanics:**
*R. C. Binder. N.Y., Prentice-Hall, Inc., 1943. 6 x 9¼ in. $5.00.*

**Municipal Public Works Service Expenditures and Appropriations:**
*Chicago, American Public Works Association, 1943. Bulletin No. 18. 69 p. $1.50.*

#### PROCEEDINGS, TRANSACTIONS

**U.S. National Research Council—Highway Research Board:**
*Proceedings of the twenty-second annual meeting held at St. Louis, Missouri, December, 1942.*

#### REPORTS

**Canada. Civil Service Commission:**
*Thirty-fourth annual report for the year 1942.*

**Illinois. State Water Survey Division:**
*Ground water supplies of the Chicago-Joliet-Chicago Heights area. Bulletin No. 35, 1943.*

**U.S. Geological Survey—Water Supply Paper:**
*No. 888: Stream-gaging procedure.—No. 916: Summary of records of surface waters of Upper Columbia river basin in Montana and Idaho 1898-1938.—No. 921: Surface water supply of the United States, 1941. Part I: North Atlantic slope basins.—No. 925: Surface water supply of the United States, 1941. Part 5: Hudson Bay and Upper Mississippi river basins.—No. 928: Surface water supply of the United States, 1941. Part 8: Western Gulf of Mexico basins.—No. 936: Water levels and artesian pressure in observation wells in the United States, 1941. Part 1: Northeastern states. No. 937: Water levels and artesian pressure in observation wells in the United States, 1941. Part 2: Southeastern states.—No. 938: Water levels and artesian pressure in observation wells in the United States, 1941. Part 3: North-Central states.—No. 939: Water levels and artesian pressure in observation wells in the United States, 1941. Part 4: South-Central states.*

**U.S. Geological Survey—Bulletin:**
*No. 930-C: Spirit levelling in Illinois, 1896-1941. Part 3: East-Central Illinois.—No. 935-C: The deposits of the Republic of Mexico.—No. 936-N: Antimony deposits of the Stampede Creek area, Kantishna District, Alaska.—No. 940-A: The Rose Creek Tungsten mine, Pershing County, Nevada.*

**U.S. Geological Survey—Professional Paper:**
*No. 197-C: Lower Pennsylvanian species of mariopteris, eremopteris, diplothmema and aneimites from the Appalachian region.—No. 200: Geology and ore deposits of the Magdalena mining district, New Mexico.—No. 202: Geology and ore deposits of the Metaline quadrangle, Washington.*

**U.S. Bureau of Mines—Bulletin:**
*No. 452: Quarry accidents in the United States during the calendar year 1941.*

**U.S. Bureau of Mines—Technical Paper:**
*No. 653: Explosion hazards of combustible anesthetics.*

**Quebec—Department of Mines—Geological Surveys:**
*Report No. 12: Kitchigama Lake area, Abitibi territory.—Report No. 13: Flavrian Lake area, Beauchastel and Duprat Townships, Temiscamingue and Abitibi Counties.*

**U.S. Bureau of Standards—Building Materials and Structures Report.**
*BMS101—Strength and resistance to corrosion of ties for cavity walls.*

**Purdue University—Engineering Extension Department Bulletin:**
*No. 55: Proceedings of the twenty-ninth annual road school held at Purdue University January 25-27, 1943.*

**Harvard University—Graduate School of Engineering Publications:**
*No. 368: Ultra-high frequency oscillations of cylindrical cavity resonators containing two and three dielectric media.—No. 369: Calculation of threshold odor.—No. 370: Time lag of impulse breakdown at high pressures.—No. 371: Electrical circuit analysis of torsional oscillations.*

**Electrochemical Society—Preprints:**
*No. 83-24: Aluminum electrolytic condensers.—No. 83-25: Protection against caustic embrittlement by coordinated phosphate—pH control.—No. 83-26: Ballasting requirements for fluorescent lamps.—No. 83-27: The electrical properties of polyvinyl acetate.—No. 83-28: Electronic methods of automatic control of industrial processes.—No. 83-29: Automatic control of electroplating processes.—No. 83-30: New phosphate with unusual corrosion resistance.*

### CANADIAN ENGINEERING STANDARDS ASSOCIATION SPECIFICATION A23—1942

*The following temporary revision sheet has just been issued relative to Conservation of Reinforcing Steel.*

**In order to effect the greatest possible conservation of reinforcing steel to meet the wartime scarcity of this material, the recommendations of Specification A23—1942 are modified as hereunder:**

*1. Reinforced concrete designs and details shall be so selected as to use the minimum amount of steel reinforcement. To accomplish this, the designs shall embody a maximum of symmetry and simplicity of layout and a minimum of ornamentation. Non-reinforced concrete or masonry shall be used in footings, walls and piers of substructures, gravity or semi-gravity type retaining walls and buttresses in lieu of reinforced concrete construction, wherever practicable. Fill under concrete slabs shall be thoroughly consolidated so that the reinforcement may be reduced to a minimum or eliminated entirely.*

*2. Wherever practicable, the width and depth of members shall be increased to avoid the use of compressive reinforcement and to minimize the use of web reinforcement and special anchorage.*

*3. The amount of reinforcement in concentrically loaded columns shall be kept to a minimum by—*

*a. Using tied columns in preference to spiralled columns.*
*b. Using not less than 0.5 per cent and not more than 2.0 per cent of longitudinal reinforcement.*
*c. Using high-strength concrete.*

*4. For beams and slabs the maximum extreme fibre stress in compression to be used in design shall be 1000 p.s.i. (Note: this corresponds to an $f'_c$ of 2500 p.s.i.*

*The designer should select the mix to be used with due regard to the conditions of exposure of the beam or slab, but should proportion such beam or slab for the above fibre stress, even where a richer mix is used).*

### TEMPORARY BUILDINGS

*5. In the case of "temporary structures," provided that the design and construction are under the control and supervision of a thoroughly qualified and experienced engineer, design stresses in the reinforcing steel may be increased up to 20% above those specified in clause 104. This increase shall not apply to the prescribed stresses for concrete, including bond and anchorage, as given in clause 103.*

*The term "temporary structure" as herein applied, means one owned and controlled by Government authority with publicly avowed temporary character, to be demolished or re-rated as to load-carrying capacity by a responsible technical body when its primary function has been completed.*

## BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.**

**(The) ADSORPTION OF GASES AND VAPORS. Vol. 1, Physical Adsorption.**

*By S. Brunauer. Princeton University Press, Princeton, N. J. Humphrey Milford, Oxford University Press, London, 1943. 511 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $7.50.*

An important work, in which adsorption is presented as a branch of physical chemistry and studied scientifically, with the aim of throwing light upon the nature of the process. The present volume deals only with physical adsorption, chemical adsorption being reserved for treatment later.

**AIRCRAFT NAVIGATION**

*Part I: Theory, by H. Stewart and A. Nichols.*

*Part II: Practice, by S. A. Walling and J. C. Hill.*

*Macmillan Co., New York; University Press, Cambridge, England, 1943. 146 pp., illus., diagrs., charts, maps, tables, 8½ x 5½ in., cloth, $2.00.*

Beginning students of air navigation will find here a concise introduction to the subjects that they must master. Star identification, map reading, position finding, meteorology and other theoretical matters are explained, and a large number of practical problems provided. The text is the work of British authorities, but has been revised for American use.

**AIRCRAFT POWER PLANTS**

*By A. P. Fraas. McGraw-Hill Book Co.. New York and London, 1943. 472 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

The two main parts of this book deal with engine operation and engine installation, with considerable space devoted to fuels and auxiliary equipment. Part III discusses propeller theory and construction. The aim of the book is to present fundamental terms and concepts that will give the reader a good background in all phases of the subject.

**AIRPLANE STRUCTURES, Vol. 1**

*By A. S. Niles and J. S. Newell. 3 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 454 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

Volume I of this two-volume set deals with general design procedure and stress analysis with respect to airplane structures. The several chapters cover critical loading conditions, reactions, torsion, beam and truss analysis, joints and connections, deflections, etc. Illustrative problems are included with each chapter to provide practice in applying the theory involved.

**ALTERNATING-CURRENT CIRCUITS**

*By R. M. Kerchner and G. F. Corcoran. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 553 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $4.75.*

A textbook intended for junior students who have had the usual courses in calculus. The new edition has been thoroughly revised and somewhat rearranged, and many illustrative examples and problems added.

**ANALYTIC MECHANICS**

*By S. D. Chambers in collaboration with V. M. Faires. Macmillan Co., New York, 1943. 375 pp., illus., diagrs., tables, 9½ x 6 in., cloth, $3.75.*

This book follows in general the basic plan of organization of Chambers' "Mechanics of Engineering" but is a completely rewritten edition. The material has been so arranged that the student begins with elementary material on simple forces and works gradually through friction, moments, etc., to the more advanced topics of balancing, impulse and momentum.

**(The) CITY, ITS GROWTH, ITS DECAY, ITS FUTURE**

*By E. Saarinen. Reinhold Publishing Corp., New York, 1943. 380 pp., illus., diagrs., 9½ x 6 in., cloth, $3.50.*

A noted architect here presents his views on city planning, in the form of an analytic study of the urban community. How this community during historic time has been born, has grown, has aged and then decayed are described, and why all this happened is shown. The remedies are considered. The subject is presented from the layman's viewpoint, and the book will interest many who are not professionally concerned.

**DIE ENGINEERING LAYOUTS AND FORMULAS**

*By C. W. Rinman. McGraw-Hill Book Co., New York, and London, 1943. 497 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $5.00.*

This volume is intended as a reference book for the tool engineer. It attempts to combine the basic principles of assembled die designs with their operating details, to give the mathematical formulas that are necessary for laying out the assembled die, and to emphasize a clearly rendered drafting technique. About ninety per cent of the key designs used in tools for presswork are described and illustrated by numerous drawings and photographs.

**DRYING AND DEHYDRATION OF FOODS**

*By H. W. von Loesecke. Reinhold Publishing Corp., New York, 1943. 302 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.25.*

This book, which aims to offer a compilation of the latest practical information on its subject, is the work of one who has had considerable experience in research work on dehydration. It presents a general outline of procedures and practices in commercial use. Types of dehydrators, the dehydration of various classes of foods, plant sanitation, costs, the nutritive value of dried foods, packing, storage, methods of analysis and the reconstitution of dehydrated foods are considered. A glossary and a list of patents are appended.

**ELECTRONIC CONTROL OF RESISTANCE WELDING**

*By C. M. Chute. McGraw-Hill Book Co., New York and London, 1943. 389 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

This textbook is based on experience in preparing men without technical training to keep resistance welding equipment in service. Electron tubes and their circuits, as used to control welders, are described in detail, with diagrams of the circuits. Synchronous timers and stored-energy controls are explained. The text is simple and practical.

**ELEMENTS OF ELECTRICAL CIRCUITS AND MACHINERY WITH INDUSTRIAL APPLICATIONS**

*By G. C. Blalock. McGraw-Hill Book Co., New York and London, 1943. 347 pp., illus., diagrs., charts, tables, 8 x 5½ in., cloth, $3.00.*

A textbook intended for brief courses in circuit theory and the practical applications of electrical equipment and adapted for use in technical high schools and trade schools. Mathematics is used sparingly, and all references to calculus and differential equations are omitted. A list of laboratory experiments is included.

**ELEMENTS OF MECHANICAL VIBRATION**

*By C. R. Freberg and E. N. Kemler. John Wiley & Sons, New York, 1943. 193 pp., diagrs., charts, tables, 8½ x 5½ in., cloth, $3.00.*

The more elementary phases of vibration are discussed in detail in this book and reduced to a form in which they can be applied to practical problems. The methods of solution presented do not call for a knowledge of advanced mathematics.

**ENGINEERING MECHANICS**

*By F. L. Singer. Harper & Brothers, New York and London, 1943. 482 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

A textbook that aims to present the fundamentals of the subject in a manner that will result in thorough understanding and permanent possession of them. Toward this aim, emphasis is centered on a physical understanding of the basic operations, rather than on routine rules. Equations are interpreted in terms of their geometrical equivalents, whereever possible. Analytic methods have been emphasized, without neglecting graphic ones. Numerous illustrative problems are explained to show the application of the theory.

**(The) ENGINEER'S MANUAL OF ENGLISH**

*By W. O. Sypherd, A.M. Fountain and S. Brown. rev. ed. Scott, Foresman and Company, Chicago, Atlanta, Dallas, New York, 1943. 503 pp., diagrs., charts, tables, 8 x 5 in., cloth, $2.50.*

This compact volume is intended as a textbook in English composition for students and as a reference book on usage for engineers. The technic that underlies all good writing is presented first, after which the writing of letters, reports, articles, bulletins and specifications is discussed in detail, with numerous examples. The new edition has been thoroughly revised and much improved. It will be found useful by all readers.

**(An) INTRODUCTION TO FLUID MECHANICS**

*By A. H. Jameson. Longmans, Green & Co., London, New York, Toronto, 2 ed. 1942. 245 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $3.40.*

This brief text has been prepared for use at the University of London, where an elementary knowledge of the subject is required of all engineering graduates. The aim has been to present the subject in a modern way and to illustrate it by diagrams, worked-out examples and "guided" exercises, and to avoid empirical formulae and tables of coefficients. New material on floe in pipes and notches, and over weirs is included.

**MAC'S (MacQuown's) DIRECTORY OF COAL OPERATING COMPANIES, 8 ed.**

*National Coal Publications, Berger Bldg., Fourth Ave. and Grant St., Pittsburgh, Pa., 1943. 204 pp., 12 x 9 in., stiff paper, $7.50.*

This directory lists the coal operating companies of America by states and by names of companies and of mines, with the names of officials and purchasing agents, and information as to equipment, number of employees, daily output and yearly output for the years 1938-41 inclusive.

**MACHINE SHOP YEARBOOK AND PRODUCTION ENGINEERS' MANUAL, 2nd edit.**

*Edited by H. C. Town. Paul Elek, Africa House, Kingsway, London, W.C.2, 1943. 497 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, 30s. 10d. or abroad 31s. 6d.*

Late developments in production, management and design are here presented in convenient form for reference and study. Four special articles are included, on electrical control gear for machine tools, on optical instruments in engineering, on centerless grinding and on the direct hydraulic system. Machine tool construction and operation are discussed at length, with descriptions of representative British machine tools. The periodical literature of 1942 is represented by abridged articles of important publications on production and shopwork.

**MANUAL OF FIREMANSHIP, Part I.**

*Great Britain, Home Office (Fire Service Department). His Majesty's Stationery Office, London, 1943. 250 pp., illus.. diagrs., tables, 8½ x 5½ in., paper, 2s. 6d, (obtainable from British Information Services, 30 Rockefeller Plaza, New York, $0.75).*

This book is the first section of a proposed seven-part work which is intended to be a comprehensive textbook and reference work for firefighters. The present instalment discusses the theory of firefighting and the equipment. The theory of combustion, methods of extinguishing fires, hose, hose fittings, ladders, ropes, hand pumps, chemical extinguishers and foams, apparatus for breathing and resuscitation are discussed. Much practical information is given.

**METALS AND ALLOYS DATA BOOK**

*By S. L. Hoyt. Reinhold Publishing Corp., New York, 1943. 334 pp., illus., diagrs., charts, tables, 10½ x 7 in., cloth, $4.75.*

Mr. Hoyt has performed a task of great value, and the result will be most useful to metallurgists and engineers. It contains, in compact, usable form, carefully selected values for the physical and engineering properties of the metals and alloys of commercial importance. The wrought, cast, and stainless steels, cast irons, heat-resistant and corrosion resistant casting alloys and non-ferrous alloys are covered in detail. The data are chiefly presented in tables, with brief comment.

**National Research Council. HIGHWAY RESEARCH BOARD. PROCEEDINGS of the Twenty-second Annual Meeting held at Hotel Statler, St. Louis, Missouri, December 1-4, 1942.**

*Edited by R. W. Crum, Washington, D.C., 1943. 494 pp., illus., diagrs., charts, maps, tables, 10 x 6½ in., cloth, $3.25.*

As in previous years, these proceedings present a valuable collection of results of research work on many problems of highway construction and maintenance. Questions of economics, design, materials, construction, maintenance, traffic and soils are discussed.

**PHYSICAL CHEMISTRY**

*By F. H. MacDougall. rev. ed. The Macmillan Co., New York, 1943. 722 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $4.25.*

An introductory text, which aims to provide a sound working knowledge of the subject for students of chemistry and chemical engineering. The new edition has been revised to include changes in the accepted values of fundamental constants, and certain additions have been made to the text.

**(The) PHYSICS OF METALS**

*By F. Seitz. McGraw-Hill Book Co., New York and London, 1943. 330 pp., diagrs., charts, tables, 8½ x 5½ in., fabrikoid, $4.00.*

This work is based on an evening lecture course given to practicing metallurgists with a limited knowledge of physics. The treatment is entirely non-mathematical. The developments of recent years are discussed, including the structure of metals, the factors that determine the stability of alloys, the theory of plasticity in metals, diffusion in metals, the theory of iron-carbon alloys, and the electron theory of solids and its applications to cohesion, magnetism and conductivity.

**PLANNING 1943, Proceedings of the Annual Meeting held in New York City, May 17-19, 1943.**

*American Society of Planning Officials, 1313 East 60th St., Chicago, Ill., 1943. 175 pp., charts, tables, 9½ x 6 in., cloth, $2.00.*

The proceedings of the 1943 meeting of the American Society of Planning Officials and the papers presented there are included in this volume. Among the topics discussed are the effect of the war upon our cities, regional councils in metropolitan areas, national planning, urban redevelopment, and the planning problems of cities.

**RADIO ENGINEERS' HANDBOOK**

*By F. E. Terman. McGraw-Hill Book Co., New York and London, 1943. 1019 pp., illus., diagrs., charts, tables, 9 x 6 in., leather, $6.00.*

This handbook brings together, in form for reference use, the body of engineering knowledge that is the basis of radio and electronics. The book brings together, in organized form, the more important contributions to the art that have appeared in the technical articles, over two thousand in number, that were reviewed while preparing it. Extensive references provide access to much pertinent literature. As the book is essentially a one-man job, the viewpoint is consistent throughout, and gaps and duplications are avoided.

**REWINDING DATA FOR DIRECT-CURRENT ARMATURES**

*By G. A. Van Brunt and A. C. Roo 2 ed. McGraw-Hill Book Co., New York and London, 1943. 277 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

Detailed practical directions are given for rewinding all types of these armatures and for taking and recording the necessary data. The new edition has been revised and enlarged. New data include such recent developments as the use of glass fiber insulation, drying and baking by infra-red heating, and the introduction of new insulating varnishes.

**SECRETARY TO THE ENGINNER. (Technical Secretary Series)**

*By Q. Hazelton. McGraw-Hill Book Co., New York and London, 1943. 309 pp., diagrs., 8 x 5½ in., loose-leaf, stiff paper, $1.75.*

The text provides a course for advanced stenographers who wish training in the vocabulary of engineering, especially that used by civil, electrical, chemical and metallurgical engineers. Extensive lists of words and phrases and of material for dictation are included.

**SMOKE STREAMS, VISUALIZED AIR FLOW**

*By C. T. Ludington, preface by E. Warner. Coward-McCann, Inc., New York, 1943. 144 pp., illus., diagrs., charts, 8½ x 5½ in., cloth, $2.75.*

The fundamentals of aerodynamics are here presented in simple language and illustrated by excellent photographs taken in the Griswold smoke tunnel. Lift, drag, high-lift devices, downwash and tip losses are explained and shown graphically. The book will interest not only pilots in training, but also young model-makers.

**(The) STEAM BOILER YEARBOOK AND MANUAL, 2nd ed.**

*Edited by S. D. Scorer, foreword by R. J. Sarjant. Paul Elek Ltd., Africa House, Kingsway, London, W.C.2, 1943. 522 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, 30s. 10d. or abroad 31s. 6d.*

This book aims to provide descriptions of the best that is available in steam boilers and their equipment, together with a résumé of developments in design and operation during 1942. Chapters are devoted to various boiler types, feed-water pumps, stokers, etc., in which good practices are reviewed and illustrated by descriptions of British products. A second section consists of lengthy abstracts of articles from periodicals of 1942, upon fuel and fuel economy, steam economy, operating, etc.

**(The) THEORY AND PRACTICE OF HEAT ENGINES**

*By R. H. Grundy. Longmans, Green & Co., London, New York and Toronto, 1942. 723 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $6.25.*

This textbook offers a course covering steam generators, reciprocating steam engines, steam turbines and internal-combustion engines in one volume. It is intended to cover the practical side of the subject and the accompanying theory to a stage from which an easy step may be made to more specialized books. The book is profusely illustrated with drawings, considerable attention is given to historical development, and the text is clear and readable. A good picture of modern practice, especially British, is provided.

**(The) THERMODYNAMICS OF FIREARMS**

*By C. S. Robinson. McGraw-Hill Book Co., New York and London, 1943. 175 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $2.50.*

This book is intended to meet the demand of newcomers into the explosives and ammunition industry for information on interior ballistics. By means of thermodynamics, a sound theoretical basis is provided, and the basic problems are discussed. Although the book contains little if anything, that is new, it brings together the available information for the first time. A good bibliography is given.

**TIMBER ECONOMY No. 4 (Windows, etc., and their Black-out)**

*Great Britain, Ministry of Works, Directorate of Constructional Design. His Majesty's Stationery Office, London, 1943. 23 p., diagrs., 13 x 8 in., paper, 1s. (obtainable from British Information Services, 30 Rockefeller Plaza, New York, $0.30).*

Specific instruction on methods of blacking out windows and other openings are given, with attention to economy of timber and other materials. Detail drawings for both domestic and industrial buildings are given.

**(The) USE OF PART-TIME WORKERS IN THE WAR EFFORT**

*By H. Baker and R. B. Friedman. Princeton University, Industrial Relations Section, Princeton, New Jersey, June, 1943. 48 pp., tables, 10 x 7 in., paper, $1.00.*

This pamphlet summarizes the experience of American and British industries with part-time workers, and is intended as a guide to those who are uncertain as to the desirability of undertaking such arrangements and those who have decided to do so. Methods of recruitment and training, hours of work and wage rates are discussed, and the advantages and problems of the method considered. There is a brief bibliography.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

September 30th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the November meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

**FOR ADMISSION**

BIRD—VIGGO EDWARD, of Montreal, Que. Born at Copenhagen, Denmark April 29th, 1885; Educ.: B.S., Mass. Inst. Tech., 1908; 1908-10, development engr., American Tel. & Tel. Co.; 1910-11, betterment engr., Stone & Webster; 1911-13, supt., Fall River Gas Works Co. (Stone & Webster); 1913-18, divn. mgr., 1918-22, gen. mgr., 1922-33, vice-president & gen. mgr., 1933-39, president, 1939-41, consltg. engr., The Connecticut Power Co. (Stone & Webster); 1941 to date, mgr., power dept., Aluminum Co. of Canada, Ltd., Arvida, Que.

References: J. B. Challies, P. S. Gregory, J. A. McCrory, J. Morse, McN. DuBose, A. W. Whitaker, Jr.

CAMPBELL—WILLIAM LYMAN, of Berlin, N.H. Born at Cincinnati, Ohio, Feb. 23rd, 1892; Educ.: A.B., Yale Univ., 1913; Grad. in Civil Engrg., Mass. Inst. Tech., 1915; 1914-17, student employee, asst. engr., etc., Baltimore & Ohio R.R.; 1917-19, U.S. Army—incl. New York Office of Military Intelligence and overseas service; 1919, traffic mgr., Billings & Spencer, Hartford, Conn.; 1919-22, mach. tool sales mgr., Automatic Machine Co., Bridgeport, Conn.; 1922-27, with Erie Railroad, New York, as follows: director, Hornell Shop & Susquehanna Shop Corporations, vice-president, of subsidiary lines, fuel agent, director, N.Y. Susquehanna & Western R.R., asst. to operating vice-president; 1927-28, mgr., eastern divn., railroad dept., Timken Roller Bearing Co., Canton, Ohio; 1927-30, industrial consltg. for bankers, Curtiss & Sanger, and Lehman Bros., New York City; 1930-32, asst. to president, Amalgamated Leather Cos., Wilmington, Del.; 1932-42, gen. mgr. of manufacturing, vice-president i/c mfg., and director, Kroger Grocery & Baking Co., Cincinnati; 1942-43, vice-president and director, Amer. Machine Defence Corp., American Machine & Foundry Co., Brooklyn, N.Y.; 1942 to date, member, visiting committee, dept. of biology and biological engrg., Mass. Inst. Tech.; 1942 to date, expert consultant, U.S. Army, U.S. Navy and Office of Rubber Director; at present, vice-president i/c manufacturing, Brown Company, Berlin, N.H.

References: A. Surveyer, J. B. Challies, P. S. Gregory, H. J. Racey, H. M. Finlayson.

CLARKE—KENNETH HARRY JOHN, of Ottawa, Ont. Born at Toronto, Ont., Oct. 12th, 1911; Educ.: B.A.Sc., Univ. of Toronto, 1936; R.P.E. Ont.; 1934 (summer) chemist, International Nickel Co. of Canada; 1935 (summer), smelter asst., Cons. Mining & Smelting Co. Ltd., Trail, B.C.; 1936-37, metallurgist, Ont. Refining Co. Ltd., Copper Cliff, Ont.; 1937-38, rolling mill and refinery, Huntington, W.Va., and N.Y. Office International Nickel Co. Inc.; 1938-41, metallurgical engr. i/c nickel Co. of Canada, Toronto; 1941 to date, chief of allocations and conservation divn., alloy development & tech. service in Canada, International Nickel Co. of Canada, Toronto; 1941 to date, chief of allocations & conservation divn., office of metals controller, Dept. of Munitions and Supply, Ottawa.

References: C. D. Howe, H. E. T. Haultain, L. E. Westman, J. B. Carswell, C. R. Young, J. A. Walker, C. R. Whittemore, F. B. Kilbourn, A. C. M. Davy.

COBURN—FREDERIC G., of New York, N.Y. Born at Duluth, Minn., June 14th, 1883; Educ.: Graduate, U.S. Naval Academy, 1907; M.S., Mass. Inst. Tech., 1908; 1900-19, U.S. Navy, service in the Line, followed by service in the Constrn. Corps., resigned with rank of Cmdr.; 1919-21, asst. to operating vice-president, Bethlehem Shipbuilding Corp. Ltd.; 1921-39, with Sanderson & Porter, New York, as follows; 1921-24, staff engr., 1924-39, partner; 1939 to date, corp. executive and consltg. engr.; president, Brown Co., Berlin, N.H.

References: J. B. Challies, A. Surveyer, J. A. McCrory, P. S. Gregory, M. Balls, H. M. Finlayson.

GERMAIN—WALTER EDGAR, of 241 Florence St., Ottawa, Ont. Born at Birkenhead, England, April 23rd, 1916; Educ.: 1930-1935-36, Central Technical School, Toronto; I.C.S. Structl. Engrg.; 1934-35, arch'l. dfting., M. Pulver, Architect; 1936-39, arch'l. and structl. dfting. and design covering residential work, commercial bldgs., etc.; 1939-43, structl. designing for Hill-Clark-Francis Ltd., Contractors, New Liskeard, Ont.

References: D. D. Whitson, G. Rankin, H. Self, C. Hershfield.

INGRAHAM—HARRY ALEXANDER, of Edmonton, Alta. Born at Minneapolis, Minn., Aug. 26th, 1886; Educ.: 1904-07, Univ. of Minnesota (Coll. of Engrg.); R.P.E. Alberta; 1907-10, dftsman., 1910-12, constrn. foreman, mill bldgs., 1912-14, asst. engr., 1914-17, res. engr., Wellford Mfg. Co., Minneapolis; 1917-27, i/c reinforced concrete design and constrn., H. Ingraham, Calgary, also consltg. engr.; 1927 to date, acting as consltg. engr. in the States and Canada, the latest work of any magnitude being res. engr. i/c constrn. of hydro-electric development at Yellowknife, N.W.T., for mining interests. (A.M.E.I.C. 1920; M.E.I.C., 1924-28.)

References: H. J. McEwen, H. B. Sherman, J. McMillan, J. E. B. Cranswick, H. B. Lebourveau.

LITTLE—JACK GRAHAM, of St. Lambert, Que. Born at Trenton, Ont., June 26th, 1905; Educ.: B.A.Sc. (Chem.), Univ. of Toronto, 1928; R.P.E. of Que.; with Northern Electric Co. Ltd. as follows: 1928-29, mfg. methods engr., telephone, power cable and rubber covered wire products, 1930-33, engr. in supervisory capacity, cable and telephone communication apparatus and equipment, 1934-39, asst. to engr. i/c tech. development divn., 1940-41, tech. engr., telephone divn., 1941, to date, tech. supt., telephone divn., i/c mfg. methods engrg., factory planning and electrical lab. depts.

References: W. C. M. Cropper, J. W. Fagan, J. S. Cameron, W. H. Eastlake, H. H. Vroom.

MIMEAULT—CAMILLE J., of Dolbeau, Que. Born at St. Moise, Que., Jan. 27th, 1908; Educ.: 1938-40, Course mach. dfting. and design, Chicago Technical College, 1938-40, McKinley-Roosevelt Univ., B.Sc. (Mech.), 1940; 1924-27, ap'ticeship, Leduc Motor Sales, Montreal; with Lake St. John Power & Paper Co., Dolbeau, as follows: 1927-29, installn. paper mill mach. and air compressor repairs, 1929-33, paper mill gen. repairs, 1933-39, millwright foreman, 1939-42, mach. shop foreman and tool design on war work, 1942 to date, gen. foreman on constrn. and repair, mach. tool and tool designer for war work.

References: E. Cowan, J. A. Beauchemin, H. P. Moller, A. G. Jacques, D. A. Evans.

PETRIE—LOUIS ADRIAN, of 2A Brittany Row, Arvida, Que. Born at St. Louis, Mo., June 23rd, 1910; Educ.: B.Eng. (Mech.), N.S. Tech. Coll., 1938; with Dominion Steel & Coal Corp. Ltd., as follows: 1926-30, tracing, dfting. sketching, record-keeping (mining equipment), 1930-38 (summers), dfting., design, mech. repairs, estimates, 1938-40, asst. to mech. supt.; 1941 to date, asst. engr., Aluminum Co. of Canada Ltd., Arvida, Que.

References: C. B. Archibald, J. B. Petrie, M. G. Saunders, S. C. Mifflen, A. T. Cairncross, S. J. Montgomery.

SUTTON—VICTOR JOSEPH, of Beaupré, Que. Born at Little Current, Ont., Nov. 20th, 1908; diploma in Chem. Engrg. I.C.S.; with Abitibi Power & Paper Co. Ltd., Iroquois Falls, as follows: 1927-28 (summers), pulp tester and member research staff, 1929, operating pilot type plant; 1929-37, senior member tech. control dept. staff, Mersey Paper Co. Ltd., Liverpool, N.S.; 1937 to date, tech. control supt., Ste. Anne Paper Co. Ltd., Beaupré, Que.

References: W. E. McBride, R. J. Askin, H. O. Brown, J. H. M. Jones, H. G. Timmis.

TRAVER—LEONARD ALTON, of 5325 Victoria Ave., Montreal, Que. Born at Timmins, Ont., Sept. 7th, 1915; Educ.: B.Sc. (Mining), Queen's Univ., 1938; 1935-38 (summers), operating, repairing, installn. of mach., and research work at Hollinger Plant; 1938-39, metallurgist, East Malartic Mines, Ltd.; 1939-42, mill supt., Central Cadillac Mines, Ltd.; 1942 to date, asst. to production mgr. i/c ships divn., Dominion Bridge Co. Ltd., Lachine, Que.

References: R. S. Eadie, G. H. Midgley, F. P. Shearwood, L. T. Rutledge F. D. Reid, R. M. Robertson, G. M. Dick.

WATT—WILLIAM C., of Toronto, Ont. Born at Aberdeenshire, Scotland, June 4th, 1901; Educ.: 1924-26, Glasgow Technical School; 1917-22, marine and mech. ap'ticeship, Kinaird Engrg. Wks., 1922-24, mech. supt., British Oil & Guano Co. Ltd., Fraserburgh; 1927-31, mech. supt., National Textiles, Ltd., Toronto; 1931-40, mech. supt., Willard's Chocolates, Toronto; 1940-41, production tool supt., D.I.L. Verdun, Que.; 1941 to date, mech. supt., Robert Simpson Co. Ltd., Toronto.

References: Drummond Giles, J. G. Notman, D. Cameron, E. G. T. Taylor, H. Short, M. J. McHenry.

# Employment Service Bureau

**NOTICE**

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## SITUATIONS VACANT

PARTNER WANTED, graduate mechanical engineer wanted in small but successful manufacturing plant and machine shop in central Ontario city. Plant currently engaged on war work but with extensive peacetime programme definitely settled. Applicant must have executive and administrative ability, preferably with some production experience on machine tools. Moderate investment required. Apply to Box No. 2660-V.

EXPERIENCED STRUCTURAL STEEL DRAUGHTSMEN. Location Windsor, Ontario. Apply to Box No. 2662-V.

ENGINEER, graduate, for manufacturing company in the Eastern Townships, Province of Quebec; peacetime product: pulp and paper machinery, but presently engaged in war work. Some pulp and paper experience preferred. Permanent position and good opportunity. Apply to Box No. 2670-V.

ELECTRICAL SUPERINTENDENT for newsprint mill in the Province of Quebec. Graduate in electrical engineering with three or four years experience in electrical work preferred. Good starting salary. Apply to Box No. 2671-V.

## SITUATIONS WANTED

MECHANICAL ENGINEER, executive ability, desires permanent position with responsibility and future. Presently employed but war conditions necessitate change. Apply to Box No. 270-W.

CIVIL ENGINEER, B.A. Sc., Age 34, married. Experience covering heating, air-conditioning, mining. Design, construction and maintenance of sewers, waterworks, streets and highways, including surveying, location, estimating, inspection, drainage and soundings. Presently employed but desires advancement. Apply to Box No. 1859-W.

STRUCTURAL ENGINEER, M.E.I.C., modern methods reinforced concrete design, experienced on construction. Location immaterial. Preference for West. Excellent civil experience home and abroad. Apply to Box No. 2425-W.

GRADUATE CIVIL ENGINEER, Queen's University, age 43, 20 years experience highways, bridges, buildings, docks, municipal pavements, sewers and waterworks. Surveying, estimating and design; emphasis on economy in earthwork and concrete. Versatile, practical and good personality for meeting the public. Presently employed, desires position as municipal engineer or with general contractor. Apply to Box No. 2453-W.

GRADUATE ENGINEER, B.Sc. in E.E. 1927, M.E.I.C. with 16 years engineering and sales experience, also office and accounting including 2-year apprentice course. West preferred. At present employed but work running out. Available on short notice. Apply to Box No. 2454-W.

BUILDING ENGINEER, twenty years' experience with well known firm of consulting engineers and contractors in design and supervision of industrial work. Desires change of employment to permanent position with industry on maintenance, alterations or extensions. Age 45. Apply to Box 2455-W.

PRODUCTION ENGINEER or shop supervisor in heavy plate work, machine shop or structural steel plant. Sixteen years experience. Excellent knowledge of production control systems, tool design and shop practice. Available under regulations of Wartime Bureau of Technical Personnel. Apply to Box No. 2456-W.

### FOR SALE

One Clinometer or Slope Level (No. 5805 in K. & E. Catalogue. Never used.

One Recording Barometer, similar to No. 5941 in K. & E. Catalogue. Size of case 11¼"x5¼"x6". No reasonable offer refused. Apply to Box 52-S.



WILBUR—ROBERT ALEXANDER, of Toronto, Ont. Born at Elmira, N.Y., May 2nd, 1897; Educ.: Ch.E., Lehigh Univ., 1920; R.P.E. Ontario; 1920-22, field engr., John R. Proctor, Inc.; 1922-24, engr., A. Wyckoff & Son Co.; 1924-35, chief engr., Ont., Wind Engine & Pump Co.; 1935 to date, chief engr. and gen. mgr., Ajax Engineers Limited, Toronto.

References: V. H. McIntyre, D. D. Whitson, S. W. S. Hall, F. E. Wellwood, C. F. Morrison.

### FOR TRANSFER FROM THE CLASS OF JUNIOR

HOLDER—ALLAN SCOTT, of Ajax, Ontario. Born at Saint John, N.B., Aug. 1, 1911; Educ.: B.Sc., Nova Scotia Tech. Coll., 1934; 1934-38, misc. mtce., power and design work, 1938-40, design engr., Canadian Industries, Ltd.; 1940-41, plant design engr., Montreal, and 1941 to date, works engr., Ajax, Ont., Defence Industries, Ltd. (St. 1931, Jr. 1939.)

References: H. W. McKiel, M. S. Macgillivray, H. K. Wyman, A. H. Heatley, M. Eaton.

LAVERGNE—EMILE DENIS, of Almaville, Que. Born at St. Boniface, Que., Nov. 29, 1909; Educ.: B.Sc., (Civil), Univ. of Michigan, 1937; 1928-30, junior dftsmn. Shawinigan Chemicals Ltd.; 1931-33, asst. forest ranger, Dept. of Lands & Forests, Quebec; with Canadian Industries, Ltd., as follows: 1937, cellophane plant, operation training, 1937-38, research dept., 1938-40, operation foreman, 1940 to date, consolidated works, engrg. dept., as maintenance and constrn. engr. (St. 1937, Jr. 1940.)

References: R. Dorion, H. J. Ward, H. K. Wyman, A. H. Heatley, C. Cuthbertson.

SAMIS—GEORGE ROY, of 3800 Decarie Blvd., Montreal. Born at Cannington, Ont., March 24, 1910; Educ.: B.A.Sc., Univ. of Toronto, 1932; Summers: 1928, constrn. dept., H.E.P.C., 1929, dftsmn., Hamilton Bridge Co. Ltd., 1933-34, instr'mn. and inspr. on highway and bridge constrn., Ontario County; 1930 (May-Dec.) instr'mn. on municipal constrn., Orillia Water Light & Power Comm.; 1935-36, rodman and instr'mn. on highway constrn., Ontario Dept. of Northern Development; Mar. 1937 to Feb. 1940, and Oct. 1940 to date, plate and boiler dept., estimator and designer, Dominion Bridge Co. Ltd., Lachine, Que.; Feb. 1940 to Oct. 1940, dftsmn and designer on plant layout, Aluminum Co. of Canada, Ltd., Arvida, Que. (on loan). (Jr. 1937.)

References: A. S. Wall, R. S. Eadie, F. Newell, H. E. Brandon, C. R. Young.

TOLLINGTON—GORDON C., of Peterborough, Ont. Born at Claresholm, Alta., Oct. 8, 1907; Educ.: B.Sc., (Elec.), Univ. of Alta., 1932; R.P.E. Ontario; 1929-31 (summers), engrg. dept. and electric light dept., City of Calgary; 1934-35, test course, 1935-41, asst. induction motor engr., 1941 to date, asst. D.C. engr., Canadian General Electric Co., Peterborough. (St. 1932, Jr. 1937.)

References: G. R. Langley, B. Ottewell, A. L. Dickieson, V. S. Foster, H. R. Sills.

### FOR TRANSFER FROM THE CLASS OF STUDENT

BRYCE—RONALD CAMPBELL, of 1012 Aird St., Saskatoon. Born at Kelliher, Sask., Aug. 8th, 1920; Educ.: B.Sc., (Mech.) Univ. of Sask., 1942; Summers, 1939 and 1941, senior rodman, survey, P.F.R.A., 1940, waterworks mtce., Parliament Bldgs., Regina; at present, engineer Sub.-Lieut., R.C.N.V.R., in training on R.C.N. minesweeper, Halifax, N.S. (St. 1942.)

References: N. B. Hutcheon, I. M. Fraser, R. A. Spencer, J. I. Mutchler, E. K. Phillips.

KELLY—JAMES OSWALD, of 4109 Northcliffe Ave., Montreal. Born at Deseronto, Ont., 27th August 1915; Educ.: B.Sc., (Chem.), McGill Univ., 1941; R.P.E. Quebec; Summers, 1935, student helper, Carneil & Belmont Constrn. Engrs., Montreal, 1939, 1940, asst. to supt. of the Record Mfg. Divn., R.C.A. Victor, Montreal; 1936-37, asst. to G. Lorne Wiggs, consltg. engr.; 1941 (May-Dec.) chemical engr. for supervision and mtce. of the acid survey and anhydride plants, at Canadian Celanese Ltd., Drummondville, Que.; Dec. 1941 to date, development chem. engr., Dominion Rubber Co., Montreal. (St. 1940.)

References: R. Ford, O. K. Ross, G. L. Wiggs, R. W. Holmes, C. R. Timm, E. A. Hankin.

COX—R. EDWARD, of 7228 Chambord St., Montreal. Born at Montreal, Que., June 18, 1916; Educ.: I.C.S., and electro-technician, Montreal Tech. Sch.; 1936-38, dfting in cable engrg. dept., and at present cable inspn. dept., in supervisory position, Northern Electric Co. Ltd. (St. 1938.)

References: W. G. Tylee, W. H. Eastlake, G. A. Wallace, N. L. Dann, N. L. Morgan.

LETENDRE—LUCIEN, of 1022 Mount Royal Ave. East, Montreal. Born at Montreal, Apr. 27th, 1916; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1942; R.P.E. Quebec; Summers, 1938 1st field engr. and supervisor in the constrn. of the Botanical Garden, Montreal, 1940, 1941, concrete inspr., Dept. of Roads, Quebec; 1942 to date, struct'l engrg., (ship building) and i/c of steel control office, Marine Industries, Ltd. (St. 1939.)

References: J. A. Lalonde, A. Circé, H. Gaudefroy, P. LeBel, L. Trudel.

SIMPSON—JOHN HAMILTON, of Ottawa, Ont. Born at Montreal, Que., May 28th, 1915; Educ.: B.Eng., McGill Univ., 1937; 1937-38, test course, Can. Gen. Elec., Peterborough and Toronto; 1938 to date, junior research engineer, National Research Council, Ottawa. (St. 1937.)

References: B. G. Ballard, R. W. Boyle, D. S. Smith, C. V. Christie, G. R. Langley.

SINGER—GERALD GERSHON, of Montreal, Que. Born at Montreal, May 9th, 1914; Educ.: B.Eng. (Mech.), McGill Univ., 1938; 1938-39, fdtsmn., Canadian Car & Foundry Co., on design of diesel engine project; 1939-40, senior dftsmn., Inspection Board United Kingdom and Canada, on design of inspn. gauges; 1940-41, tool engr., Montreal Locomotive Works, on design of tools and fixtures used in Montreal Tank Arsenal; 1941 to date, manager, Atlas Engrg. Works, Montreal. (St. 1939.)

References: C. M. McKergow, A. R. Roberts, E. I. Wigdor, A. Benjamin.

SUTHERLAND—DONALD HENRY, Capt., R.C.E., of Halfax, N.S. Born at Summerside, P.E.I., July 25, 1912; Educ.: B.Sc., (Civil), Univ. of N.B., 1938; 1928-29, C.N.R.; 1937 (summer), P.E.I. National Park, Dept. of Munitions & Supply; 1938-40, engrg. and constrn. branch, instr'man and asst. engr., Dept. of Munitions & Supply; Aug., 1940, to Jan., 1942, works officer, i/c sewage, bldgs., roads, Debert Military Camp, N.S.; Aug. 1942-Jan. 1943, asst. chief works officer, No. 6 Coy., R.C.E., Halifax; at present 2nd in command, 2nd Fortress Coy., R.C.E., Halifax, N.S.

References: W. S. Lawrence, F. C. Wightman, W. C. Murdie, H. Dunn, E. O. Turner.

TURNER—LESLIE CHARLES, of Halifax, N.S. Born at Prince Albert, Sask., July 25, 1921; Educ.: B.Sc., (Mech.), Univ. of Sask., 1942; Summers, 1940, aircraft inspn., Canada Car, Ft. William, 1941, material and labour costing (aircraft), Canadian Vickers, Montreal; at present, engineer Sub.-Lieut., R.C.N.V.R., employed on escort work, Halifax. (St. 1941.)

References: R. A. Spencer, W. E. Lovell, I. M. Fraser, N. B. Hutcheon, E. K. Phillips.

WESLEY—WILLIAM GRANT, of Outremont, Que. Born at Montreal, Que., Jan. 24th, 1914; Educ.: B.Eng., McGill Univ., 1937; 1937-42, wire and cable sales specialist, Northern Electric Co., Montreal; at present, P/O, R.C.A.F., Montreal. (St. 1936.)

References: C. V. Christie, C. M. McKergow, W. H. Eastlake, N. L. Dann, W. G. Tyler.

**Industrial development — new products — changes in personnel — special events — trade literature**

**COMPETITION ANNOUNCED**

Minneapolis-Honeywell Regulator Company in Canada and the United States is offering $10,000.00, in competition, for apartment heating design. First prize is $2,000.00 with twenty-four others ranging from $150.00 to $1,000.00.

The design must include the control system and is for a six storey building. It must incorporate the individual tenant or personalized heating control idea. Contest closes November 15, 1943.

The competition is open to contestants in Canada as well as the United States. Its purpose is to provide a heating system which will give greatest tenant health, comfort and convenience, low first cost and low operating cost, as well as individual temperatures. (See page 39 of this issue.)

**SERVICES REWARDED**

In recognition of twenty-five years of service, Mr. J. B. McInroy, chief draftsman for Bepco Canada Ltd., was presented with an engraved gold wrist watch on September 22nd. The presentation was made by Mr. C. G. Abbey, president of the firm. Mr. McInroy joined the Harland Engineering Company, Ltd., in Alloa, Scotland, in September, 1918, and came to Canada in 1926 to join the Canadian branch. In 1933, Harland Engineering was one of the four British electrical manufacturing companies which merged under the name of Bepco Canada Limited and Mr. McInroy continued in his position.

**BUILDING MATERIALS**

A 56-page catalogue is being distributed by Atlas Asbestos Company, Ltd., Montreal, Que. This catalogue which constitutes a builders' guide and specification manual of the many products manufactured and distributed by this company. Sections are devoted to asbestos building lumber, industrial roofing and siding, thermal and sound insulations, asbestos boards for the electrical industry, waterproofing, wood finishing and masonry materials; in all, 118 products, together with their characteristics and applications, are illustrated and described.

**NEW APPOINTMENT**

Mr. S. E. Goodwin was recently appointed general manager, with headquarters in Toronto, of Chas. Warnock & Company, Ltd. Mr. Goodwin was formerly the Ontario district manager of the company.

**S. E. Goodwin**

**J. C. Macfarlane, K.C.**

**ADDRESS ON "ELECTRONICS"**

Mr. J. C. Macfarlane, K.C., a vice-president of Canadian General Electric Company, Ltd., delivered an address on "Electronics" before the members of the Montreal chapter of the American Institute of Electrical Engineers on September 24th.

During the course of his remarks, Mr. Macfarlane indicated that this rapidly developing science of the electron promised to remould our peace-time lives. Electronics has already given us radio and talking pictures. It was playing a vital part in many secret war weapons. It was serving in industry, in agriculture, in medicine. Tomorrow it will bring television; assist in heating and cleaning homes; increase protection against disease and prove of untold usefulness in a host of manufacturing processes.

Mr. Macfarlane, who is a graduate of arts, Queen's University—of which university he is a trustee—a graduate of law, Osgoode Hall, Toronto, and a King's Counsel for Ontario, is also the 1st vice-president of the Canadian Manufacturer's Association.

**RELAYS**

Cansfield Electrical Works Ltd., Toronto, Ont., have issued bulletin No. A.2, 1943, 31 pages, covering this company's line of control and auxiliary relays. A variety of types of relays are shown including circuit opening and closing, blocking, transfer, definite time, annunciator and alarm, and combination models.

**WARTIME ENGINEERING DEVELOPMENTS**

Canadian Westinghouse Company, Ltd., Hamilton, Ont., have recently issued a 32-page booklet outlining the achievements of the Westinghouse Electric & Manufacturing Company in the production of weapons and devices for the war effort, as far as the story may now be told. Stories covering the development of aircraft and landing field equipment, marine equipment and accessories, electrical equipment, ammunition and weapons, materials and labour conservation, give the reader an appreciation of the extent to which this company has applied its resources to the cause of the United Nations.

**COMPANY NAME CHANGED**

According to a recent announcement by Mr. Robert A. Emmett, president and chairman of the board of Detroit Rex Products Company, metal cleaning engineers, the name of the firm has been changed to Detrex Corporation. No change in ownership, company policy or management will be made. This company, which manufactures degreasers, alkali and petroleum spirits washers and emulsion cleaners, degreasing solvents and alkali cleaning compounds was established in January, 1920.

**ATMOSPHERE-GAS CONVERTERS**

Canadian General Electric Company, Ltd., Toronto, Ont., have for distribution bulletin C.G.E.A.-2948, four pages. The line of atmosphere-gas converters described and illustrated in this folder have nominal ratings of from 250 to 3,000 c.f.h. Their function is to supply low-cost inert and reducing gases for controlled atmosphere furnaces, for supplying inexpensive gases for use in various industrial processes. The folder provides specifications of the various types, a flow diagram and curves of characteristics and analysis of the prepared gases.

**MONORAIL SYSTEMS**

A 30-page catalogue recently published by Beatty Bros. Ltd., Fergus, Ont., describes a complete monorail system for the overhead handling of materials in process, from raw stock to finished articles on the shipping platform. Switches, turntables, track elevators, hoists and cranes can be combined to meet any materials handling contingency. Tracks, trolleys, switches, swivel connections, hoists and all necessary accessories are illustrated, described and specified. The "Beatty" line of ladders and extension trestles is included in this catalogue.

**RECENT APPOINTMENT**

Mr. H. W. Jones has been appointed manager of operations of Chatham Malleable & Steel Products Ltd., Chatham, Ont. Mr. Jones, who has been with the company for over twenty years, has had wide experience in metal stampings, rolling and machining. Both Chatco plants are now under his charge.

**H. W. Jones**

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 — MONTREAL, NOVEMBER 1943 — NUMBER 11


"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."

★ ★ ★


PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL





**Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.**




## CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P. BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que.
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont.
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Beauharnois, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que.

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**PAPERS**
L. F. GRANT, *Chairman*

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PUBLICATION**
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**PROFESSIONAL INTERESTS**
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

**STUDENTS' AND JUNIORS' PRIZES**

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. P. BRIERLEY
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
R. DUPUIS
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville, Ont

**CALGARY**
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE, H. R. HAYES, A. HIGGINS, W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS, G. P. F. BOESE, H. J. McEWEN
*Sec.-Treas.,* K. W. MITCHELL, 803-17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN, J. W. JUDGE, E. D. ROBERTSON, J. D. A. MACDONALD, I. F. MORRISON, H. W. TYE
*(Ex-Officio),* D. HUTCHISON, E. NELSON
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**ALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B. STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE, S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON, R. J. G. SCHOFIELD, NORMAN EAGER, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, STANLEY SHUPE, A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN, 91 Barnesdale Blvd., Hamilton, Ont.

**KINGSTON**
*Chairman,* K. M. WINSLOW
*Vice-Chair.,* S. D. LASH
*Executive,* W. F. NOONAN, J. R. CARTER, J. D. LEE
*(Ex-Officio),* T. A. McGINNIS, L. F. GRANT, A. JACKSON
*Sec. Treas.,* R. A. LOW, Dept. of Civil Engineering, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* R. B. CHANDLER
*Vice-Chair.,* S. T. McCAVOUR
*Executive,* S. E. FLOOK, O. J. KOREEN, E. L. GOODALL, J. I. CARMICHAEL, W. H. SMALL, A. D. NORTON, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* E. M. G. MacGILL (Mrs. E. J. Soulsby), E. J. DAVIES, H. G. O'LEARY
*Sec.-Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT, W. C. MILLER, F. T. TAYLOR, F. C. BALL, V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN, J. A. VANCE
*Sec. Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS, H. W. HOLE, A. GORDON, G. C. TORRENS, G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE, G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R. Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE, R. C. FLITTON, G. D. HULME, C. E. GELINAS, K. G. CAMERON, G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD, J. E. ARMSTRONG, R. E. HEARTZ, W. G. HUNT, J. A. LALONDE, G. MacL. PITTS, E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR, C. G. MOON, G. F. VOLLMER, H. E. BARNETT, J. W. BROOKS, G. MORRISON, D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 2135 Culp Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY, G. A. LINDSAY, R. YUILL, W. H. B. BEVAN, J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY, K. M. CAMERON, N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON, Dept. of Mines & Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN, A. L. MALBY, F. R. POPE, C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY, H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD, 308 Monaghan Road, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldgs., Quebec, Que.

**SAGUENAY**
*Chairman,* CHAS. MILLER
*Vice-Chair.,* G. B. MOXON
*Executive,* J. FRISCH, W. E. COOPER, F. T. BOUTILIER
*(Ex-Officio),* R. H. RIMMER, J. W. WARD, ALEX. T. CAIRNCROSS
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, 8-C Brittany Row, Arvida, Que.

**SAINT JOHN**
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN, C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH, J. P. MOONEY, D. R. SMITH, G. W. GRIFFIN
*Sec.-Treas.,* F. A. PATRIQUEN, P. O. Box 1417, Saint John, N.B

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vice-Chair.,* R. DORION
*Executive,* G. B. BAXTER, E. BUTLER, A. G. JACQUES, R. D. PACKARD, M. EATON, E. T. BUCHANAN, J. JOYAL, W. E. A. McLEISH, H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN, H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS, Shawinigan Water & Power Company, P.O. Box 190, Three Rivers, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN, E. K. PHILLIPS, J. I. STRONG, F. C. DEMPSEY, N. B. HUTCHEON, J. G. SCHAEFFER, R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG, P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK, C. R. MURDOCK, G. W. MacLEOD, K. G. ROSS, H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG, A. E. PICKERING, L. R. BROWN
*Sec. Treas.,* O. A. EVANS, 159 Upton Road, Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR, R. F. LEGGET, E. G. HEWSON, A. H. HULL, C. F. MORRISON, E. A. CROSS
*(Ex-Officio),* H. E. BRANDON, W. S. WILSON, T. H. HOGG, C. R. YOUNG, N. MacNICOL, J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* W. N. KELLY
*Vice-Chair.,* T. V. BERRY
*Executive,* J. P. FRASER, H. P. ARCHIBALD, R. E. POTTER, I. C. BARLTROP, E. S. JONES, H. J. MacLEOD
*(Ex-Officio),* W. O. SCOTT, C. E. WEBB
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD, A. N. ANDERSON, F. C. GREEN, J. H. BLAKE
*(Ex-Officio),* E. W. IZARD, A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING, 41 Gorge Road West, Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING, N. M. HALL, B. B. HOGARTH, R. H. ROBINSON, R. A. SARA
*(Ex-Officio),* W. P. BRERETON, J. W. SANGER, D. M. STEPHENS
*Sec.-Treas.,* T E. STOREY, 55 Princess Street, Winnipeg, Man.

# DEVELOPMENT OF POST-WAR AIRCRAFT

JAMES T. BAIN

*Superintendent of Engineering and Maintenance, Trans-Canada Air Lines, Winnipeg, Man.*

**An address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on September 30th, 1943**

The subject of post-war aviation has been discussed by almost everyone who can catch anyone to listen to him. Never a day passes without some additional writings on the future centres of global aviation or the monster aircraft that will be used as operating media.

It is indeed fortunate that there are some shining lights of sound engineering and common sense to guide safely the development of the transport aircraft through the amazing welter of words that have been written. One such shining light is the Wilbur Wright memorial lecture delivered before the Royal Aeronautical Society in London by Edward Warner, vice-chairman of the Civil Aeronautics Board at Washington. Because of Mr. Warner's lecture, I do not propose to discuss the aerodynamics of post-war aircraft, but rather to present the viewpoint of an operator, nor do I propose to enter into any discussions on public service, national prestige, politics, or the well-being of this crazy world's peoples. Aircraft operation is a commercial enterprise which must be developed in terms of dollars and cents if it is to succeed. The truth is that the best air transportation will sell most easily, so our endeavours for improvement are largely dictated by a need for greater saleability.

The stock in trade of air transportation is speed with safety, regularity, and comfort. The speed factor is already sufficiently established to satisfy immediate requirements; comfort is reasonable but can be considerably improved; regularity has not been attained, and the reserve margin of safety in operation is less than any other form of transportation. Without much higher standards of safety and regularity, air transportation cannot progress to the vast horizons that have been forecast so freely.

My discussions to-day on the form of our post-war aircraft are based on two convictions.

### No Revolutionary Structural Changes in Post-war Period

*The first is that the basic aeroplane as we know it to-day will not undergo any revolutionary structural or size change for a considerable time in the post-war period.*

I will briefly outline a few of the factors which I believe support this contention.

Probably the most simple reason is that the only types from which immediate post-war aircraft can be developed are the present military and transport aircraft. With the concentrated effort there is on all sides for war production the application of sufficient engineering time to develop new commercial aircraft is simply not possible. Admittedly one cannot visit any manufacturer's plant without someone opening a desk drawer and pulling out a preliminary specification of what he proposes to build, but the difference between preliminary specifications and completed aircraft may well amount to four or more years of hard work. The design and construction of a new aircraft is a long and costly business and, associated with it, is the mass of detail specifications of items which the aircraft manufacturer himself purchases as completely designed units.

Even if the manufacturers were able to give sufficient time and study to new type aircraft, from what basis are they to start?

The best heads in the industry have variously estimated traffic potentials at anything between prewar level and astronomical percentages of increase. Each new estimate is made from what appear to be logical assumptions. They can't all be right. One committee sets up a 20-passenger aeroplane as the most essential requirement and another fellow is planning a 300-ton monstrosity as his interpretation of pressing necessity. The fact is that no one yet knows how post-war aviation will develop. The entire situation depends on the economics of the world reconstruction that will follow the present holocaust. We cannot compare masses of population in North America and Continental Europe and make assumptions on traffic potentials based on prewar North American standards of living. It may and probably will take years to justify any volume of transoceanic travel.

In many respects, desires are conflicting. For example, on one hand it is known the frequency of flight with small aircraft will give many advantages such as a higher percentage of non-stop flights; flexibility of aircraft disposition and routing; more desirable travel times for the greater number of people and higher percentages of revenue hours flown. On the other hand, there is the desire to provide the spacious comfort of the larger aeroplane which has the inherent penalties of lower frequency of service and a smaller percentage of nonstop flights.

The air cargo picture is still so obscure that no one is yet able to determine whether or not mail and air express will be carried in special-type aircraft or carried in regular passenger-service aircraft. National standards of living, cost of aircraft production, disposal of wartime equipment and many other variables make any estimate of little more value than blind guesswork.

With the evidence that future requirements of aircraft types and sizes cannot be deducted from any existing statistics, I am forced on the conclusion that such intensely interesting developments as flying-wing aircraft and jet propulsion must for the time being be left to our research engineers and to the relatively distant future. We are immediately concerned with getting air transportation back on its own feet and essentially this must be done with what we already have in the line of equipment.

### Effect of Wartime Developments

Many of us are labouring under the belief that the war has given tremendous impetus to the development of the aeroplane. This is an illusion from which we must free ourselves. Because of the war it is true that many equipment items have undergone forced growth and will be available after development and adaptation for the furtherance of peacetime commercial operation. Even this benefit may be delayed or destroyed unless we can overcome the problem of disposal of wartime aircraft and equipment without putting the entire aircraft manufacturing industry out of business.

In the immediate prewar period, several new transport aircraft were under development and construction. Notably such manufacturers as (alphabetically) Boeing, Curtis, Douglas, and Lockheed were developing newer and larger airline equipment based on specifications compiled in consultation with the commercial operators. The commencement of hostilities stopped the development of these aircraft as commercial types and put an approximate version of them into military garb for the duration. Additionally, the commencement of hostilities drastically altered every airline operation. Shortage of aircraft has resulted in schedules being run at times dictated by maintenance requirements. There has been no advance in the methods of operation since the war started. The airlines have been "getting by" and it has been a hard struggle to maintain prewar standards. The point I am trying to make is that at the cessation of hostilities we will, with luck and good government policies, be starting in where we left off at the beginning of the war.

It has been contended that the operations of the various Air Transport Commands have developed transport aircraft, have "taken the bugs out" of the new types. I contend that on the contrary, the job would have been done better and faster by commercial operators. Without the war, the concentration of knowledge that existed in manufacturers plants and the airlines would have more easily solved shakedown troubles. The operations of Air Transport Commands do have some lessons for us. Their practice of using heavier gross loads than are normal in transport aircraft has caused many people to question the validity of present airworthiness strength factors and performance requirements. Personally, I believe that it is essential that we proceed with extreme caution in attempts to revise airworthiness requirements or we are liable to experience a reduction in safety standards that are already not too high.

I would like to give just one more reason why we will have no radical changes in aircraft design for some years to come.

Aeroplanes such as the Douglas *DC-4* and the Lockheed *Constellation* were designed in the prewar years because the airlines had need for them. Such considerations as (1) improvement of safety standards with four-engined equipment; (2) improved performance and passenger comfort; (3) the probability of all first-class mail being airborne, and so on, made these aircraft necessary for normal airline development. Had there been no interruption by war, all the major airlines would presently be flying with these larger aircraft.

The programme of purchasing new equipment is the immediate prospect of all airlines as soon as manufacturing facilities are available. The strain on financial resources will be very heavy. It will be impossible to repurchase aircraft with each minor advance in design.

If the costs of air transportation are to be kept down to usable levels, it is only when it is economically better to re-equip than to continue existing aircraft in operation, that an equipment change is possible. From all present indications, this condition will not be reached for a number of years in the post-war era. I personally believe that full depreciation in six years from purchase date will be a reasonable figure.

So much then for my conviction that commercial aircraft will not undergo any revolutionary changes for a considerable time in the post-war years.

### Revised Standards of Safety and Regularity Needed

*My second conviction is that we have got to revise our thinking regarding aircraft operation and develop new methods to achieve the necessary standards of safety and regularity.*

I propose to briefly discuss present practices and attempt to show some possible corrections.

Two major functions are involved in the flight operations of aircraft:

(1) The maintenance and overhaul of aircraft to insure mechanical perfection at all times and

(2) The flight of the aircraft from departure point to arrival at destination.

I am omitting reference to the many associated functions such as traffic, ground communication, and passenger service, because they do not directly affect this discussion.

Taking first the function of maintenance and overhaul, we find that present practices on all airlines broadly follow the same lines.

After a certain specified period of operation, each aircraft is removed from service for inspection and what can be called "preventive maintenance work."

The "out-of-service" period varies with the particular inspection or "check" to be made and ranges from a few hours for the frequent daily or "line" check to several days for a major overhaul. I have already referred to the fact that present-day flying schedules are virtually dictated by the necessity of conducting maintenance work at specified times. On the major routes, layover times have been reduced to the minimum and aircraft are flown continuously regardless of desirable schedule times until removed from service for routine maintenance inspection and adjustment.

In maintenance work the emphasis has always been on airworthiness and no lowering of standard has been permitted. Since the war, the airline passenger may have had, on occasion, some reason to complain about some of the niceties of air travel which have had to take second place. Heating systems, upholstery, food service and the like, have very correctly been sacrificed in some degree to airworthiness and the maximum number of flight schedules.

In spite of the emphasis given to maintenance necessities, the airlines are fortunate over each year's operation to average 12 hours in service per day per aircraft.

It is very seldom in these days of equipment shortage that spare aircraft are available to cover mechanical irregularities, and such minor troubles as defective cowl flaps or spark plugs can cause delays of some hours in scheduled operation. In some cases where trouble-shooting is difficult, it may be necessary to cancel the schedule or, if it is available, to ferry a replacement aircraft. In either event, there will be a rushed concentration of highly skilled ground mechanics to correct the defect in the grounded aircraft.

Under the present system, maintenance supervisors are always faced with the problem of the immediate future and very often the only planning and control of work that can be done depends on comparatively speaking "snap jugdments."

This roughly covers the picture of airline maintenance, without elaboration on the shortage of men, equipment, accommodation, and knowledge that presently makes life so complicated.

### Designing for Ease in Maintenance

Present-day aircraft by their nature are extremely complicated mechanisms condensed into small bulk. It is true to say that the manufacturers could have done a great deal more than they have to simplify maintenance and overhaul problems, but in the past, the small voices of the airline-maintenance mechanics and the factory project engineers have pleaded in vain for a study of maintenance facility. The designers of aircraft have always concentrated on the aerodynamic properties of their products to the almost total exclusion of all else.

Aircraft now being built are beginning to show that a little more consideration has been given to the importance of ease in aircraft maintenance, but the optimum cannot be obtained with most of the types of construction being used and it will continue to be virtually impossible to make every individual component easily replaceable and accessible until suitable construction methods are adopted.

I would like to present some suggestions which I believe will make it entirely possible to overcome some of the major defects in our present system of maintenance and overhaul.

The war has taught the aircraft manufacturers a great deal about what can be called "unit" construction of aircraft. The conservation of floor area and the necessity of subcontracting major portions of their finished products have developed accurate jig and tool work in the fabrication of aircraft in sections. During final assembly the many sections are brought together and made up into a single complete unit.

With a little care in design and our understanding of the operator's requirements it should be possible to construct an aircraft from sections similar to those presently being used but having the major difference that they can be subsequently disassembled from the complete aircraft with ease and rapidity.

As an example of what I mean it should be possible to remove the entire tail unit of an aircraft complete with fins, rudders, elevators, and their controls in a period of 15 minutes and replace a similar unit in the same period of time. Power plants should all be exactly alike and quickly replaceable by simply disconnecting one electrical attachment, a gas line, the controls, and a few easily accessible bolts. (Manufacturers, please note that the oil tank and system is part of the power plant.) The entire aircraft structure and furnishings should be an assembly of units which can be quickly and easily disassembled and reassembled.

When designing the installation of the accessory and instrument systems, care should be taken to group associated items in readily accessible and quickly removable compartments or panels. Any items which cannot be grouped in such a manner, should be disposed individually in such a way that they can be reached and replaced in a maximum period of five minutes.

All of these construction features are quite possible. To some extent the airlines themselves achieve some measure of maintenance facility and interchangeability after delivery from the manufacturer. There is much however that cannot be corrected after construction and must be accomplished in the basic planning and development.

With aircraft designed and constructed in the manner I am suggesting, a picture very different from the present one would be seen in the function of maintenance and overhaul.

With the facility of quickly replacing a defective unit, the aircraft need only be grounded during the process of change, the reconditioning of the removed unit being done at leisure after the aircraft has proceeded on its way. The interruption of flight schedule by mechanical defects would be reduced to a minimum. For example, if a spark plug goes dead (which generally necessitates up to a three-hour job to replace the set) the entire power plant would be quickly pulled out and the schedule continued with a replacement unit.

### Advantages of Improved Maintenance

Such a system would have many advantages which may be listed as follows:

(1) The improvement in regularity of schedule is obvious.

(2) The hours in service per day per aircraft would be appreciably stepped up.

(3) The overhaul or reconditioning of units could be planned in a smooth flow of work. The high pressure rush periods and depressed slack periods would be largely eliminated.

(4) The overhaul of aircraft would be going on continuously without the present large sacrifice of valuable revenue hours.

Being something of a maintenance man, I will not elaborate further, but am quite prepared to talk anyone down on this pet subject.

Since the earliest days of flying machines, several factors have contributed to develop flight operations as we see them to-day.

Briefly examining a few of the more important of these factors, we see that aircraft structures and engines are now very reliable jobs of engineering. Mechanical defects and irregularities no longer jeopardize the safety of operation and I have just outlined some proposals to overcome the defects in regularity.

Weather reporting and forecasting has progressed a long way since the day when, before taking off, one tossed some blades of grass in the air to find out which way the wind was blowing. We cannot yet control the weather but weather forecasting has become reasonably reliable and, with war restrictions removed, will undoubtedly be on the way to becoming an exact science.

One of the greatest contributions to successful flight operations has been the development of aircraft radio. Continuous contact with aircraft in flight, precision in navigation by "beam" flying, position fixes or bearings are now commonplace, while static-free radio, terrain clearance indicators, blind-landing systems, radio control, and radar are opening up new vistas.

Aircraft accessory and instrument development has greatly increased the scope of operations and when used correctly contributes greatly to safety and regularity.

### Pilot the Most Important Factor

In all the phases of operation, the advance has been rapid and reliable but there remains one and possibly the most important factor of all that cannot adequately progress with the present system. I refer, of course, to the pilot of the aircraft.

In earlier days a pilot had to be part fool and part juggler. His instruments were very elementary and his own senses were the most reliable guide he had to tell him if his juggling with joy stick and rudder bar was producing reasonably correct results. I take my hat off to these boys. They made air transportation possible. Since those early days there has been rapid advancement of the flying machine. Improvements in airframes and engines have greatly extended the scope of operations; the development of radio and precision blind-flying instruments has made it possible to navigate accurately without visual contact with the ground. Blind-landing systems and precision altimeters now allow operation under hitherto impossible conditions of cloud height and ground visibility, but the fact still is that the safety of air transportation rests on the pilot of the aircraft. We have to rely completely on that most unstable of all unknown factors—the individual human being.

Most people will argue that the addition of all the present-day specialized equipment and the presence of specialists in the flight crew decreases the load on the pilot. I contend this is totally wrong. A study of the facts shows, as is proved by the record of accidents, that each new development, each new so-called aid or safety device, has placed a further burden on the skill and knowledge of the pilot and has been used to permit operation under still more adverse atmospheric conditions than was previously possible.

In no other form of transportation are such terrific demands made on a human being. Additional training, additional "aids" cannot correct this condition.

### Automatic Ground Control Foreseen

Now I will examine aircraft flight operation as I believe it can and must be, before we can hope to make any real progress.

First, let us take an example from one of the older brothers in transportation.

If my understanding is correct, the "underground" or "tube" train system used in London, England, which handles astronomical numbers of passengers each day is completely provided with automatic safety controls. There is a driver or engineer aboard all trains, but apart from stopping and starting at the exact spot on the station platforms, and maintaining his stop to stop schedule, there is nothing he can do which will jeopardize the safety of his passengers. If he fails to stop at a station, the train is stopped by automatic control. If he gets ahead of schedule to the point of overtaking another train on the same track, the power is automatically cut off. It is impossible for a delayed train to proceed on its own initiative unless all tracks ahead of it are clear. If the driver falls asleep or otherwise becomes unconscious, the power is disconnected from his train by a "dead-man control".

This whole system is controlled by comparatively elementary electrical devices, yet the result to date is 100 per cent safety of operation. Some inconvenience to passengers perhaps on occasion, but never an injury, never a serious dislocation of traffic.

Every element that could endanger the safety of passengers in this extensive system has been designed to eliminate reliance on the individual human element.

The same basic principles as used by this British railway system, adopted and developed for flight operation, present a most logical future for air transportation.

In my conception of correct flight operations, the mechanical handling of aircraft will be completely and automatically controlled from ground stations.

Consider for a moment some of the radio and instrument developments that already exist: (1) Since the early 1930's, the DeHavilland *Queen Bee* has been used as a radio-controlled anti-aircraft gun target; (2) the Lorenz and Indianapolis blind-landing systems have been used for some years; (3) the control of flight path by an automatic pilot has almost reached perfection; (4) with provision of correct ground facilities, we have aircraft position indicators which will exactly locate an aircraft over any route in the world. Radio beams, collision indicators, terrain clearance indicators, radar, and hosts of other developments are now available. It takes but little imagination to visualize an integrated system of ground control built with our existing knowledge.

I am not suggesting for a minute that aircraft will be controlled from the ground in the immediate post-war period, but I am suggesting that now is the correct time to adopt the principle.

Imagine for a moment an aircraft in stormy weather, or meeting unpredicted adverse weather conditions. With his mind free of the encumbrances of a host of mechanical gadgets, our future airline captain will be able to apply all his mature judgments to governing the flight conditions. He will not be wrestling a control column and rudder bar because they, I hope, will be painted red and tucked away in a glass case labelled "for use in extreme emergency only."

### Conclusion

In conclusion, I think it is correct to look a little further into the future. There appear to be three phases through which we must develop. The first I have described as I see it. It can be covered by repetition of my convictions that there will be no revolutionary changes in aircraft for some years in the post-war period, but we can expect a considerable change in the detailed design of aircraft and the principles of flight operation.

The second phase will develop naturally from the first and in it we shall see revolutionary designs of greater efficiency.

The third phase will only be reached when some degree of stabilization of aircraft design has been attained. It will be in this third phase that we can expect great reductions in the cost of air travel and the universal acceptance of the flying machine as the standard method of transportation.

# CANADA'S WAR PRODUCTION

H. J. CARMICHAEL

*Co-ordinator of Production, Department of Munitions and Supply, Ottawa, Ont.*

**A luncheon address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, October 1st, 1943.**

To discuss Canada's war production before a meeting of the American Society of Mechanical Engineers and the Engineering Institute of Canada is a privilege. I am honoured by the opportunity to pay tribute to two organizations which, in their respective countries, have played such an important part in this war.

There has never been a conflict in which the production front has been so vital. On that front you have won victories all the way down the line. You have contributed to phenomenal feats of output. You have designed new and better weapons. You have perfected new and better ways of making things. You are doing your full part in turning the tide of battle against our enemies. And for what you are doing, for the contribution your organizations have made, you have earned the gratitude of the fighting forces and the appreciation of democracy.

You are men who know much about internal and specific matters of war production. To-day I would like to speak to you from the administrative end, and tell you something of what Canada has done.

All war materials made in Canada for the armies of the United Nations are contracted for and produced under the direction of the Department of Munitions and Supply. Thus the production can be co-ordinated to the highest degree. Thus the available facilities and materials can be used to the greatest advantage.

In no other country is all the purchasing for the armed forces carried out by one central body. Canada is unique in this respect. There is no competition between the armed services for supplies. But we have gone even further than this. In no other country has the body which supplies the services the power to mobilize industry and resources to attain maximum production.

Perhaps this compact organization could not have been achieved if Canada were not a relatively small country. But on the other hand the very diversity of our resources, the vast geographical expanse of the nation and the smallness of our population, have created problems that have made it very difficult to obtain unified control of all war production and supply. Nevertheless, that is our system. And it works.

The administrative organization is as follows:

Our production of war materials is under the direct supervision of the Co-ordinator of Production, who is also Chairman of the Production Board. The Chairman of the Wartime Industries Control Board, whose various controllers control the production of all basic raw materials, is a member of the Production Board. This close relationship makes for the utmost co-operation and intimate knowledge of the requirements of war production. New programmes are divulged at their very inception, before the money is appropriated for the building of plants and the purchase of new equipment.

The Production Board consists of twenty members, who are Directors General and Presidents of Crown Companies, or are other officials who are responsible for the production of munitions. Meetings are held regularly once a week. All problems affecting the welfare of the over-all production of war materials are discussed, and what is by far the most important, all new projects involving capital expenditure of even minor nature must receive the approval of the Board —if under $50,000 through the Chairman; if over $50,000 by a vote of the entire Board.

Even those items under $50,000 are listed before the meeting. Any Director General who feels that another Director General is making an expenditure that is unwarranted has the right to protest and discuss his reasons for so doing. Discussion in many cases discloses the fact that there is surplus capacity existing which makes the expansion by new facilities entirely unnecessary.

Every appropriation submitted to the Board must clearly indicate that the interested controllers certify to the availability of all materials and essential services required.

In the Office of the Co-ordinator of Production, there is complete information and data on all machine tools, both

Government-owned and privately-owned, with detail as to their physical condition. We also know the amount of skilled and semi-skilled labour, as well as the floor space in existing plants. This information is revised periodically and controlled through five offices located at Halifax, Montreal, Toronto, Winnipeg and Vancouver. Competent staffs are available to advise and assist Directors General and prime contractors, when requested, as to what facilities are available. Through the Machine Tools War Service Committee, under the Chairmanship of Mr. J. G. Notman, Assistant Co-ordinator of Production, hundreds of machine tools are transferred from one plant to another as the demands require. When possible, the work is transferred rather than the machine tools, to plants where the personnel is already trained.

The total value of Canadian war production, exclusive of minerals and food stuffs, for the fiscal year 1941-42 was approximately $1,450,000,000; in the fiscal year 1942-43, approximately $2,740,000,000; and in the fiscal year 1943-44, it is estimated that it will be approximately $3,500,000,000.

If the war exports of food and strategic raw materials were added to the 1943-44 picture, there would be $910,000,000 added to the above total.

The total capital assistance on fixed assets since the start of the war approximates $1,000,000,000.

As engineers you can appreciate the magnitude of the problems this country faced in taking on the job of making munitions and armaments of war. The layman, for example, has no conception of what it meant to establish production of anti-aircraft guns in Canada. A modern anti-aircraft gun may consist of as many as four thousand separate parts, demanding the finest sort of precision work. You need very complete plans and specifications, you need highly skilled workers, you need machine tools, and above all you need gun steel and high quality alloy steel.

Unlike other nations, we had no established armaments industry. We had neither the tradition, the experience, the workers, nor the plants. We had never made gun steel. But we set to work and established an armaments industry. We converted. We improvised. We got the steel. We got the plants. We got the tools. We trained the workers. Often we had to work from incomplete plans and specifications. But now we are turning out anti-aircraft guns, field guns, naval guns, tank and anti-tank guns equal to any in the world.

In that instance Canada established an entire new industry from scratch. We had to do pretty much the same thing in the field of ammunition. Even in the last war we had never turned out complete rounds of heavy ammunition. In this war, working against time, we created an entire industry, for the manufacture of heavy and small arms ammunition, depth charges, land mines and aerial bombs.

In other instances we had a basis for conversion and expansion. We had an automotive industry. But as you know there is a big difference between a commercial truck and a universal carrier, between a light coupé and a field ambulance. Canada's automotive industry had to practically turn itself inside out overnight, but it has produced more than 550,000 units of mechanized transport for the United Nations. We had a small peacetime aircraft industry turning out a handful of planes a year. That has been converted and expanded far beyond its pre-war capacity until now we are turning out eight of the finest trainer and combat types in the world. We had a small radio equipment industry. With radio revolutionizing communications in modern warfare we have been called on to make the most intricate types of modern signals and communications equipment. We shall turn out $250 million worth of that material this year for the United Nations. One type of vehicle radio set for instance has 6,000 parts and for each of these parts the schedules call for essential spares. That set is only one of 100 equipment types, ranging from telephone supplies to the most secret developments of radio location and detection apparatus.

We had shipyards in this country but Canada had not built a seagoing vessel in the last twenty years. Here again a huge industry has been created from a small peacetime nucleus and our yards are not only turning out merchant vessels to carry our supplies across the sea, but naval vessels to protect them. It was a red-letter day for Canada when the first Canadian-made destroyer was launched at Halifax two weeks ago.

These are only a few of the high spots. To-day Canadian production is at a high level, virtually at its peak. The latest figures available to me indicate that our machine gun and small arms production was up 50 per cent this summer over 1942. Small arms ammunition production is up by 30 per cent. The output of chemicals and explosives has mounted by some 10 per cent. We have doubled our production of signals and communications equipment over last year. Gun production has increased by 15 per cent. And although the number of planes produced has hardly varied from the 1942 output we are now producing more service planes and heavier types, so that on a dollar or poundage basis our plane production has substantially increased. Ship production reached a peak on September 18th this year, when we launched our 620th ship. Of those 215 were cargo vessels and 405 were escort and other types.

The whole history of this amazing wartime industrial revolution in Canada—for it amounts to a transformation that would have taken at least a quarter of a century under normal conditions—breaks down into four phases. The first phase began in June, 1940, when we took on the job of helping replace Britain's lost equipment after Dunkerque. 1940 was a period of planning and organization. 1941 was occupied with construction, the expansion of industrial facilities, and the beginning of production. In 1942 we were turning out all the munitions and materials on our list and increasing the output. This year we have reached the peak and have been revising the programme in line with the new needs and requirements which have grown out of United Nations successes in the war.

The total value of the contracts awarded by the Department of Munitions and Supply for war materials is now in excess of $8,900,000,000, exclusive of food and raw materials.

The first quarter of 1943 represented Canadian war production of munitions at maximum rates of output in dollar value. While certain aircraft and naval escort vessel programmes have not reached their peak, ground army equipment is at its peak; the decline which will occur in this line of war material will be counter-balanced by an increase in naval and aircraft production.

The percentage distribution of our war production by Governments for 1943 is as follows:

| | |
|---|---|
| Canada | 30% |
| United Kingdom and other Empire countries | 48% |
| United States, through War Supplies Limited | 22% |

The Canadian programme is therefore in large part determined by the requirements of the United Nations rather than by the requirements of the Canadian Armed Services. All possible efforts have been made to integrate the production of Canada with that of the United Kingdom and United States with a view to maximum utilization of resources. Canadian munitions and supplies have been shipped to all the United Nations and have participated in all the theatres of war.

Through the medium of the Joint War Production Committee, Canada and the United States, the production of war materials has been very closely co-ordinated and controlled by regular meetings of the various sub-committees. These are headed by the respective officials in each country who are responsible for production, to ensure the maximum use of existing facilities and to take full advantage of technique and material savings. In a great many instances, components have been transferred between the two countries so that the maximum output of various munitions of war might be attained.

Technicians in both countries have readily disclosed to each other all improved methods. Blue prints, jigs, dies and fixtures and all pertinent production data have been freely interchanged between the two countries. New processes developed have been immediately made available between the two nations and a more complete system of co-operation and co-ordination than that attained seems impossible. For this magnificent result, great credit must go to sub-committee chairmen and executive directors, who have been so active in this regard.

The total amount of war contracts placed by the United States since the inception of the Joint War Production Committee amounts to well over one billion dollars, of which over 675 millions have been delivered; the balance will be delivered at the rate of 50 millions per month.

We in Canada who are closely associated with the activities of war production in the United States realize that the output there has reached such stupendous totals that pre-war comparison results in rather fantastic percentages. At the present time we understand that your production in the United States exceeds the combined output of our enemies. This is a great feat and is bad news for all the aggressor nations.

We in Canada feel that our effort is dwarfed alongside of your extraordinary production record, but we have been greatly encouraged by statements made by your great war President, Mr. Roosevelt, to the effect that per capita Canada's contribution in men and materials exceeds that of the United States.

Dealing specifically with war production in Canada, at the present time this is at its maximum as far as physical volume is concerned, and its value totals 2½ billion dollars of direct war materials, not including metals and foodstuffs, which would add another billion dollars if the exports of metals and foodstuffs to the United Nations were included. According to all reports that we receive from the various fighting troops, Canadian supplies are proving of a calibre and quality second to none.

At the present time over one million Canadians are engaged in Canada's war programme. Over 250,000 of them are women who are doing a splendid job with their fellow men-workers in producing an ever-increasing stream of war supplies.

Since the outbreak of the war, Canada has developed a great shipbuilding industry which has already launched well over 600 vessels of the cargo, combat and escort types, completely equipped with components manufactured in Canada. Any one who is familiar with the enormous amount of equipment on a modern escort vessel will realize what a titanic task this was. In addition, over 4,000 smaller craft have been produced in Canada. In fact, ships are being launched now at a rate of one a day.

Our infant aircraft industry will have produced 10,000 planes by the end of 1943. Were it not for the fact that this year's production was interrupted by a major changeover affecting practically every plant in the Dominion, this figure would have been greatly exceeded.

Canada's production of mechanical transport and armoured fighting vehicles exceeds 550,000. In a recent address, Donald Nelson, Chairman of the War Production Board, stated that according to official figures, one-third of all the mechanical transport used by the fighting forces of the United Nations was produced in Canada. This, you will agree, is an enviable record.

Our newly-created ordnance industry has produced approximately 60,000 units of heavy ordnance and 800,000 small arms weapons. Over 467,000,000 rounds of filled ammunition have been delivered by our various filling plants and our production of small arms ammunition has reached the staggering total of two billion, five hundred million rounds.

In order to carry out this enormous programme, it has been necessary for our chemicals and explosives industry to produce one million tons of chemicals and explosives.

The output of the instruments and communications Industry exceeds $200,000,000, and by the end of this year, production will be at the rate of $250,000,000 annually. This from an industry whose normal peace-time production was approximately $10,000,000 a year.

Miscellaneous stores have been made to the extent of 2½ billion dollars since the start of the war. This covers everything from pins to locomotives.

These statistics give a broad picture of our over-all programme. There are however important items which are seldom considered when weighing our war effort.

First, there is the great task of maintaining and keeping flying the planes required in Canada's gigantic British Commonwealth Air Training Plan. This little-heard-of industry occupies well over two million feet of floor space and employs over 15,500 workers, of whom about 35 per cent are female. They render repair and maintenance service to engines and airframes to the extent of about one million dollars per week.

The second of these activities is ship repairs. During the first three years of this war, exclusive of naval ships, this division of our war effort has repaired over 5,000 vessels, averaging 4,000 gross tons each. This represents putting back into war service 20 million gross tons of shipping. Now that Canada has assumed a greater share of the responsibility for convoying ships to Britain, this work will continue to expand.

Finally, Canadian engineers throughout the war have constantly developed for us better methods, better designs, and better weapons. As these have been developed, tested, and proved they have been adopted not merely by Canada, but by the Allies. As an example, Canada has developed self propelled gun mounts, and only recently we have designed and are now producing a 20 mm. anti-aircraft gun and its multiple mountings. This gun has been tested and proved overseas where it was received most enthusiastically.

In the production of raw materials, Canada's record is just as impressive as in the field of finished munitions. Our production of steel is more than double the peak of any pre-war year and now exceeds an annual rate of three million tons. Canada has expanded its alloy steel production to well over ten times its pre-war peak, and is practically self-sufficient in this line.

Further, Canada is now the greatest base-metal exporting country in the world, having achieved the largest output in her history, and is producing the following percentages of the combined output of the United Nations:

| | |
|---|---|
| Nickel | 95% |
| Asbestos | 75% |
| Aluminum | 40% |
| Mercury | 20% |
| Zinc | 20% |
| Lead | 15% |
| Copper | 12½% |

Many other vital metals are being produced in substantial quantities.

Canada's output of these and many other commodities has made it necessary to add nearly two million horsepower to its pre-war total power installation of slightly over seven million horsepower, which it had taken forty-five years to develop.

We have spent over a billion dollars in expanding and equipping war plants and defence projects—creating many new industries whose techniques were previously unknown to our country. In connection with this programme, twenty-eight Government-owned companies have been formed to assist in the production of essential war materials and the control of war services. In setting up these companies great care was taken to select personnel whose experience and record showed them most capable of carrying the important responsibilities assigned to them. As a result, very efficient operation has been attained.

As already stated, the job of production is closely linked with the job of control and the Chairman of the Wartime Industries Control Board is also a member of the Production Board. As Canada plays an important role in the co-ordinated Anglo-Canadian-American production programme, our problems of raw materials supply are very complex. We hear some criticism of details of control policies from time to time, but it must be remembered that our whole production programme depends on effective control of materials and services.

You cannot make guns without steel; steel plants require coal; you cannot supply coal without transportation; a manufacturing plant cannot run without electricity. ships must have engines, and to make engines you must make the parts. One missing part may mean that a ship cannot sail or a bomber cannot fly or a gun will not fire. So one war plant cannot have materials and services at the expense of another. It is a very intricate set-up and the wonder is that it runs as smoothly as it does. And in addition, parallel to the problems of wartine production, are the problems of producing for the civilian population.

The Control Board has the gigantic job of finding enough timber, rubber, steel, copper, power and other services and materials for the war programme. Every controller tries to meet the war demand for the goods and services under his jurisdiction. Then the Control Board examines his recommendations in the light of the programme as a whole, in relation to the economic structure of the entire country, realizing that there must be a certain ratio between the production of war supplies and the production and distribution of consumer goods and services.

Each controller has to seek ways and means of expanding the production of the goods and services under his administration. And on the other hand, wherever necessary, he must divert scarce materials or services from civilian uses to war uses. The Metals Controller, for instance, will work with copper producers to get an increased output of copper, while at the same time he will prohibit the use of copper in non-essential production. His work, by the way, is one of the most graphic illustrations of the workings of wartime control. Every possible pound of scarce copper and nickel has been diverted from civilian use to war industry in the United Nations. At the same time great expansion of metals production has been achieved. Our aluminum industry has been enormously expanded, a Canadian process for production of magnesium has been developed, recovery operations at large base metal mines have been extended, old mines have been revived, existing properties have been expanded and new marginal and sub-marginal deposits have been developed. Millions of dollars have been spent building up stockpiles.

And in spite of all this, because we are sharing our material resources with the other United Nations, we still have to exert rigid control of these supplies in our own country. This applies not only to metals but to timber and other raw materials.

In this matter of conservation we have scored some remarkable successes, which will have far-reaching influence on post-war industry. Munitions manufacturers in Canada have been asked to conserve scarce materials, machine tools and man-power wherever possible. Sometimes this has been done by changes of design, by eliminating or simplifying parts in the original specifications of war materials. Sometimes it has been achieved by substituting more plentiful materials for scarce materials in actual production. Sometimes it has been the result of new production techniques. This conservation effort now runs through the whole fabric of Canadian war industry, under direction from Ottawa. Conservation has been applied to Canadian war industry from top to bottom, right from the design table to the work bench, because industrial workers are also encouraged to submit their suggestions. Perhaps a worker may suggest a change which may save only a few ounces of scarce material or a few minutes of production time in the manufacture of a component. But over a year's time, with hundreds of similar suggestions pouring in and being adopted in scores of war plants, huge over-all savings have resulted.

For me it has been a privilege to attempt to show you something of the wartime production picture in Canada to-day. May I remind you that I am in a good position to know what Canada owes to the engineering profession in this time of war. The public hears very little about you. They know about the man who uses the weapon and the man who makes the weapon, but the engineer who makes it possible to build the factory, the machine, the power plant or the bridge—he is a shadowy and anonymous figure away off in the background. You are the sort of men who love your work for its own sake, who get little in the way of public recognition, but who find your reward in the knowledge of your own achievements and in the good opinion of those in your own brotherhood. But I cannot conclude without letting you know that your work does not go unobserved or unnoticed by those who understand.

No country, no service, no one man or class of man is all-important in this war. The production front could not survive without the fighting front but the fighting front depends on the industrial front. Our successes in this war have been achieved by teamwork and on teamwork rests our hope of ultimate victory. You are doing your part to the utmost and to-day the results are manifest in all parts of the world. May I thank you for the help you have given me personally in the job we are doing in Canada to-day, and on behalf of my associates may I pay tribute to the vital part you have played and are playing in the life-and-death struggle for a free and better world.

## ORDNANCE PRODUCTION

Canada's armament engineers have expedited production by instituting numerous redesigns. For example, the axletree assembly of the 6-pounder anti-tank gun mount is now built up by welding formed steel plate. To this section are bolted two 5½-lb. steel forgings, and two 1 and ⅛-lb. castings are welded onto the assembly. Formerly, the part consisted of a large main forging to which two 30-lb. forgings and two 20-lb. castings were fitted. The redesign saves an estimated 500,000 lbs. of high-alloy steel annually and releases three engine lathes, a turret lathe, a drill press, and a cylindrical grinder for other war jobs.

The breech ring of the 3.7 anti-aircraft gun, formerly made from a massive forging imported from Great Britain, is now made from an intricate steel casting developed by Hamilton Munitions Ltd. and Dominion Foundries and Steel Ltd. Estimated savings are $1,094,400 in costs, 2,750,400 lbs. of steel, and 100,800 man-hours. The front axle of the gun, formerly a steel forging which had to be machined all over, is now made from steel bar stock to which lugs are welded, a change which results in the conservation of nearly 400,000 lbs. of steel annually.—*Product Engineering*, June 1943.

# PRODUCTION PACES THE WAR

CHARLES E. WILSON

*Executive Vice-Chairman, War Production Board, Washington, D.C.*

**A dinner address delivered at the joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, on October 1st, 1943**

In the fall of 1939 Hitler's Germany struck a new note in warfare. The planning and execution of military campaigns suddenly emerged as a gigantic contest in engineering skills. Back of the relentless panzer divisions and the screaming Stukas, there was marshalled and applied all of the technical knowledge and inventiveness of a highly ingenious industrialized people. *All* that Germany knew about machines and the use of machines was turned into deadly striking power. Warfare was reshaped in the light of modern techniques. War became so mechanized, that no nation could hope to survive unless it could surpass its enemies in engineering skill and inventive ability.

**Charles E. Wilson**

Yet wars are still fought by men: *by* men, *with* machines. To-day the men who fight must have enormous quantities of matériel. That matériel must be superior to that of the enemy. Our fighting men in this war can not do their job unless the engineer and the technician devise better matériel than the enemy has and find ways of making it in unlimited volume. The engineer is the strategist of the battle of production. His strategy has got to be good.

That puts it squarely up to you, as engineers.

In getting into a war of this kind, we may think we are on perfectly familiar ground. Our lives have been wrapped up in machines and their uses. In peacetime we strove for high quality and mass production, but the tempo was different. We went slowly from model to model. Improvements were carefully tried and tested before adoption. But in wartime, our product is tried in a test of fire. And as these tests reveal that changes are needed, those changes require immediate action. The whole process of production is thus affected. Work goes on at white heat. Constant improvement has to go hand-in-hand with volume production. The result is a never-ending problem of invention and production which the engineer and the technician must meet.

The pace of production in wartime is thus infinitely rapid. There is a corresponding step-up in the pace of technical advancement. And the blend of the two—steadily increasing volume and steadily improving quality—is the base upon which rests the military strategy of the whole war. In the long run our inventiveness and our ingenuity have got to exceed the inventiveness and ingenuity of our enemies.

That puts a terrific responsibility on us as engineers. The responsibility is primarily a demand on our skill and our technical ability, but it is also a demand for our understanding. We must realize what we are up against. We must know just what we are responsible for. Production paces the war, and the engineer paces production. The engineer has got to deliver.

Exactly what does that mean to us?

I think it compels us to begin by being very clear on three simple facts. These are:

(1) The war has not been won. A good many men are going to die, and billions of dollars worth of equipment is going to be destroyed before the Armistice whistles start to blow.

(2) Even if we were perfectly sure that the war had been won, we still would have no right to relax in our efforts to produce, because any let-down in production will surely mean unnecessary loss of life and the prolongation of the war.

(3) There is a changing production pattern which we must follow, not merely to win the war, but also to ensure the peace.

Let's examine these points briefly, one at a time.

### The War Has Not Yet Been Won

There is, of course, a difference of opinion as to how long the war will last. By some criteria, we have a right to be highly optimistic. The United Nations are on the offensive, and the several offensives are meeting with splendid success. But before your optimism begins to run away with you, take a look at the maps. I do not mean to-day's encouraging maps alone, but rather to-day's maps in relation to the maps of Nov. 11, 1918. Some of our arm-chair strategists are saying that Germany to-day is about where she was in November, 1918, so that the end cannot be far off. Well, that would be very nice if it were true—but the maps do not say so.

The maps say that we are far from having retaken all the ground or the material or the natural resources which have been seized by the enemy since 1939. The maps say that we have hardly done more than crack the surface of Hitler's *Festung Europa*. Our chance of breaking into that well-advertised fortress in the near future may be extremely good, but the maps say that we have not done it yet. The maps do not tell us that we are entitled to a breathing spell; rather, there are a solemn warning that the hardest and costliest part of the job is still ahead of us. They show pretty clearly that Germany and Japan still hold, in territory and in resources, a great deal that belongs to someone else. They do not, in plain fact, look the least bit like the maps of November, 1918.

### We Must Not Relax Production Effort

Now, for the second point. Even if we insist on believing that our enemies are already beaten and will presently give up, we have no right to relax our production effort in the slightest degree. On the contrary, the very fact that victory was assured would make it more than ever imperative for us to continue increasing our production of war goods to the very limit of our ability.

The United Nations' war effort is complex. It is made up of many parts, and all of these parts have to fit together. Military strategy has to be co-ordinated with production schedules, with transportation time-tables, with man-power assignments, and so on. Each of these subdivisions, in turn, is very complex, with many separate parts that have to dovetail. The failure of any part is not just a local default which can be shrugged off: it is a failure which affects and imperils the whole. It is a failure which must be felt on the battlefield.

You can remember the tragic cry, "Too little, and too late!" which we heard all too often early in the war. You remember what the results were. Soldiers who go to battle less well-equipped than their enemies fight under a terrible handicap, the price of which is paid in human lives. Let me repeat again—this is a war of engineering skills. There is a direct, provable relationship between an army's equipment and an army's casualties.

So every bit of equipment made to-day will save the lives of our fighting men tomorrow on some battlefront. Any extra equipment, made through extra effort, will save extra lives. Why did the campaign in Sicily cost fewer lives than we had anticipated? Because the British and the Canadians and the Americans were able to be lavish in arming and equipping the invading forces. The engineering back of that campaign met the test—and a lot of our boys are alive to-day who otherwise would have died.

That is why we cannot tolerate any let-down in production, no matter how good the news from the front may look. Are we nearer to victory? Then, for that very reason, increase the volume of production so that we save as many boys as possible.

### The Changing Pattern of Production

Now, to the third point—the changing pattern of production.

Conditions governing the needs of our fighting forces are mobile and fluid. Nothing stays put in this war. Mechanized war is dynamic, not static. The very physical surroundings in which our boys fight change from season to season, and, as they change, corresponding changes must be made in the matériel our boys fight with. Day before yesterday we were fighting on the blistering sands of the desert; yesterday we were fighting on a rocky island; to-day we are fighting amid the mountains and the plains of southern Italy. Tomorrow, or the day after tomorrow, perhaps, our boys may be fighting in the green fields of northern Europe. And as the geography of our fighting changes, the problems of war production change accordingly.

For example: Now that we are no longer fighting in the African deserts there is a reduced demand for tank treads and air filters. The desert rocks and sands punished tanks, and there was a constant and imperative demand for replacement parts. The nature of that demand has changed: The changing geography of the war compelled the change. Yet as that change was made, the eternal requirement for new and better weapons brought about a different sort of demand, the demand, for instance, for the bazooka and its rocket projectiles, that man-from-Mars weapon that has proved so enormously effective against the enemy's armour.

These two very small examples of shifting demand could be multiplied a hundredfold. They prove very clearly that we need, not only volume production, but an exceedingly flexible and adaptable production system. In his recent message to Congress, President Roosevelt said:

> Even as the actual fighting engagements in which our troops take part increase in number, it is becoming more and more evident that this is essentially a great war of production. The best way to avoid heavy casualties is to provide our troops with the best equipment possible—and plenty of it.

That struggle to turn out the best equipment possible is unending. It makes our production job hard and costly. And it means virtually unlimited demands on the creative power of the engineer, the technician, the man with the know-how.

The best we can possibly do may be good enough to-day, but it will never be good enough tomorrow. We are not only in competition with our enemies: We are in competition with ourselves. We must always be beating our own records. New inventions and new techniques are carefully devised to give our fighting men that little margin of advantage that will mean victory. But these things never remain secret. Sooner or later the enemy always matches them, or even betters them. We reach one peak of technical or mechanical achievement only to go on to a higher one. We can never for one instant be satisfied with what we have done, no matter how good it is.

We have to follow that rule if we are going to win the war. But that is not the end of it. The pattern set in this war is going to carry over into peace. That is inevitable. We have learned—at bitter cost—since this war began that no nation which tries to fight at half throttle can hope to survive. Are we not also going to discover that it is fatal to live at half throttle in peacetime? If the peace that follows this war is to be secure, we will have to go on with the never-ending struggle to find and use the techniques that will enable us to make the best possible use of what we have.

### Developing Our Potential Strength to the Full

In 1939 or in 1940 it was obvious that the free peoples who inhabit the vast block of land running from the Gulf of Mexico to the top of the American continent—the peoples of the United States and Canada—had a greater potential strength than anyone else on earth. They had space, resources, machinery, men: They had the freedom to use these to the best advantage; they had the brains and inventiveness to tell them how to use them.

But this was merely potential strength. It had not been organized or mobilized so that it could be translated into actual power. It had not been turned into military power; it had not even been turned into full-strength peacetime power. The strength that enables a people to make the maximum possible use of what they have simply had not been put to work at full throttle.

To an extent the same thing was true of all of the United Nations. On paper, there simply was no comparison between the resources of the Axis and the resources of the nations which the Axis proposed to despoil. Those countries which have become the United Nations were incomparably superior: They had within themselves the resources which, if used properly, could have meant the direction of the affairs of the world. But the resources were latent. The free peoples of this earth had at their disposal the means to stamp down forever the Axis-born threat to their liberty and their security.

They could have insisted that this remain a world in which free men and women are free to work out their own destinies. But the power with which this could have been done was never marshalled. We did not make full use of the resources we had. In short, we had world leadership and we failed to exercise it.

So came the dark years of 1939, 1940, and 1941. The invasion of Poland, the Battle of France, the attack on Russia, Pearl Harbor—all of those grim milestones in human history represented attempts on the part of the Axis to strike the free peoples down before their latent strength could be turned into actual striking power.

Those blows failed. The margin by which they failed was painfully narrow, but they did fail. But as the blows fell, we grew both frightened and angry, and in our fear and anger we found inspiration.

You know what has happened since then. In Canada and in the United States there followed the most dynamic period of preparation for an all-out fight ever known in the history of the world. I would like to summarize the result in the words which President Roosevelt used to the Congress not long ago. He said:

> Our great production programme started during the darkest days of 1940. With the magnificent contribution made by American industry and American labour, it is approaching full production. Britain has already attained full production. To-day the British Empire and the United States together are turning out so much of every essential of war that we have definite superiority over Germany and Japan which is growing with every succeeding minute.

That brief statement is the account of an amazing achievement. Our countries to-day are measurably close to exercising, for the first time, the full potential power with which God has blessed us. They are beginning to find their own strength. The great gamble of our enemies has failed forever. The free peoples of this earth found themselves in time.

### War-time Lessons Must be Used in Peacetime

But let us not waste time patting ourselves on the back. As engineers, we can be proud of the way we met the test, but more tests are ahead of us. When this war is finally won, we have got to use in peace the lessons which we learned in war.

All of those lessons really mean the same thing; namely, that technical and mechanical obstacles need not keep a people from doing anything which that people really wants to do. We do not admit the impossible these days. If the impossible is something that vitally needs to be done, we find ways to do it. In this way we have broken through all kinds of physical limitations; to keep the peace secure, we must keep on doing the same. The challenge to our ingenuity, to our intelligence and alertness and determination, will be just as great in peace as in war. We shall have to go on being eternally dissatisfied with our own best achievements.

It took a world of ingenuity to adapt the great mass production processes to the making of military goods. This war is not only completely mechanized; in its mechanisms it relies on workmanship and tolerances which would be exacting even if volume production were not called for. As engineers we had to take this host of involved, finely tooled mechanisms and find ways of making them in unheard-of volume—the volume that can only be attained by mass production.

Yet that was only the beginning of the challenge. The demand for these weapons and implements was practically unlimited, and the time was short. Neither materials, man-power, nor factory capacity could be wasted. We had to begrudge every ton of material and every hour of time that was used. In a war in which money was no consideration, we nevertheless had to find ways of making these weapons more and more cheaply, for that is what saving man-power, machine time, and materials in a manufacturing process amounts to.

But while we made weapons faster and more cheaply, we also had to make them better. Our men go into battle; there they find that the enemy has some particular weapon which is better than their own. Immediately, therefore, we must improve our own weapon and make it better than our enemy's. But while we do this, the enemy, also, is making his own improvements. So when we bring out a better weapon we dare not rest. Even before we see his answer to it we must drive ahead for some further improvement. It is an unending process. And while we are making the design changes which will give us a better weapon, we always face a rising demand for the production of the very article which is being improved. We cannot do as we might do in peacetime and stop production altogether while the changes are made. Even though it occasionally seems impossible, we have to maintain an unbroken flow of production at the very time when we are changing models.

### A Challenge to Engineers to Exercise Ingenuity

That explains the great and challenging responsibility which rests upon us as engineers and technicians. It is a responsibility which we cannot escape. No cheering news from the fighting fronts can lighten it. No optimistic belief that the end of the war is approaching can entitle us to relax for an instant. For the pace of the war itself is set by production; and the pace of production, in turn, depends upon our ingenuity, our resourcefulness, our inventiveness, and our unflagging competitive spirit. No matter how well we do, we will not come to a point where we can say we have done well enough. The engineer bears the sobering, compelling responsibility that comes to men who are swinging upon a great door in human history. His satisfaction can only be the satisfaction of the doer who knows that somewhere within himself he can find the resources to meet the challenge.

We have talked, so far, about winning the war. We know that we are going to win, although we do not know whether the victory will come soon or late. We know what our responsibilities in wartime are. Can we drop them when peace comes, or will they simply become a slightly different kind of responsibilities as compelling as those we now bear?

Winning the war, as I see it, is only half the job. The peace itself must be protected. I do not pretend to know what kind of mechanism should or could be set up among nations to insure the peace, but I believe that I can see where our own responsibility will lie—our responsibility as engineers and technicians.

I believe it will consist very largely in an eternal continuation of the demand for ingenuity and competition which has rested upon us thus far.

That ingenuity and that competitive spirit are being used now to make every ounce of our unlimited potential strength available for war. I cannot believe that once the war is over, the free peoples of this world are going to be content to lapse back into a state wherein they used only a portion of their strength. I believe that they will insist upon being completely healthy, fully functioning social organisms. I believe that they will insist that the strength they have be used.

We have at last found out how to make the most of the strength that God gave us and that that strength can be used just as effectively in peacetime as in war-time, and to an infinitely greater gain in human happiness. Look at our own two nations, Canada and the United States, as an example. At this moment we are busy, as never before, making the things of destruction, and dealing stout blows with them. Does one have to be a visionary to believe that when the war is over we should be just as busy, making just as many things for peace, for construction rather than destruction, for life rather than death?

The needs of war, I suspect, can, in a large part, be traced to the fact that this modern world has not thus far discovered the way to use its own strength and resources in time of peace. There can be plenty all around the globe. People can be busy—*usefully* busy—on every continent, all of the time, if the power which is available to the human race is simply used to meet the age-old needs which the human race has. If those needs are not met, we shall never have a true peace. If, by happy chance, they can be met, then we can build a peace which can last.

It will not be easy. The production strategy of peace will be just as hard to master as the production strategy of war. But by what we have done in the last three years we know that the job can be done; and the pattern which is being set to-day, in the unending struggle to find new ways of making better things in greater quantity, in the refusal ever to be satisfied with an existing technique or an existing mechanism, that pattern can be carried on to make the peace secure.

It will be possible in the world that lies ahead of us to strike many shackles from the human spirit. By the faith we were born with, we know that if that can be done the possibilities are infinite.

# THE CONTINUING NEED FOR THE CONSERVATION OF RESOURCES

HOWARD COONLEY
*Chairman, Conservation Division, War Production Board, Washington, D.C., President, Walworth Company, N.Y.*

**An address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on October 1st, 1943**

Materials, facilities, transportation, and man-power are basic to success in war as they are essential to progress in time of peace. Where such resources are not available, experience and ingenuity must be called into play to provide them. Once more the world is witnessing a demonstration that free men, given the opportunity to develop their latent abilities in the democratic atmospheres of the Allied Nations, can out-produce and out-fight the peoples of the regimented and therefore restricted nations.

Even in countries so rich in material resources as the United States and Canada, such huge quantities of materials, facilities, and transportation as a war of world-wide proportions requires do not lie ready for our immediate use. The exigencies of war compel us to plan, design, construct, convert. We must make two blades of grass sprout where one grew before. We must stretch. We must conserve.

Soon after the Office of Production Management was established, on Jan. 7, 1941, it became apparent that it would be necessary to discover ways and means of conserving the material resources of the United States if we were to become in truth the Arsenal of Democracy.

With this purpose in mind, C. Laurence Warwick, secretary-treasurer of the American Society for Testing Materials, was called to Washington in April, 1941, by Donald Nelson to take over the responsibilities of reviewing specifications. In August of the same year Harvey A. Anderson obtained leave of absence from the Western Electric Company to develop for the Government a programme of substitution out of critical materials into those that were more abundant. Six months later Dr. Edwin W. Ely, of the National Bureau of Standards, joined the office of Production Management to add his background of experience in the field of simplification.

It was not until January, 1942, that the War Production Board was established to take over the duties of the Office of Production Management, as well as those of other agencies concerned with production and procurement. A few weeks later, the Bureau of Industrial Conservation, which had been formed in September, 1941, under the directorship of Lessing J. Rosenwald, was set up within the structure of the War Production Board as the Conservation Division, to co-ordinate the related functions of substitution, specifications, simplification, and standardization. At that time the primary responsibility of the Conservation Division was that of securing adequate supplies of raw materials.

The impact of the disaster of Pearl Harbor high lighted the importance of conservation. It was immediately recognized that our responsibilities for conservation extended beyond the realm of materials into those of facilities. Still later, the scene again changed to include transportation and man-power. To-day, man-power is number one on our critical list.

The Conservation Division of the War Production Board is a staff agency. Its responsibilities are exclusively advisory. It is in effect a general engineering and technical staff for the War Production Board.

Our consultants have been recruited from the research and engineering laboratories of industry and from scientific institutions and associations. I believe I can say, with due modesty, that the caliber of our staff is outstanding, the quality of our advice such as to carry conviction. To illustrate, of our 71 consultants, 6 are chemists, 31 are engineers, 11 are metallurgists, 5 are technicians, and 7 are architects. The staff averages 23 years of experience in industry. These 71 consultants are trained in the techniques of substitutions, specifications, simplification, and standardization, and apply these techniques to produce the greatest possible conservation of our resources.

The Conservation Division also has representatives on four of the most important committees of the War Production Board—the Programme Adjustment Committee; Clearance Committee; Appeals Board; and the Facilities Committee. Through the Conservation Division's representation on these committees we have the opportunity of bringing to their deliberations the cross section viewpoint of all of our industry divisions, as well as that of other Government agencies. For through the medium of our inter-agency staff we have daily liaison relationships with the Army, Navy, Lend-Lease, Treasury Procurement, and Office of Economic Warfare, as well as with Canada and Great Britain.

I have given you this background because I feel it will be helpful in measuring the effectiveness of the Conservation Division in its specialized techniques.

### Substitution

In the early stages of our conservation programme substitution was used as a means of relieving excessively heavy demands on certain materials that were insufficient in quantity to take care of our rapidly expanding production programme. With the loss of the Malay Peninsula and the Dutch East Indies, vast reservoirs of precious materials were cut off almost over night, making it necessary for us to find new sources of supply or to discover ways and means of using available materials to replace those that were no longer obtainable.

Three general methods were used in achieving substitution. The first is a complete change of material. For example, when our aircraft programme made aluminum a very critical material, we experimented with substitutes for aluminum in such products as canteens, and were able to develop a satisfactory stainless-steel canteen that has been accepted by both the Army and Navy.

In other cases where a complete change of material was not possible, we were able to accomplish our purpose by using less of the critical material in question. An example of this type of substitution would be found in galley equipment and mess equipment where we were able to substitute stainless clad steel in place of solid stainless steel, thereby saving better than 90 per cent of the stainless steel involved.

The third type of substitution consists of downgrading the same material for a given product. An example of this may be found in propeller-shaft sleeves for Maritime ships, wherein we have been able to substitute "M" metal, a composition of 88 per cent copper, 6 per cent tin, 4½ per cent zinc, and 1½ per cent lead, in place of "G" metal, a composition of 88 per cent copper, 10 per cent tin, 2 per cent zinc, and no lead.

Virgin copper has from the first been one of our critically short materials.

*The Silver Programme.* The proposal to use silver as a substitute for copper in bus bars was first suggested by Dr. Zay Jefferies of the Research Council, Sept. 26, 1941. On Oct. 6, 1941, the Conservation Division recommended this use of silver to Donald Nelson, and in February, 1942, negotiations started with the Aluminum Company of America at Pittsburgh to use silver bus bars in 20 "pot" lines for the manufacture of aluminum. After many legal obstacles were overcome, a contract between the Defence Plant Corporation and the Treasury was signed on May 6, 1942, providing for a loan of 34,286 short tons of silver to the Defence Plant Corporation, who would make all arrangements for guarding, transporting, casting, and fabricating the bus bars. Most of the silver bus bars are being used in the new aluminum and magnesium plants and to date we have certified about 20,000 tons of silver bus bars which have saved 16,000 tons of copper.

*Nickel Programme.* In its eager search for every possible means of reducing the demand on highly critical metals the Conservation Division found that some 3,600 tons of copper and 860 tons of nickel were being used annually in the fabrication of 5-cent pieces, generally known as nickels. With the assistance of George Hogaboom and Dr. A. K. Graham, two of our consultants, we furnished the Treasury Department with a revised specification on nickels using an alloy of 56 per cent copper, 35 per cent silver and 9 per cent manganese, instead of 75 per cent copper and 25 per cent nickel in the original coin, thereby entirely eliminating the use of nickel. This composition had nearly the same specific gravity, magnetic, electric, and elastic characteristics possessed by the original coin, and therefore was usable in telephones, vending machines, and automatic coin machines of all types.

*The Steel-Cartridge-Case Programme.* In cartridge cases, as in many other products, it was the obviously extreme shortage of copper that made it apparent early in 1942 that some substitution would have to be made in order to give the Army and Navy their requirements in ammunition. Steel cartridge cases had been the subject of experiments for years, and had been used by the Germans and Russians, but their guns had been designed to take steel cartridge cases while ours had been designed for brass, and therefore our problem was more complicated and more serious than either that of the Germans or Russians. In May, 1942, the Conservation Division was asked to assist in the problem of developing satisfactory steel cartridge cases, and investigation and research was undertaken by Dr. A. B. Kinzel, one of our steel consultants. After many obstacles were overcome in the fabrication of a satisfactory steel case, the 0.45-caliber-size ammunition was completely converted from brass to steel, with a production of over 300 million per month. At present the 0.30- and 0.50-caliber sizes are also in production at a slightly lower rate, and we have been successful in furnishing the 105-mm. case, the 20-mm. case, the 40-mm. case, and even as large as the long 3-in. gun case (Navy), all of which have been certified for combat use and are now in full production. At the present rate we are showing savings in brass of approximately 200,000 tons a year, and this figure is rising rapidly. The conversion has been so effective that further conversion from brass lines to steel is temporarily suspended pending the forthcoming 1944 requirements for ammunition.

*The Die-Casting Programme.* The use of die castings as a conservation measure has been a part of the Conservation Division's programme for more than two and a half years. Through the efforts of our consultants hundreds of items have been changed from screw-machine products, forgings sand castings, and other methods of fabrication to the die-casting process. The expanded use of die castings with their characteristic high-speed production and low-scrap loss has represented huge savings in critical materials, man-power, and machine hours.

We have worked with the die-casting industry through industry advisory committees, co-operating with them on many problems of production, inspection, and process control. Through the establishment of proper control and inspection procedures, it is expected that the die-casting process can replace, satisfactorily, many critical parts now produced as forgings or wrought products, thereby saving much metal and many machine operations.

*O.W.I. Photo*

**Paper replaces steel as material for trailer wheel wells at the Western Trailer Company's plant in Los Angeles. Wadded-up paper, impregnated with a glue-like solution is smoothed into place over molds in continuous layers. The material is self-hardening and self-compressing. When dried, it is sanded, sawed and drilled and may be installed with nails, screws or bolts.**

## Specifications

Specifications provide an important means for conservation. A purchase specification is simply a detailed statement of the requirements that must be met by the product under consideration.

The United States Government is undoubtedly the largest buyer that the world has ever known, and it is all-important that the quality and performance of all products purchased be a fair exchange for the money paid for them.

The system of federal specifications was established to standardize the grades and sizes of products purchased by more than one government department. They are prepared by 71 federal specification committees composed of representatives of the various government departments interested in the product in question.

When a product is used by only one department, that department prepares its own specification. For instance, there are many Navy Department specifications for products used only by the Navy. Similarly, the War Department prepares certain specifications for its own use.

The Conservation Division is represented on all federal specification committees, and takes part in the preparation of the specifications to see that true conservation of the scarce materials is practiced. We also review specifications prepared by the Army, Navy, and other government departments to see where conservation can be effected. Two methods of conservation are considered in this review:

(1) By issuing amendments limited to the war period specifying substitutes in place of critical materials needed in the war programme.

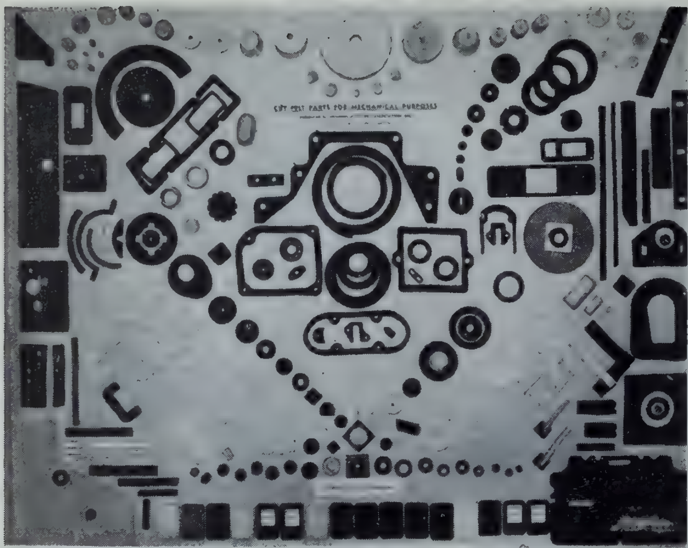
(2) By issuing emergency alternate federal specifications to indicate alternate materials for consideration.

In the design of modern equipment, advantage was taken of the superior properties provided by modern materials of construction, such as aluminum, copper, brass, alloy steels, rubber, and plastics, to provide greater durability and greater convenience, and in many cases, lower cost. With these materials so urgently needed for the war programme, it has been necessary to replace them by others, which, while not quite as satisfactory, will still do the job. Many government specifications, therefore, have been reviewed and changed to specify available materials in place of those that are short.

For instance, specifications for bronze valves were changed to call for cast iron, sometimes with bronze seats.

Specifications for large searchlights were changed from aluminum castings to sheet steel.

Specifications for fire-hose couplings were changed from



*O.W.I. Photo*

**A wool felt exhibit, illustrating "mechanical type" felt in some of the many forms in which it appears for use with machinery as a substitute for rubber parts.**

high-tin bronze to malleable iron for shore use, and low-grade bronze for shipboard use.

Specifications for wire-screen cloth were changed from commercial bronze to galvanized steel wire.

The federal specification covering tissue paper, a special Japanese tissue no longer available, was revised to describe a new type of American tissue.

Specifications for a number of rubber products have been issued as emergency alternate federal specifications to allow the use of reclaimed rubber.

Another step in conservation was realized through the establishment of National Emergency Steel Specifications. This work has the objective of standardizing and simplifying specification requirements for steel-mill products, simplifying dimensional requirements, and conserving critical ferro alloys by adjustments in composition. It is in the hands of technically qualified representatives of producers and consumers. J. G. Morrow of the office of the Canadian Steel Controller has actively participated in the work.

Fifteen schedules under W.P.B. Limitation Order L-211 have been issued to control the production and delivery of their respective products.

About 65 per cent of the steel-mill production is now covered by order schedules or agreements.

These schedules in general list two kinds of permissible specifications: (1) selected government specifications for government use only, (2) specifications for general use, either by government or private industry. In this latter category, selection of specifications is made from those issued by recognized national organizations, so that all private consumer specifications not in agreement with a listed specification are ruled out. This simplification of the specification field has been a very important contribution to increased production with existing facilities.

Schedule 15 to order L-211, covering hot-rolled carbon-steel bars, was issued after a tremendous amount of research by the carbon-steel-bar industry, and the Technical Advisory Committee on Carbon and Alloy Steel Bars. This schedule eliminated 40 per cent of the carbon-steel-bar sizes, or 5 per cent of the total tonnage.

Reports from the industry indicate an increase of 5 per cent to 15 per cent in the effective use of production facilities, accomplished through longer runs, less roll changes, smaller inventories, and less rejections.

### Simplification and Standardization

Simplification as we conceive it may be defined as the elimination of those items, types, sizes, and colors of products which do not serve the war effort; in fact, many of which do not serve any economical purpose. In most instances they are a positive hindrance to the flow of essential products to the armed services and to civilians.

To make simplification effective, a certain amount of standardization is usually necessary. But standardization, as interpreted by the Conservation Division of the War Production Board, is not the molding of styles and types of products into a fixed form. It is not a requirement that identical procedures or designs be followed which would destroy individuality.

Often it is only a single element in a product that must be standardized in order to achieve the necessary degree of simplification. Very seldom is the standardization of more than a few elements necessary.

Standardization as to quality is sometimes necessary in order that the buying public be protected in their purchases. The purpose of standards of quality or of performances is to assure the public of their getting their money's worth. It acts as a brake against the wasteful use of critical materials and facilities in the production of goods that will not serve the purpose for which they are intended or that will deteriorate rapidly. It is an insurance policy to the honourable producer against those who are less honourable.

Another important role played by standards is to provide for interchangeability, particularly in combat equipment. A large part of such equipment is being shipped to far distant lands. This equipment must be repaired quickly and on the field of battle. It is self-evident that the interchangeability of components of tanks, trucks, and jeeps will reduce the necessity for creating large floating stocks of repair parts. Much progress has already been made in the field of interchangeability. More is in prospect.

*Methods.* Recommendations regarding products that may be simplified or standardized come to the War Production Board in many different ways. A majority of the suggestions come from industry directly, through trade associations, or through the W.P.B. industry advisory committees. Others are received from the War and Navy Departments, the Office of Price Administration, and other agencies concerned with either procurement or regulatory actions.

The problem is normally referred to the industry division responsible for the product or material involved, with the Conservation Division consultant acting in an advisory capacity as a staff function. A rough check is made to determine the value of the recommendation from the standpoint of helping to win the war. If the saving in materials, manpower, or facilities will justify the action required, a detailed study and recommendation is made by one of the following:

(1) The industry division.

(2) A task committee of the industry advisory committee.

(3) National Bureau of Standards, or other government agency.

(4) An independent technical association.

The simplification or standardization programme is then presented to the W.P.B. industry advisory committee for comment. Necessary changes may be referred back to the responsible committee. The final programme is then incorporated in the draft of a limitation order which is circulated to the Army-Navy Munitions Board, and to all divisions of the War Production Board that would be affected by the action. Following suitable settlement of all objections, the order is issued and the programme is thereby made effective.

Examples of simplification and standardization programmes that have been developed are given in what follows.

### Examples of Simplification

(1) *Simplification in pipe fittings* made of cast iron, malleable iron, or brass, reduced types and sizes by 65 per cent and still fulfils 94 per cent of total demand and increased possible output by 25 per cent.

(2) *Simplification of universal portable electrical tools* reduced sizes and models by 25 per cent, reduced the number of types of drills from 338 to 200, and increased productive capacity 10 per cent.

(3) *Simplification of incandescent and fluorescent lamps* reduced types from 3,500 to 1,700, colors from 13 to 3,

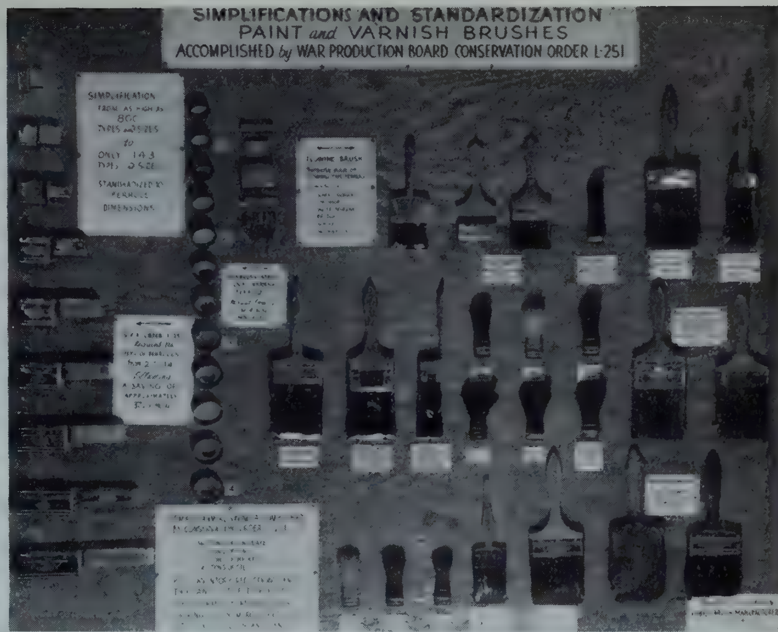



*Photo courtesy Conservation Division, W.P.B.*

**This photograph represents a combined simplification and standardization project that was developed and completed by the Conservation Division of War Production Board in collaboration with the task committee from the industry and the Textiles Division. The display board pictured also illustrates substitution—nylon for hogs bristle and horse hair.**

and voltages from 32 to 7. This schedule saves 35,000 lb. of solder, 2,000 lb. of tungsten, and releases 1,200,000 man-hours per year.

(4) *Simplification of types of men's work clothes* reduced the number of types of garments to 6, and makes savings in excess of 21,000,000 yards of cloth; sufficient for 7,000,000 new garments over a period of one year.

### Examples of Standardization

(1) *Standardization of air-cooled gas engines* was effected by reducing the number of basic models by 50 per cent, thus reducing the number of repair parts by 40 per cent. Each manufacturer standardized his models so as to use the same type and sizes of various parts in as many classes of engines as was possible. This is an example of company standardization.

(2) *Standardization of electrical indicating instruments* makes possible interchangeability in combat vehicles, through reduction in variety of sizes, from more than 90,000 to 2,100 sizes. Production is thereby substantially increased.

(3) *Standardization of radio parts* reduces the variety from an innumerable number of parts to 42, and insures a reasonable production for civilian supply.

### Co-ordinating Committees

One of the most effective means we have had of promoting conservation has been through the medium of co-ordinating committees. In September, 1942, an inter-agency Conservation Co-ordinating Committee was set up under the chairmanship of the Director of the Conservation Division. The committee was composed of the heads of the conservative activities of the Army, Navy, and Maritime Commission, and the chiefs of the three branches of the Conservation Division.

Later this committee was expanded to include representatives of the Office of Lend-Lease Administration, Treasury Procurement, Board of Economic Warfare, Aircraft Production Board, Great Britain, and Canada. Bi-weekly meetings have been held continuously, at which over-all conservation programmes have been discussed. Where a consensus of approval was indicated, the individual representatives have promoted the programmes within their own organizations and in this way made them particularly effective.

The fact that the Conservation Division has had for over a year representatives in London, attached to the Harriman Mission, has brought about a continuous flow of information between the two allied countries which has been still further implemented by the able assistance of H. K. Wilby, who is representative of conservation for Canada assigned to the Conservation Division, and F. A. M. Tabor, similarly representing Great Britain.

Within the past few weeks this close relationship and interchange has been expanded and formalized by the creation of the Combined Conservation Committee, under the sponsorship of the Combined Production and Resources Board and the Combined Raw Materials Board of the United States and the United Kingdom. The effectiveness of this method of interchange of information has already been demonstrated.

### Educational Programme

One of the most effective means of achieving conservation is an appeal to the patriotism and good sense of the individual through the radio and press, indicating definite ways and means by which savings can be accomplished. This method has been given increasing emphasis in the last few months, expedited by the unselfish co-operation of industrial, commercial, and engineering groups.

One such campaign, to conserve cutting tools, is now drawing to a close. This was planned and developed by the Conservation Division with the co-operation of the War Advertising Council. The campaign book, posters, and stickers that carry the slogan, "Tools are Weapons—Treat 'em Right," were distributed largely through the 2,500 members of the National Industrial Advertisers' Association, aided by the National Association of Manufacturers. We also had effective co-operation from 2,200 labor management committees through the War Production Drive and 825 mill supply houses. Through all these sources, plus the efforts of Mr. Wilby, the campaign has been brought to Canada also. Altogether this campaign is having a splendid reception.

Another current campaign, just getting under way, is on cordage. Manila fibre was entirely cut off when we lost the Philippines. The Rope Conservation Committee of the Cordage Institute is handling the campaign in co-operation with the War Advertising Council, under the direction of the Conservation Division. Though the chairman, Edwin G. Roos of Plymouth, Mass., was appointed only on August 14, already he has raised funds from industry, prepared, had approved by Washington, and published all the material for an unusually excellent and complete campaign which is gaining rapid headway. We like to think that this cordage campaign will serve as a pattern for similar future activities, blending the efforts of the Conservation Division and industry to assure rapid, effective action on vital conservation needs.

I have already indicated the changing complexion of our conservation problems. Recently we have reviewed the responsibilities of our division and developed a revised policy to meet these changed conditions. As certain materials become adequate, our programme, to some extent, must be put into reverse gear. Yet we conceive it as our duty to safeguard and guide the relaxation of controls as carefully as they were designed. In other words, we must recommend that surplus resources as they develop shall be channeled into those products which will assure the greatest benefits to the war effort.

And so conservation must be carried on until every Axis nation is subdued and the world can be assured of a lasting peace. And after peace there will be the problem of reconstruction for the war-torn countries, which will require conservation for their solution. And after peace and reconstruction there will remain the age-old problem of enough to feed, to clothe, and to shelter all mankind. CONSERVATION IS ETERNAL.

# WEAPON MAINTENANCE IN BATTLE

BRIGADIER GENERAL E. E. MacMORLAND

*Deputy Chief, Field Division for Planning and Head, Maintenance Branch, Ordnance Department, U.S. Army*

**A luncheon address delivered at the joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on September 30th, 1943**

The other Sunday afternoon I listened to a short-wave broadcast from the battlefields of Sicily that vividly brought home to me the essential elements of armament maintenance in battle.

The purpose of this battle-area broadcast was to impress upon the American people at home the importance of their continued donations of blood that the lives of gallant men wounded in battle might be saved.

Within the sound of guns and sometimes actually under fire, men of the Medical Corps were administering blood plasma to dangerously wounded soldiers. This plasma came from the blood bank to which all of us have contributed. The fact that it was your blood and my blood which was saving lives of Canadian, British, and American soldiers brought the subject of maintenance into the realm of human understanding more vividly, I believe, than could be possible if the telling of the story of maintenance revolved only around the inert elements of machinery, tools, and spare parts.

Of course this story about maintenance of life upon the battlefield concerned men who were possessed of the knowledge and the instruments with which to do their work, but most of all it concerned another element, the blood bank which was under their control and from which they could draw the revitalizing and life-prolonging plasma. It was not the men alone, or the instruments alone, or knowledge alone—or even the three combined—which prolonged life. It was that fourth and essential element, the plasma from the blood bank which the men with knowledge and possessing the proper instruments could draw that made possible the job of maintaining the human body on the battlefield.

## The Ordnance "Blood Bank"

I wish you would think about that for a moment because I have an analogy to draw. Think about those four great essentials for prolonging life—blood, instruments, men, and knowledge. Yet, however important were the men, instruments, and knowledge, the great essential element was the blood bank held at the necessary supply level determined by the requirements of the human organism.

In that I see the analogy to the United States Army Ordnance system of weapon maintenance in battle. Substitute spare parts for blood plasma, substitute tools for medical instruments, substitute damaged weapons for wounded soldiers, and add the trained men—really Ordnance doctors—with knowledge, and you have the elements for weapon maintenance in battle.

Eliminate control of the blood plasma from those capable of administering it and the soldier will die; eliminate control of spare parts from those upon whom weapon maintenance depends and the weapon does not go back into the firing line as quickly as it should and men also die.

There is quite a parallel between how the United States Army regards its men and its weapons starting with the first echelon of preventive health measures and preventive maintenance of weapons up through each of the higher echelons. In each echelon Ordnance regards, as its prime responsibility above everything else, the maintenance of weapons so the men may fight.

The subject which I was given to discuss was "Weapon Maintenance in Battle." There is relatively little weapon maintenance in actual battle. Of course there is some, but the major maintenance is carried on in the combat zone—that fluid area immediately behind the battle line into which the United States Army disposes Ordnance maintenance and supply units under single control in the service of the combat troops. More accurately my subject should be redefined as "Weapon Maintenance in the Combat Zone."

In this mechanized war we should not think toc narrowly about weapons as being only guns. The motor vehicle which transports troops and supplies and the prime mover that hauls the guns is as much a weapon in our modern army as is the gun itself.

## Motor Vehicles Increase Maintenance Problem

In all armies and in all wars the care and maintenance of guns has been the responsibility of Ordnance officers. It is only in this war that the motor vehicle with its diversity of mechanical problems, its multiplicity of spare parts, and the interchangeability of parts between different makes of vehicles, has produced its new problems of maintenance. True, guns have become more complex, fire-control instruments are more intricate and delicate, but the spare-parts and maintenance problems for guns have not been as serious as the maintenance problems for automotive equipment. It is the conversion of the peacetime motor vehicle into a weapon of war, whether it be truck, tank, or half-track, that has really made the maintenance problem in all armies a major headache.

The United States Army recognized early in this war that the motor-vehicle problem had to be solved if we were going to fight successfully. Perhaps we did this as early as we did because we are an automobile-minded people—a nation where once it was promised there would be two cars in every garage, and we came pretty near fulfilling that promise.

## How Supply and Maintenance Troops are Echeloned

An understanding of how the Ordnance supply and maintenance troops are echeloned in theatres of operation is important. The plan grows directly out of combat necessity. The soldier at the firing line has to be a good marksman; he need not necessarily be an expert mechanic and he will have little time for repairs. In the combat zone, directly to the rear, an expert mechanic is needed, but he need not necessarily be an expert marksman. Between these two will be several degrees of ability.

The prime objective of the men in the front line is to advance, not to repair. In order to get around quickly they must have a minimum of impedimenta. They are interested in guns that will shoot and vehicles that will transport. Here they apply the Ordnance lessons of preventive maintenance. When either gun or vehicle fails they are intensely interested in getting it fixed, but by the time it breaks down, it is sometimes too big a job to fix on the spot.

An individual tank in the firing line has its tools along with it. Where there is a company of tanks, perhaps eighteen of them, the company has a pool of spare parts, tools, and equipment and good mechanics. Farther back, servicing more tanks, are battalions with larger pools of spare parts and more specialized mechanics. Still farther to the rear is the Division, which has an Ordnance Company, which is as mobile as the Division. Being mobile they must be limited in equipment, but they are depended on to make unit replacements from their own spare parts supply as far as possible. Then behind the Divisions are the Corps Ordnance troops which are more or less mobile. Still farther back are the Army Ordnance troops, semi-mobile, which can be moved, but movement must be done by shuttle. On to the rear are the Ordnance bases, veritable arsenals. Here is the big reservoir of spare parts, and great specialization is possible, both of men and tools.

These echelons of assigned responsibilities, based upon parts, equipment, and allowable time, (which in turn depends on mobility), tend to merge somewhat in practice, depending on the situation. The front echelons will undertake heavier jobs when they are idle than when they are in the midst of battle, but the echelon system always acts as a cushion.

The plan calls for the combat troops to use Ordnance maintenance and supply personnel to the maximum advantage. About five per cent of the total military strength of the Army is allowed for accomplishment of Ordnance supply and maintenance in the field, so every Ordnance man and his tools and equipment, must, and does, operate in the most efficient manner to serve the greatest possible number of troops from his own controlled supply of parts.

To accomplish this the United States Army pools Ordnance field personnel into as large organizations as practicable, considering the mission of the troops being served. This pooling has important advantages. The bigger the pool the more it is possible to specialize the individuals in it. Furthermore, spare parts and equipment are saved in pools instead of being frittered away.

A typical Ordnance company is a composite organization consisting of several functional sections and is able to handle all types of Ordnance repair. It also has administrative and supply sections. These supply sections, which are the blood bank of Ordnance maintenance, can furnish the needs of the troops directly, without requiring the maintenance sections either to get in contact with higher echelons or to call upon another service for their supply. Ordnance would no more consider the separation of supply of spare parts for replacements from its maintenance company than the medical man would consider separating his blood bank from his hospital.

You will recognize that our Ordnance impetus of maintenance is from the front to the rear and the impetus of supply from the rear to the front. The heavier and less mobile supplies, in greater quantity, are stocked toward the rear where the heavier repairs are made. Nowhere along the line is the blood bank of supplies separated from the men who have the tools and the know-how. Plans of organization change under the stress of combat experience, but nothing has developed from the experience of battle that has justified the separation of control of spare-parts supply from the maintenance activities.

There are two problems in maintenance, one if the troops are advancing and the other if they are retiring. If forces are advancing, combat commanders press every advantage, consolidate new positions, advance, and leave upon the field such equipment as may require repair. If, on the other hand, the forces have met with reverses and are being pushed back, the attempt at repair or maintenance of weapons during an evacuation under pressure would tend only to impede the movement.

### An Example from the Battle of Tunisia

The latter was particularly true in the second phase of the Battle of Tunisia in which the Second Corps of United States troops met its first reverse in January of this year. An enemy force of material strength in armor, infantry, and artillery had captured Faid about fifty miles northeast of Gafsa at which point the Second Corps was attempting to push through to a junction with the British Eighth Army advancing up the coast. We were forced to evacuate Gafsa after the enemy attacked through Faid Pass, took Sidi-Bon-Zid, Sbeitla, and Feriana, and later overran the Kasserine Pass.

During all this time, the Ordnance depot supply companies and the maintenance companies were never separated by any great distance, although they were unable to do any material amount of maintenance work.

The situation was stabilized when a British Armored Brigade arrived and joined one of the U.S. Infantry Divisions and our artillery and shot it out with the enemy's armored spearhead in a decisive action. The recession of the enemy through Kaserine Pass began.

Our troops were not in a position to engage in intensive pursuit operations. One of our armored divisions and one infantry division faced major problems of re-equipment and reorganization. Battle losses included a considerable number of major items of Ordnance equipment. Ordnance Service now faced a supply and maintenance crisis of staggering proportions in the combat zone rather than in the battle zone. More than 1,300 major items had been lost, not to say anything of the damage to other equipment. To overcome this condition the movement in the combat zone involved keeping the supply units with their depot stocks of spare parts in constant contact with the maintenance units. They must not be separated. Also, supply contact with the zone of communications is essential with central control maintaining consolidated stock records. This is a firm link between men with the know-how and the tools and the depot companies with a blood bank of parts replenished from advance bases.

The engagement of which I have spoken was a retreating operation with a problem of maintenance quite different from those which were to come later when the British and Americans drove the enemy into Cap Bon and final annihilation. The reason I mention this particular situation is because it lends emphasis to the co-ordination of movement of supply and maintenance companies for what obviously was to come. If this phase of the battle had not ended by requiring a regrouping of the forces but on the other hand had turned into a continued action with our engaging in pursuit operations through Kasserine Pass, it would have been even more vital to keep supply and maintenance together.

The importance of the control of the blood bank of spare parts between phases of an engagement must not be overlooked. The Ordnance supply and maintenance units not only had the job of rehabilitating the Second Corps' damaged equipment but it had to draw upon its resources for whatever the next phase of the battle might be.

It is hardly necessary to detail the problem involved in the refitting of the Second Corps, but it is important to bring out how essential it is that the control of spare parts be under a single jurisdiction so that the correct balance will be maintained between the refitting requirements and the new supply problem for the next phase. With divided control over supplies the inevitable conflict arises as to which is the more important, to draw upon the parts for maintenance or to draw upon them for the supply of the forces in the next phase. It appears obvious that the rehabilitation of damaged equipment is the more important because another phase of battle is impossible unless the equipment is in shape to enter the engagement. However, with divided control, it is frequently the case that the supply officer thinks first of the stocks for the next engagement, leaving the maintenance crews who have to requisition their spare parts to wait until the supply job is completed.

### Procurement of Spare Parts

One important factor in the Ordnance supply-maintenance combination I have purposely left to the last. By so doing I hope it will get the consideration which it deserves. It is the subject of procurement of spare parts.

Under our Ordnance system spare-parts procurement is based upon requirements determined by Ordnance maintenance records. We believe and practice that the men who do the maintaining are best qualified to determine the supply levels and therefore should establish the procurement factors. It is not, in our opinion, a sound practice to rely upon an authority separated from maintenance either for procurement or distribution. (*Continued on page 624*)

# EVOLUTION OF A 1300-TON PRESS*

R. H. FERGUSON

*Mechanical Engineer, Vancouver Machinery Depot and Vancouver Iron Works Limited, Vancouver, B.C.*

**SUMMARY—At a Vancouver engineering works a 1,300-ton press was urgently needed to bend thick boiler plates. The author tells how the press was made up from scrap material and existing equipment available. Arc welding was employed with marked advantage in this work.**

At the outbreak of the present war our firm possessed a horizontal hydraulic ram testing machine which had been built in 1938 for testing all welded steel pipe fabricated in the shop.

### Construction of the 1000-ton Press

It became apparent that there would be no steel available for large pipe making, and as our boiler shop had obtained a contract for the fabrication of Yarrow type water tube boilers, it was decided to use the 41 in. diameter hydraulic ram, with its cast steel strongbacks, for a vertical ram 1000-ton press. This press was necessary to form the 1½ in. shell plates of the lower drums of the boilers, because our large rolls were not quite strong enough to roll a plate of almost 9 ft. in length to the required small size of 23 in. inside diameter.

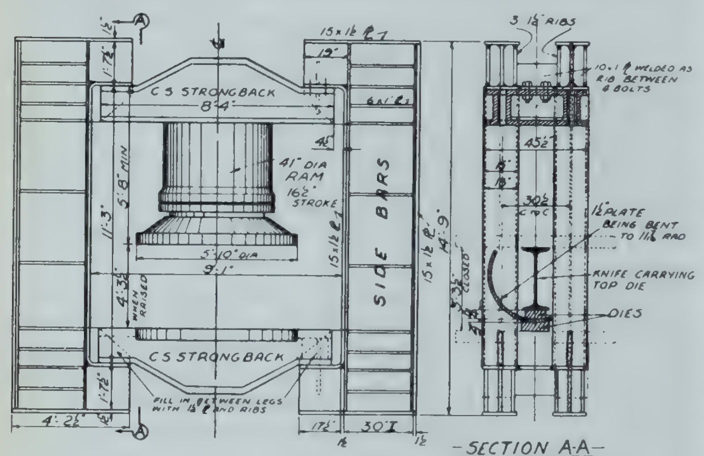



**Fig. 1—General arrangement of original 1,000-ton press showing welded side bars.**

We were already equipped with a 380-ton all welded plate end breaking press, which incidentally had been made in our own shop, and a 200-ton 3-ram flanging press; but these were unsuitable for the job because the drums had to be very true to radius and straight. They could have been formed to the required half circles in the flanging press sectionally, but satisfactory results could only have been attained by slow and careful work. It was decided that pressing hot in a single stroke was impracticable in the flanging press without considerable die expense, and revision of our heating and handling equipment.

Fortunately, the testing machine had been designed with a stroke long enough, and strongbacks strong enough for it to be used for an all purpose press. It was decided to connect the cylinder to the 1500 lb. per sq. in. accumulator system, for which pressure it had been designed, although when used as a testing machine it had been actuated by a reciprocating air-hydraulic pump.

The pressure from the accumulator is definite and has a fixed maximum, and naturally the ram is not fast acting, so the forces acting on the structure are definite and never cause shock. These considerations allowed of a low factor of safety compared to ordinary heavy duty machinery driven by electric motors.

The basic requirement was a press of 1000-ton pressure spread over a 9 ft. long narrow top die, with a table and knife strong enough for a load of 1000 tons concentrated over about 2 ft., which would allow for possible misuse. The table also had to be at a comfortable operating level, and the structure had to be such that it could sit on a plank floor and be moved to new locations on that floor as other special set-ups might require.

The 9 ft. gap made necessary the step type side bars shown in Fig. 1, since the cast steel strongbacks of the testing machine were only 8 ft. 4 in. long. A space between the side bars was necessary for the operators to get at the plate being bent for manipulation and template testing.

At that time there happened to be several pieces of used 30 in.-173 lb. I beam in the shop, which had been salvaged for some structural job. They had a section modulus of 535, an area of 53 sq. in. and a flange width of 13 in. They were too weak to stand a combined bending moment and tension resulting from the 500-ton load, 27½ in. from the centre of the I beam, so it was decided to strengthen them by welding 1½ by 15 in. plates to both flanges, as shown in Fig. 1. The tensile fibre stress then amounts to 16,500 lb. per sq. in. and the compressive stress to 6,500 lb. per sq. in.

The steps at the top and bottom of the side bars had to be kept down to 19½ in. in depth in order to bring the table down to the proper operating level; also the table had to sit on this step because the castings were not strong enough to carry across to the side bars. Moreover, it was desirable to have the side bars bolted to these strongbacks in order to facilitate future alterations if required.

The strength of the step designed as shown depends largely on the welding of three 1½ in. plate ribs to the face of the I beam flange, and this was done by first welding the centre rib in place on both sides and then bevelling the side ribs almost full thickness and welding from the outside only. The concentration of the stress at the bend of the inside flange plate made it imperative that a good heavy weld be made in the natural V formed by the bend and along the edges of the I beam flange. In fact a stress of 14,000 lb. per sq. in. was allowed for this weld metal alone.

There never has been a sign of deformation in these steps under frequent full load conditions, over a period of one year's operation. We did have some trouble with weeping of the weld joining the cast steel cylinder to the upper strongback, but this was caused by porosity and was corrected by caulking of the cast steel. A steel plate cylinder would not have given this trouble.

The knife carrying the top die was made from a piece of the 30 in. I beam, with reinforcements similar to those of the longer knife (used later), shown in Fig. 2. At first it did not have the top and bottom plates, or the additional web plates, and it telescoped ½ in. for a distance of about 15 in. when the full 1000-ton pressure was mistakenly put on a short piece of plate. It was repaired by filling with weld and then the strengtheners were added.

The welded steel side bars cost about $500 each. Steel castings would have cost $800 each, because of extra weight required and patterns. This resulted in a saving of $1200 for the four side bars. The cast steel side bars would probably have needed machining on the step faces (a very difficult job for our machine shop), whereas the welded steps were true enough not to require machining. The straight edges of the 1½ in. flange plates are used as guides for the knife, whereas the cast steel bars would have had to be machined or other guides bolted on. These savings are in addition to the $1,200.

The bottom cast steel strongback had to be filled in between the legs, in order to support the bottom die at the

* This paper was awarded a prize in the James F. Lincoln Arc Welding Foundation contest for 1942.

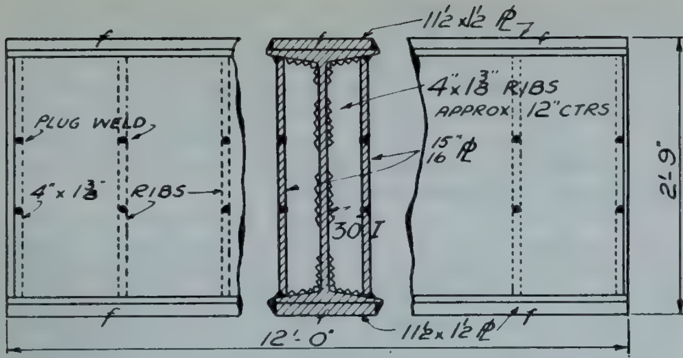



**Fig. 2—Details of knife carrying top die.**

ends. This was easily done by welding in a plate with ribs to carry the load to the webs. These welds are occasionally very highly stressed because of concentrated loads necessary at times to take the longitudinal curve out of some of the plates, caused by a slight variation in hardness. However, they have stood up without apparent deformation, and we are secure in the knowledge that additional strengthening and repairs can easily be made if required. When it is realized that 1½ in. plates are bended cold, to within 1½ in. of the edge, and that the plates and ribs supporting the bottom die are of this same plate thickness, some idea of the stresses induced in these welds by transverse deflection of the die can be pictured without delving into the mathematics of the case. At times shim strips are inserted in the dies in short lengths so as to give proper curvature, and the stress concentrations are so severe as to imbed these strips into the dies.

On completion of the contract for these boilers, the knife strongback was turned at right angles and a V block and sharp bending knife fastened to the table and knife strongback respectively. Long plates for ship construction are now being bent in 6 ft. bites, and the press has been found quite handy for this work.

### Conversion into a 1300-ton Press

Several months ago the firm was awarded a contract to build a number of larger Yarrow type boilers of similar construction to those previously made. It is necessary to bend the same thickness of plate, 1½ in., to the same radius, but the drums are now almost 12 ft. long, and are of all welded construction, instead of riveted, as in the previous boilers.

By taking tests of the pressure required for bending the previous plates, it was found that 1300 tons would be needed to bend these new drum plates, and also the gap would have to be increased to 12 ft. Some 1⅜ in. and 15/16 in. plate was available from a previous contract, and fortunately there was enough to these miscellaneous sized plates to make a welded press, as shown in Fig. 3.

Steel castings were out of the question because of the size and slow delivery due to wartime glutting of local foundries, although we would have preferred to let this work out at increased cost, our own shops being so full of work. It was also impracticable to order more desirable plate sizes from the mills because of priorities and delay.

For these reasons some unusual things were done, as a glance at the drawings will show, but they could only be explained by a detailed study of the material and cutting lists. Suffice it to say, the parts were cut out and our stock of spare plates is gone.

It was thus decided to make new welded strongbacks, to weld the old cast steel 1000-ton cylinder to the new top strongback, and to bring the total pressure to 1300 tons minimum by adding two independent 190-ton presses, one to each side. The old welded steel side bars are used to carry their share of the load, which is 500 tons each. The new 190-ton presses each push on one end of a new 12 ft. knife strongback, and are located between the original side bars, which are separated enough by the new design to allow of this being done. They have their own welded side bars of 1½ in. plate which carry their load independently of the main side bars. The bottom steps of the auxiliary side bars shove against the new bottom strongback, but each unit is so bolted in place that there is no difficulty in removing the auxiliary presses if so desired. They were built, as shown on Fig. 2, with 18 in. clear between their side plates, so that the operations will have room for manipulation.

The new main strongbacks (see Fig. 4) are designed for a concentrated load of 1000 tons in the middle of the 11 ft. span so that the press can be used for bending operations, using the knife lying across the strongback table. To obtain the required strength in the lower strongback for bending operations lengthwise on the table requires careful welding of the ribs to the two middle webs, since the span is considerable, being 17 in., and the bottom die cannot practically be made heavy enough to carry the load across by itself. Consideration of possible future misuse also entered into the calculations. These welds were made in the shop; the procedure was to weld all the ribs in place against the straight plate, except the end ribs which were welded in from the outside after the curved plate has been welded in.

The welding of this curved plate to the webs was the most difficult part, and it was necessary to so design the structure that the welders could make a decent weld in their confined quarters, and get in and out without too much trouble. We could not get any volunteers to weld themselves inside as a contribution to the war effort, and were forced to design the ends with this in mind, and the fact that the ribs had to be as shallow as possible. Alternative methods of welding from the outside suggested themselves, but were found impracticable with the sizes of material available, and in order to get the required depth for strength. The two ribs shown at the centre of the bottom strongback were put there so that future additions to the width of the table can be made as a cantilever to react through the ribs against the webs.

The material for the alteration to the press, other than the auxiliary cylinders and pull back cylinders, weighs 60,000 lb. The total cost on completion will be about $4,500 net. If these parts that are being welded could have been made in cast steel, the weight would have been

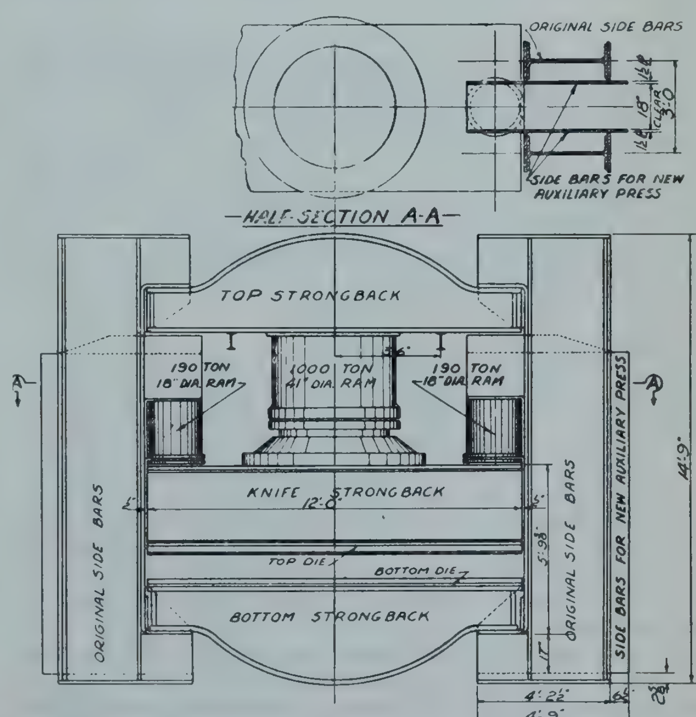



**Fig. 3—General arrangement of 1,300-ton press after conversion, showing auxiliary presses.**

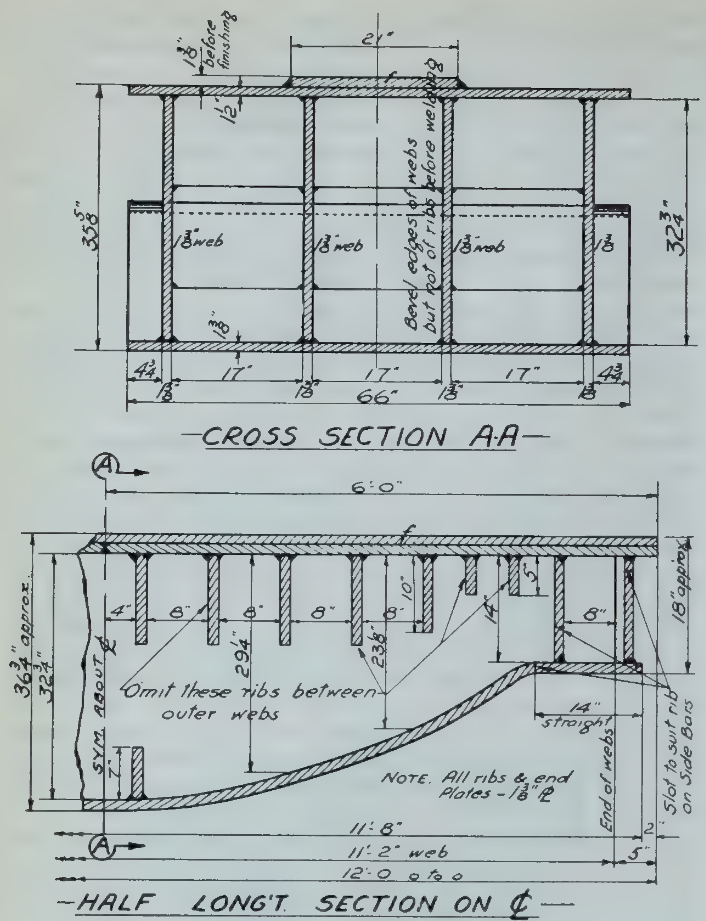



**Fig. 4—Details of welded lower strongback for 1,300-ton press.**

about 75,000 lb., and the net cost $7,500, without allowing for any machining or possible straightening. This results in a net saving of $3,000.

The cast steel strongbacks left from the original press can now be used for other work, if desired, by building a welded steel cylinder and piston to complete them as another press.

## Conclusion

The following is a summary of essential points with reference to the use of welding instead of other methods of construction for this class of work:

1. Welding is generally cheaper, even in this locality where heavy castings can be purchased in ordinary times for 7½c per lb.; whereas plate and structural shapes purchased locally cost 5c or more per lb., to which must be added the costs of transport and fabrication.

2. Welding permits a job to be rushed through in our own shops without being dependent on outside patternmakers and foundries for delivery.

3. The variety of work in our shop makes it necessary to make frequent alterations to our limited equipment. Structures and machines built up from steel plates and shapes lend themselves admirably to alterations, because the surfaces are flat and square. All parts are accessible for repair or alteration, since they can always be cut out the way they were assembled. For instance we could do nothing in the way of incorporating the cast steel strongbacks into our new strongbacks, except at considerable cost, but it would be possible to alter the new strongbacks with far greater ease.

4. The fear of blow holes and spongy metal is eliminated by using rolled steel plates and shapes. The warping of welded steel parts is, of course, a recognized hazard which can be controlled or provided for. In our experience, castings of economical thin sections give just as much trouble, but with the added grief of not being allowed for. Castings are, of course, often lumpy or have shrinkage hollows and cracks. Occasionally we are left holding the bag when a large casting is a failure, and we are tied up for delivery. Local cast iron has been of such variable quality in large castings that it is practically ruled out as far as its use by our firm is concerned, where closely calculated strength is required with ordinary factors of safety. This state of affairs is now being remedied somewhat.

5. In the rush of our alterations and variety of other work, detailed design is sometimes not possible, but with welded fabrication the job can be watched as it builds up, and defects not noticed in the design can be cared for easily. In some cases it is difficult to get a correct idea of the finished castings from a survey of the pattern and core boxes. Desirable alterations are impossible when the metal is cast. The shifting of cores and other accidents may escape unnoticed.

6. Finally, in the structures described in this article, arc welding was used because we have found from experience that arc welding, done by competent welders, stands up to all that is claimed by reputable manufacturers of arc welding machinery. Welding in this locality has had a long uphill fight against the inertia of custom, severe competition in price from other forms of fabrication, and the relatively high cost of steel plates and shapes. Tests demanded by inspectors of welding now being used in our shop in the fabrication of combustion chambers and the joining of furnaces to tube sheets in Scotch marine boilers have proved that consistent good quality of arc welds is easily obtainable. In the next few months further justification of the use of arc welding will be shown, when we have installed the X-ray equipment necessary for the examination of the welds in the drums for the large Yarrow type boilers.

7. Welding makes it possible to utilise odd shapes and sizes of material, or salvaged material, for the manufacture of equipment such as these presses. This makes it feasible to develop machine tools which under ordinary conditions could not be hoped for because of the cost. For instance, a press of the capacity we required would have cost about $30,000 landed here, if it could have been bought. This 1300-ton press will only cost us about $6,000 for the work now being done, and will most likely be far more adaptable to future changes. Press equipment such as has been described is invaluable for bending plates and shapes for use in arc welded construction, and the use of arc welded construction makes it possible for small shops to build this equipment.

## WEAPON MAINTENANCE IN BATTLE

*(Continued from page 621)*

The end result of all Ordnance procedure is maintenance of all weapons in a condition suitable to the job for which they were designed. To accomplish this end result it is well recognized that there must be no deviation of the factors of parts control anywhere along the line.

The main job of maintenance revolves around the "bits and pieces" rather than the unit replacements. There are more piston rings needing replacement that there are transfer cases; more distributor points than batteries needing attention; more gaskets than engine blocks; and so on through the whole list. It is these bits and pieces which must be procured and distributed in proportion to their usage as determined by the consumer who is the maintenance man.

These bits and pieces represent 85 per cent of the volume of spare parts and only 15 per cent of the dollar value; while the major units represent only 15 per cent of the volume and 85 per cent of the dollar value.

It is the record of maintenance working in close association with supply under the direction of a single Ordnance organization that is making possible the successful job which the United States Army is doing not only in keeping its own vehicles rolling and its guns shooting but sometimes those of the United Nations as well.

# THE ENGINEER AS PLANNER

RALPH E. FLANDERS

*Chairman, Committee on Research of Committee for Economic Development. President, Jones and Lamson Machine Company, Springfield, Vt.*

**An address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on October 2nd, 1943**

Some ten years or so ago it chanced that I appeared at a round-table discussion at which another participant was one of the leading economists of the country. Before the meeting, we were being entertained at dinner, and in the conversation around the board, my economist friend remarked that the worst thing that could happen to the country was to put its economy in the hands of engineers.

This seemed at the moment like an uncalled-for criticism of the abilities and usefulness of our profession, and as can be imagined, I was up in arms at once.

When, however, he began to expand his point of view, it began to appear as true and important. If may serve a good purpose to review that point of view even to-day, after the lapse of a decade of turbulent history.

It would be disastrous to apply engineering procedures directly to the control of society. It would be disastrous because it is completely unworkable to treat human beings, whether individually or in the mass, as though they were machines subject to simple, invariable, mechanical laws which can be discovered, organized, and successfully applied. However much we may discover about the causes and the nature of human actions, the control of them still remains an art rather than a science, and it certainly will remain an art rather than a science so long as any of us who are here present live and have the faculties intelligently to observe.

How many of us remember "Technocracy ?" It was the spectacular economic fallacy of that day. It was the attempt of a poorly informed, intellectually confused engineer to reduce social problems to engineering terms. It struck terror into the hearts of some groups and aroused unwarranted hopes in the hearts of others. More seriously, the possibilities of the direct use of engineering principles to our current problems fascinated some engineers of real ability. This was the serious and the dangerous thing.

How dangerous it was we can see clearly in retrospect when we review the history of Germany in the period between the two wars. In that nation, every resource of science, every resource of engineering, was bent toward the development and carrying out of a social end. That end was the building up of Germany into an irresistible world power. Pure science for its own sake disappeared. Engineering as applied to its normal, limited objective of undertakings useful to human progress was caught in the net of national control and made abjectly subservient to the nation's paranoiac objective.

Not merely was science and engineering thus enslaved, but cultural studies and the humanities as a whole were in large part abolished, while the remainder was likewise channeled into the service of the national objective. The great search for truth was abandoned. German scholarship and professional integrity were alike prostituted to an unworthy purpose.

In a great address made a year ago in New York, Dr. Hopkins, president of Dartmouth, described this situation and made an eloquent plea for the preservation of the humanities and for their independent cultivation outside of the control of government or of organized majorities. He performed thereby a great service in putting his finger on one of the greatest dangers with which we are faced—that of the political supremacy of technicians in a centralized government. It should be a matter of great concern to us in the engineering profession that we resist the fatal fascination which we are all liable to feel for the direct application of engineering principles to social problems. The danger having thus been pointed out, let us proceed to consider just where our contribution lies and just how we can best make it.

We are faced with the necessity for a considerable measure of planning. This necessity will be made still more clear by the difficulty of shifting our operations from the first total war in which we have ever been engaged over to a peacetime economy in which, again for the first time, we meet the opportunity of a high level of employment, production, and human satisfaction.

The problem divides itself into two parts. The first is the determination of what is economically, industrially, and scientifically possible. The second is the question of what is politically possible.

We must never forget that this second question—what is politically possible—is the ruling factor. Ultimately, politics in the broad sense determines what we can do and what is going to happen to us. Your speaker does not have the wisdom or experience to make authoritative pronouncements on this score. All of us, as citizens, are a part of the influences which make reasonable procedures possible or impossible. As specialists in our profession, we have simply to realize that our usefulness is limited by the political conditions in which we participate as citizens. Let us turn at once, therefore, to some reflections on that area of our problem which is more nearly a science than it is an art.

The subject of economics occupies the middle ground between the two. It is classified as a social science. That classification in itself indicates its position midway. None of the social sciences is so clear in its relations of cause and effect, or has such clearly definable causes, that effects and results can confidently be predicted in advance.

Economics itself is a study of human behaviour. It is based first and earliest on generalizations derived from observation, more lately and more specifically on statistical studies of human behaviour under conditions in which the causes were isolated, so far as isolation is possible.

Laboratory procedure is impossible. Experimentation by varying one factor at a time and observing its influence unaffected by other factors is unattainable. The laboratory is the nation as a whole and the world as a whole.The variables are numerous and complex, and they do vary beyond our control.

If this is a mechanism, its nearest approach in physical terms is to celestial mechanisms, in which there are no fixed points and only kinetic constraints on the movement of the elements. The disturbance of the movement of the smallest and most remote body affects the movement of every part.

We have discovered the complex nature of these relationships first in our endeavours in the United States to control recovery and secondly in the necessary attempt to control and direct our economy to the waging of an all-out war. Every time some apparently simple and obvious action has been adopted—for instance, in price or production control—its effects have spread throughout the whole structure and have resulted in disturbances which were unexpected, difficult of correction, and sometimes almost disastrous.

A current example is the difficulties which have been developed by the prices which have been set on such simple, earthy products as corn and hogs. The price of corn has been so set that it is more profitable to feed it to hogs than, for instance, to dairy cattle and poultry. In consequence, it has been so fed on an enormous scale. At the same time, the selling prices on hogs have still been such that, in connection with frozen prices on pork products, all of the smaller meat-packing houses have been thrown out of production, leaving the industry in the hands of the big packing houses.

As a result, the States are threatened with a cutting down of the dairy industry and a shortage in our milk supply, at a time when the requirements for fluid milk domestically and for powdered milk and cheese for export are of extreme importance. Poultry products, particularly powdered egg, again essential to our allies in the conduct of the war, are likewise destined to be curtailed. The complexity of disturbances reaches into transportation, into the cost-of-living index and wages, and unfavourably affects the whole task of restraining the inflation spiral with its destructive effect on savings and our future well-being.

The most hopeful thing that has come out of our wartime administration was the remark made by a man in high place in our war administration a few months ago, to the effect that he never realized what useful things the profit motive and the price system were until he had been charged with the responsibility for controlling our economy by direct action.

Society is not a mechanism. It is an organism. Let us never forget this. But where, in this case, shall we find the sphere for social action of the engineer?

In the first place, the whole situation demands the engineering approach. It is the role of the engineer to apply the discoveries of pure science to the practical attainment of human desires. He stands and works with one foot in each of these two worlds.

Our society has long needed this point of view and this approach. We have had the scientists working as scientists in the expansion of human knowledge. We have long had human problems crying for solution. We are now engaged in the task of building up a technique of social engineering which shall bridge that gap in the social field as the engineer has bridged it in the physical field.

A moment ago, I spoke of society as an organism rather than as a mechanism. Perhaps this gives the clue to the procedure. Our most useful parallel may be between the social organism and the human organism, rather than between the social organism and the machine.

The endeavour to maintain the health of the human body has gone through a number of phases. Its first phase was the pre-scientific, in which untenable physiological theories such as that of bodily "humours" in the theoretical field and the deadlines of "night air" in the popular field held sway. Animistic remedies and safeguards of fetishism were invoked.

Then scientists began to learn something about the human body and, at the same time, began to note the effect of various drugs, and we had a period in which symptoms and medication were, I suppose, the foundation of medical science. A large measure of usefulness still remains in this type of applied knowledge. Later, developments came in surgery, and for a time it seemed to the layman that the remedy offered for an unusually large percentage of human ills was to "cut it out." The specialist in cutting out this or that organism was in high repute—and he still remains so when his specialty is considered against the whole background of knowledge of human health.

The real triumph, however, in prolonging the healthful life of the race has been based on the science of hygiene. Better living conditions so far as they concern fresh air, exercise, and well balanced diet have worked wonders. The whole study of vitamins and their natural or artificial provision in the human diet has worked wonders. The elimination of disease germs by proper sewerage disposal, food handling and refrigeration, and all the other improvements have added their quota to the sum total of human health and happiness.

As we look over the actual processes by which these undeniable and statistically measurable results have been reached, I am sure we will be convinced that, in a very large measure, the job itself has been done by engineers, while the specific jobs were set by the specialists in medicine and hygiene.

It will be useful to remember that the scientific study of the human body during all this period has not been in the direction of making its actions more simply comprehensible. Every new bit of knowledge has added immeasurably to the mystery of its complication and the mystery of its elaborate and microscopically confined chemical activity. The more complicated, the more incomprehensible we have found the human body to be, the greater success we have attained in ministering to its health and well-being.

May I refer briefly to one endeavour being made at the present time to determine and apply effective principles of hygiene to the support of the health of our social body.

Many of you have heard of the Committee for Economic Development. It is an undertaking on the part of businessmen, first to assure that they play their part as businessmen in the post-war world, to make their contribution in their individual companies, in their communities, and in their industries in the maintenance of a high level of profitable productive employment. They can see that if this is not done, the body of our society, for inescapable political reasons, will suffer a very severe sickness indeed, so great that the well-being of every citizen will be damaged or destroyed.

In this detailed planning for individual companies, for communities, and for whole industries, the engineers concerned have a large part to play. They are concerned with the development of new products. They are concerned with the development of their communities and the public works which are needed therein and which can furnish a reservoir of employment for times when employment is falling off. They are concerned with the broader appraisal of the future of the industries with which they are connected—whether or not new products and new methods are tending to render them obsolete or whether new opportunities are arising out of new scientific developments which should lead to expansion and redirection.

The second part of "C.E.D.," as it is familiarly known, deals with these questions of social hygiene which have just been mentioned. This has been defined as the "climate" in which business lives and performs its functions. This climate may become unfavourable so that business cannot perform its social functions; it may become deadly so that those functions are practically impossible and chaos and anarchy result. We are committed to the belief that effective action lies in over-all controls rather than in the multitude of complicated and impossible specific controls that have seemed so necessary in total warfare, and which the O.P.A. official previously mentioned found so difficult of satisfactory application.

Your speaker is chairman of the Research Committee of C.E.D., which has set itself the task of developing the hygienic principles which, if applied to our society, will enable business to perform its socially useful function. It performs the engineering office of making application of the studies undertaken by a staff of technical men and an advisory body of social scientists, to the practical problems which it has posed. This is the true engineering function applied to social problems. In my belief, it is the most hopeful project now under way in the United States for reaching a practical solution of the immensely complicated problem which will face us as the war draws to a close.

Our earnest attention to this group of problems is more than a domestic necessity for the United States or for Canada or for any other nation. With the close of the war, we will be faced with an international crisis which the social conditions of the individual countries will affect and by which they will be affected.

It is becoming, I believe, increasingly clear that the determining factor in the post-war world lies with the relations between the United States and Great Britain on the one hand and Russia on the other, with a corresponding effect on the future of China. It is not necessary to go into a detailed discussion of this matter here, except to say that it overrides and overwhelms all planning of ideal world states, international police forces, world banks, and all of the other paper organizations on which we are so busily engaged.

We probably need not fear Russia from the standpoint of military conquest. We may confidently expect that after the terrific effort she has made in this war she will be concerned to an almost exclusive extent with the rebuilding of her industries and the reviving of her programme for raising the standard of living among her own people. This is not the area in which she will pose her problem to the western world.

The problem she will pose will be a political one. We must not be surprised to find that she will come out of the war with her political influence dominant in the Baltic states, in Poland, and in the Danube basin. We must not be surprised if it is dominant in the Balkans. We must not be surprised if the only popular government which can be formed in Germany will be one which accepts Russian political opinions. It is even within the bounds of possibility that the same may be true of France and Italy. It is finally probable that the British Empire and the United States together will be unable to prevent this development.

To sum the matter up, we must raise questions as to whether we have any right, under the terms of the Atlantic Charter, to endeavour to prevent forcibly (and that would be the only way) this political development, each nation having the right to choose its own form of government. Not merely would we lack the right to interfere, but we would lack the right to question the wisdom of these countries in coming to such a conclusion, in view of the strength of protection which Russia has proved that she can offer and the weakness of the insurance on which the Western powers were able to make good when the need for cashing in on that insurance arrived.

This is the international post-war problem, and its repercussions will not terminate at the boundaries of those nations which tie up their fortunes with Russia. They will be felt throughout the body politic of the British Empire, as they are being felt to-day. They will be felt throughout the masses of our own citizens in the United States.

It can be demonstrated by historic analysis and by valid reasoning therefrom that these political principles from Eastern Europe never have and, in all human probability, never can and never will provide for the common man the advantages which free enterprise has provided for him in the past and which it can in larger measure provide in the future if the necessary over-all controls are determined and applied. These cold-blooded, logical approaches will not prevail. The only effective protection which the people of our western world will have against the spread of unfortunate ideology will be the active, rapid, and effective development of our own economy to higher levels of employment that are both profitable and productive to the mass of ordinary citizens.

This will be a real ideological war beginning as the physical warfare ends and increasing in intensity when the physical warfare ceases. It can never be anything other than tragic to have to throw a nation into physical warfare, but we can welcome this coming ideological contest with confidence and with joy. Our warfare will be waged by increasing the well-being of our country and its citizens, not by destroying that well-being. The peril is great; the opportunity is even greater, and engineers have a great part to play.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

## QUALITY CONTROL

From *Trade and Engineering* (London, Eng.), August, 1943

### A Checking System

One of the biggest aircraft and aero-engine producers in Great Britain, the Bristol Aeroplane Company, is now employing a checking system which enables the inspection department to discover, without loss of time, the fundamental cause of any poor workmanship in its workshops. The success of the system is proved by results: in the department in which it has been operating for some time it has reduced scrap from about 3 per cent of the total output to 0.75 per cent and corrections from approximately 7 per cent to less than 3 per cent.

The system is based on the laws of probability and aims at preventing inaccuracies before they reach serious proportions, rather than waiting until the harm has been done; in other words, it is designed to check at an early stage a tendency to turn out spoilt parts, either on the part of the operator or the machine. As production has gone up and up to meet war demands, without firms being able to make a corresponding increase in the size of their skilled inspection departments, there has been a tendency for inspection to form bottleneck, with the result that work has piled up and frequently not been inspected until long after the shift has ceased work and gone home. It was therefore impossible to discover whether a particular operator or a particular machine was a consistent offender; all that was clear was that the percentage of scrap to good work was high. To prevent such an occurrence the ideal would perhaps be for each machine and each operator to have its own inspector, but this would not be possible in peace-time for economic reasons, while in war-time it is quite out of the question, with production many times its pre-war size and the demand for skilled inspectors far exceeding supply. For that reason the Bristol Company has experimented for the last six or seven months with a new system which can detect mistakes before they have become expensive in time and material. The first experiment was carried out in a turning shop, and the system has now been extended in an adapted form to a press shop. It cannot be used to detect faulty materials; it is concerned only with workmanship. It is based on what is known as quality control, and in the Bristol workshops it has led to a greater uniformity of product, a larger volume of good output without increase in cost, the earliest possible detection of trouble, or prospective trouble, in production, and, not least, a current and authentic record of the quality of the product.

#### USEFUL FORECASTS

In effect, what happens is that the statistical scientist says that the probable range of variation in the manufacture of a particular part can be forecast on the evidence of a trial run, and that precise limits can then be set within which an inspector with a measuring gauge can check, not each individual part, but the average run of the output. The system seeks to anticipate faulty work, not so much by checking the spoilt parts as by checking the tendency to turn them out. The inspection check can normally be applied before the inaccurate work is produced; in other words, it discovers a trend towards inaccuracy on the part of the machine or the operator and at once takes the appropriate steps to check that trend. This is possible because every part which the inspector selects for examination is recorded on a control chart not unlike the temperature charts used in hospitals. The chart shows permitted tolerances in manufacture, and between those outside limits other lines are drawn on the chart to indicate lesser limits, arrived at by measuring the essential dimensions on the first set of samples and treating the average as expressing the law of probability. Both the extreme and lesser limits are indicated on the chart by lines. Each chart is ruled out in small squares, each representing one ten-thousandth or one-thousandth of an inch. A dot in the appropriate square shows the average measurement of each sample group of parts examined. New entries are made on the chart every hour, half-hour, or less, as is appropriate, to test the trend of the work. If the dots show an inclination to move towards the limiting lines and a tendency to remain there the indication is that something is wrong with either the machine or the operator.

SAMPLE CHECKS

Whether the machine-tool appears to be all right or whether the operator appears to be carrying out his or her work correctly, it will be obvious from the results shown on the chart that one or the other, or perhaps both, is committing some fault. The intervals at which sample checks are made are so arranged that not less than 15 per cent, and not more than 30 per cent of the parts produced by one machine and one operator are measured. For checking purposes the last components produced on the machine are always used as samples, so that the most up-to-date information may be available. It will be seen therefore that while this system cannot prevent defective work on the part of a machine or an operator it has the effect of reducing the volume of defective work by checking the tendency before the output has reached serious proportions. At the Bristol works the inspection is carried out in the same shop as that in which the machines are working. The inspectors sit at the benches alongside the machines, keeping their charts up to date, so that no time is lost between the discovery of a tendency towards faulty work and the adoption of measures to check it. If a machine-tool is suspect a setter is near at hand to examine it.

The system relies for its success on the formula for converting sample averages into control limits. To calculate those limits the average dimensions and range recordings are used, and at least eight consecutive sample checks are taken in order to provide sufficient data to give a true indication of the trend of an individual machine and/or operator. Having decided upon the number of sample checks to be taken the full average dimension—that is, the average of averages—and also the average range over the whole series of samples can be ascertained. In addition to this current check, a data sheet is compiled, both as a running record and for future use in the event of a demand to repeat work on the same article.

EXTENSION OF THE SYSTEM

Before the scheme was introduced at the Bristol works the quality control system was the subject of much discussion and research, and it was ultimately decided to apply it for an experimental period to the automatic section of the machine shop. A training school was set up to train women inspectors in the requirements of the system, these inspectors having been employed on the final inspection of machine details. The experience gained in the automatic section was sufficient to indicate the value of the system, and training was extended to cover a further group of women inspectors with a view to applying the process to the remainder of the shop. Further experiments showed that there were inherent in the organization of the shop various factors which rendered the purely theoretical technique unusable except to a limited extent. While it was quite possible to apply the theoretical system to parts produced by automatic machines, with large orders running over a period of several days, it could not be applied to the capstan lathe and milling sections, where work is planned on short orders to suit production requirements, and in many cases the time covered by an operation is so short that control cannot be established.

The system was, however, found to be adaptable to the various peculiarities of production needs. Modified arrangements have therefore been adopted; for example, the use of one chart to cover a number of successive orders from the same type of machine, even though there is a time interval between the orders. Adjustment of control limits to allow maximum permissible variation and the use of small groups, and shorter intervals between checks on small orders, have also proved beneficial. The experience of the company to date indicated that in this adapted form quality control can be accepted as a substitute for final inspection, provided that the chart shows a satisfactory course of production. Therefore, except where the dimension involved is so vital that 100 per cent inspection is essential, no final inspection other than a visual check for obvious defects, such as material flaws, is now carried out on parts which have been controlled on production. It has been found that women inspectors, if properly trained, are quite capable of dealing with the periodical sample checks and the plotting of the charts. The general preparation of the chart (including the insertion of the vertical scale), data sheets, and other records is dealt with by a small clerical staff on each shift.

The Bristol Company has issued a hand-book explaining the new checking system to the employees concerned. They have welcomed the scheme, realizing that it will result in their efforts making a consistently greater contribution to the war effort by reducing the time and material lost by a faulty machine or imperfect workmanship.

## OIL ENGINES FOR LANDING CRAFT

From *The Engineer* (London, Eng.), August, 1943.

Considerable interest has been aroused by the outstanding success of the amphibious operations in Sicily. The success of such operations depends largely upon a continuous supply of suitably designed oil engines for the propulsion of the craft which take so important a part in the landing of guns, tanks, and personnel. A short time ago we were invited to visit one of the many factories which are engaged in the production of hulls, engines, and gears for landing craft. The occasion marked with fitting ceremony the reaching of a production figure which stands high in the oil engine outputs in this country. The factory we were permitted to inspect is a wartime creation which is engaged on Admiralty contracts, and is under the able management of a leading firm of oil engine manufacturers. It was taken over in an almost derelict state, as the business in which it was previously occupied had been abandoned for close upon twenty years. The entire reconstruction of the premises and their adaptation to a wartime programme of engine construction was accomplished in the short space of six months, and when we visited these works we were impressed by the general lay-out and the order and cleanliness in the various shops, which is in accordance with the highest standards of oil engine construction.

We were interested to learn that very few skilled men, other than key operatives, are employed at this factory, and that the workers who have been up-graded and trained by the firm are about 100 per cent of the whole. Again, the percentage of women workers is high and reaches over 45 per cent. Many of those now actively employed in assembling engines, both men and women, have had no previous experience in the engineering trade.

The factory is primarily an assembly works, although some overhauling and reconditioning of used engines is done. Some 200 subcontractors are engaged in the production of finished parts for delivery to the factory, which work represents the activities of some 25,000 workers. All parts delivered have been previously accepted by inspectors of Lloyd's Register of Shipping. In designing the special engine chosen for this work, a number of features were introduced with a view to the employment of a maximum number of sub-contractors and at the same time the maximum dispersal essential under wartime conditions of manufacture, having always in view the maintaining of a constant flow of parts to the assembly plant. This bold policy has been fully justified by the result obtained, and we were interested to learn that the actual performance of the engine has indicated its capability of withstanding double the running hours for which the unit was originally designed.

The engine chosen for this particular work is of the twelve-cylinder pattern, there being two banks of cylinders, in vee form, with an angle of 60 deg. between them. Each bank consists of two blocks of three cylinders. Each cylinder has a bore of 7 in. and a stroke of 7¾ in., and the designed output of the engine is 500 B.H.P., when running at 1,375 r.p.m. The compression ratio is 17 to 1, and the brake mean effective pressure at full load is 81 lb. per square inch. The engine has no fly-wheel, and it is coupled to an oil-operated reverse and reduction gear-box through a flexible coupling. The total combined weight of the unit is 84½ cwt. The engine is run up to speed from cold by means of an electric starter of standard pattern.

Some points in design may be noted. The crank case differs from that of a standard engine, and is specially designed to receive the four blocks of cylinders, which are finished machined, and honed to receive the dry type liners, which are pressed into them by hydraulic machines operating at a pressure of 2 tons. The internal finish of the cylinder blocks and external finish of the liners makes a metal-to-metal joint, which allows for the maximum transference of heat. The cam box consists of a separate unit built in two halves, which is accommodated in a central position between the cylinder blocks. We noted that cast iron camshafts are employed in conjunction with cam levers having chrome-deposited surfaces. The main connecting-rods are of the central type, combined with a specially designed forked connecting-rod in which the customary foot has been avoided by incorporating a radius palm, which makes possible a lighter rod and relieves the stresses in the connecting-rod bolts.

On arrival at the works the various parts are accommodated in the stores. One of the first operations we noted was that of completely scouring the crank case in order to remove all traces of sand, after which a coating of special oxide paint is applied. The cylinder blocks are lapped to the crank case in order to ensure a perfect oil-tight joint. The crank shafts, after careful inspection, are hand polished and all burrs removed. The scale is removed from the interior of all pipes before assembly. After the fuel pump connection pipes have been bent to the required shape, they are connected to a standard fuel injection pump and submitted to a process of flushing for 15 min. in order to remove all traces of internal scale.

Owing to the weight of the engine unit, it was found not practical to adopt the track or moving belt system of erection, but equally good results have, we understand, been attained by the use of groups of specially trained operators who carry out the various stages in the erection process and move from engine to engine.

On completion, the engine pass, after final inspection, to the test bay, which is equipped with a large number of test cubicles, permitting non-stop testing. Each cubicle is complete with its Froude water brake and the various testing instruments. The units are first submitted to a twelve-hour continuous test at a water temperature of 150 deg. F., which reproduces closely the actual conditions under which the engine will be called upon to work. The fuel and lubricating consumptions are carefully checked, and on the completion of test the engines are stripped down and all working parts are carefully examined by a Lloyd's acceptance officer. On the completion of this inspection the engine is reassembled, and it then undergoes a short test at varying speeds. It is now packed and prepared for dispatch. In order to avoid possible damage when lifting engines for dispatch or on arrival at their destination, a neat lifting gear has been devised which is attached to lifting buttons incorporated in the design of the engine.

Apart from the erection and testing of the new engines, which we have already referred to, engines are periodically received from service and are completely overhauled and reconditioned. After stripping down, all parts of the engine are inspected, gauged and their measurement and condition recorded on special charts, so that the general performance of these parts can be carefully studied. A special wear replacement schedule has been drawn up, and this is strictly adhered to, all parts worn to dimensions outside the prescribed limits being removed and replaced by new ones. The pistons and the other parts connected with the process of combustion are decarbonised in special tanks filled with chemical solutions which facilitate the decarbonising process, and the cylinder heads and blocks are subject to a careful descaling process. The cleaned and inspected parts then pass to the assembly and erecting shops, where they are reassembled under the same conditions as for a new engine. In view of the thoroughness of the methods we have outlined, no distinction is made between the overhauled and the new engines, all parts being drawn from a common pool.

The inspection of this wartime factory by members of the technical Press and the authorities in charge of the factory and those using the engines was a gratifying part of the production celebration. They were able to see for themselves the fulfilment of the advanced planning during the dark days of the Continental setbacks, when it hardly seemed possible that the units for the construction of which in such large quantities plans were being courageously laid could be so effectively utilised to carry the war into the enemy's camp.

## BRITAIN'S MAN-POWER

From *The Engineer* (London, Eng.), August 27, 1943

In *The British Ally*, which is officially published weekly in Russia, an article by Mr. M. S. McCorquodale, the Parliamentary Secretary of the Ministry of Labour, analyses the use of man-power in Great Britain, and claims that Britain has mobilised her man-power more highly than any other nation. In the middle of 1942 Britain had a total of 46,750,000 people, of which about 33,130,000 were effective, representing those over fourteen and under sixty-five years of age. This effective population comprised 15,900,000 males and 17,230,000 females; 10,000,000 of the women were married or occupied in necessary household duties and there were 9,000,000 children under fourteen. The number of persons in full-time paid service or employment was about 22,300,000, which number consisted of 15,200,000 males and 7,100,000 females, including 2,500,000 married women. In munition factories the percentage of women employed was high. It was about 35 per cent in the engineering and allied industries and about 52 per cent in the chemical and explosive industries. A million more men are employed on the production of munitions than were employed on similar work at the end of the last war. Of the 3,250,000 unmarried women between the ages of eighteen and forty, over 90 per cent were engaged in whole-time work in the Armed Forces, in civil defence, or in industry. The whole of the men born between the middle of 1900 and September, 1925, had been registered under the National Service Acts to the number of 7,750,000, while the older men born in the year of 1892 to the middle of 1900 who were registered under the Registration of Employment Order numbered 1,933,000. The great majority of these men were already engaged in work of national importance. The women born in the year 1897 to the middle of 1924 who had been registered numbered 9,600,000; 2,000,000 men and women in classes which were not normally engaged in industrial employment had been mobilised for full-time war work, while 650,000 women, most of whom were married and had household responsibilities, were in part-time industrial employment.

## SALVAGING THE "NORMANDIE"

From *Marine Engineering and Shipping Review*, Sept. 1943

Abstracted by *Mechanical Engineering*, Nov. 1943

Salvage operations on the former French liner, *Normandie*, transferred by the U.S. Maritime Commission to the Navy Department on December 24, 1941, renamed the U.S.S. *Lafayette*, and damaged by fire at a New York pier on Feb. 2, 1942, are reported briefly in the September issue of *Marine Engineering and Shipping Review*.

It will be remembered that the *Lafayette* capsized and was resting on its port side at an angle of 79 deg. On Feb. 24, 1942, jurisdiction of the vessel was assumed by the Chief of the Bureau of Ships who placed it under the immediate cognizance of the Supervisor of Salvage, U.S.N.

In order to determine whether or not the *Lafayette* should be salvaged, the Secretary of the Navy, on April 15, 1942, appointed a special committee to make recommendations in respect to salvage or other disposition.

On May 1, 1942, the committee reported, recommending that the vessel be raised and the question of reconditioning be held in abeyance.

Captain W. A. Sullivan, U.S.N., supervisor of salvage, undertook direction of the operation on the *Lafayette*. Owing to the size of the operation and the great number of other operations being conducted by the Navy Salvage Service and Merritt-Chapman & Scott Corporation, salvage was undertaken directly by the Navy using as little of key personnel of the Merritt-Chapman & Scott Corporation as possible.

In November, 1942, when Captain Sullivan was ordered to North Africa, Captain B. E. Manseau, U.S.N., who had been hull superintendent in the Navy Yard, Pearl Harbor, several years previous to and several months following the Japanese attack, succeeded Captain Sullivan in directing the salvage operations of the *Lafayette*.

Six hundred to eight hundred men have been regularly employed on the salvage job during the past year, of which as many as 75 have been divers. Upon their efforts as well as those of the supervisors and engineers hinged the success of the salvage plan. Three-hundred-fifty-six air ports submerged an average of 60 ft. below the surface and 8 to 10 ft. in the mud, had to be patched and braced with reinforced concrete in order to withstand the water pressure that would be exerted on them when pumping was started.

Table of Weights, Capacities, and Volumes

| | |
|---|---|
| Portholes closed | 356 |
| Deck opening, patched, sq. ft. | 5,447 |
| Estimated tons of debris and scrap removed | 6,000 |
| Tons of superstructure removed | 5,000 |
| Estimated pounds of broken glass removed | 8,000 |
| Cubic yards of mud removed | 10,000 |
| Board feet of lumber placed in ship by divers as shoring and bulkheads | 240,500 |
| Number of wedges, plugs and small patches (by divers) | 4,500 |
| Total weight of large patches, tons | 150 |
| Tons of concrete added | 1,685 |
| Number of 10-in. salvage pumps aboard | 40 |
| Number of 6-in. salvage pumps aboard | 28 |
| Number of 3-in. salvage pumps aboard | 25 |
| Total capacity of pumps, tons per hour | 40,000 |
| Average number of men working on wreck | 700 |
| Average number of divers | 70 |
| Estimated total cost of salvage | $3,750,000 |
| Actual cost of salvage up to June 1, 1943 | $3,050,000 |
| Estimated total volume of divers' air used, cubic feet (standard temperature and pressure) | 2,530,000,000 |
| Tons of water inside ship to be pumped out | 100,000 |

In addition to these ports, certain cargo ports were open at the time of the disaster. They also had to be closed and backed with reinforced concrete laid under water. In patching, closing, and shoring of the air ports, cargo ports, and other openings, the great difficulties encountered by divers cannot be overemphasized. Because of the complexity of construction, divers had to find their way through devious passages, staterooms, and machinery spaces. Because of the silt in New York Harbour, these men had to work in total darkness for underwater lights cannot penetrate this murky water.

Before divers could work in these submerged spaces, the spaces had to be cleared of the dunnage, debris, and miscellaneous stores and equipment with which they were filled. When the vessel rolled over, the furniture, stores, and all other portable objects contained inside of the vessel were dislodged and fell to port. The submerged portion of the athwartship passageways between the cargo ports in the ship's side, through which much of the access to the spaces requiring attention by the divers was obtained, were practically blocked with debris.

Almost all of the air ports and cargo doors, which required patching, were found to be covered with mud which had been squeezed into the ship through open or broken air ports or cargo doors. In many cases, divers found that some of the staging, hung on the portside of the vessel prior to the fire, had been crushed under the side of the vessel with many large timbers protruding at sharp angles through open ports, making the patching of these ports extremely difficult. In several cases, where both doors of cargo ports were open, more than 30 ft. of mud had squeezed through. It was necessary for divers to enter these compartments, sometimes sinking over their heads in the mud, to clean out debris and direct mud discharge.

In most cases, mud was found to be 10 to 12 ft. deep in way of open cargo ports. Moreover, divers spent months fighting the hazard of spun glass which had been used for insulation throughout the ship. It seemed that the fine glass penetrated the skin through the pores and could not be removed except by allowing time to let it grow out. Actually, the divers' lives were constantly in danger because of the broken glass and ragged steel edges, threatened to sever air and life lines.

In most salvage cases, the salvor must constantly be on guard against gas hazards arising from the decomposition of organic materials and the displacement of oxygen by any one of a number of causes, such as burners' torches and the operation of engines. Besides these usual dangers of gas, the salvors on the *Lafayette* were faced with additional hazards resulting from the organic material entering the ship from the slip. Two of the city sewers empty into the slip where the *Lafayette* lies. Extensive water tests were made early in the salvage operations to determine the extent of the hazard resulting from these organic materials.

Various gas-testing devices and implements were used throughout the salvage of the vessel as a constant precaution against formation of gas. The fatal hydrogen sulphide was found at various times and the workmen were prevented from entering these compartments until proper ventilation had done away with the danger.

The salvage plan involved the completion of the following general operations:

1. Removal of the superstructure above the promenade deck above and below the water line.
2. Trimming of the promenade deck to prepare for the placing of patches on all of the openings.
3. Removal of all partition bulkheads, furniture, woodwork, and inflammable material inside of the vessel, both above and below the water line.
4. Closing sixteen cargo ports on the portside of the vessel and concreting and bracing port cargo hatches.
5. Closing 356 air ports on the portside of the vessel and patching and concreting the air ports.
6. Removing approximately 10,000 cu. yd. of mud.
7. Cleaning out boiler rooms, rearranging floor plates, securing boilers to foundations.
8. Cleaning out turbogenerator room and propulsion-motor rooms.
9. Patching all promenade-deck openings below the water line.
10. Installing timber and concrete bulkheads.
11. Shoring promenade deck.
12. Making intermediate deck tight; patching all openings.
13. Checking pumping arrangements. Closing all pipe lines in the vessel leading from one compartment to another.
14. Checking all available plans of ship to determine strength of bulkheads and decks for dewatering operations.
15. Installing and arranging forty 10-in. salvage pumps, twenty-eight 6-in. salvage pumps, and twenty-five 3-in. salvage pumps and piping for dewatering.
16. Making detailed calculations of stability and strength for righting operations.
17. Removing portion of the pier and driving fender piles.

After pumping operations had started, it became necessary to maintain complete control of the vessel at all times. The plan involved a pumping schedule which restricted the initial movement of the vessel to one of rotation on the port bilge keel rather than actual flotation. Mud suction, however, might restrict free movement to the extent that when the suction was broken, the ship might lurch to starboard. This uncontrolled flopping of the ship would be extremely dangerous since the vessel might crash into the pier. It was, then, of great importance that the mud suction be broken very gradually so that at no time would the vessel be out of control. This was accomplished by pumping down a certain amount, as was predetermined by stability calculations and holding that pumped water level in the various compartments in order to let time help break the suction, rather than to set up tremendous stresses by extreme pumping. Water and air jets were installed to help break this suction if required, although their use was not required.

It was planned that the righting operations should commence during the latter part of the summer of 1943. Actually they began on August 6. The cleaning up of the ship and the removal of the timber and concrete bulkheads must be done before actual reconstruction can take place.

Pumping operations were commenced with the vessel at the original 79-deg. inclination. By August 15, pumping having proceeded under careful control, the vessel had righted to approximately 30-deg., at which point, removal of bulkheading and salvage gear was necessary eventually to bring the ship to an even keel. This work is now in process of completion.

Expenditures for salvage up to June 1, 1943, totalled $3,050,000. It is estimated that the total cost of salvage will be $3,750,000.

## THE INTERNATIONAL ORGANIZATION OF RESEARCH

From *The Engineering*, (London, Eng.), August 27, 1943

There is good reason to believe that the co-ordination of scientific effort between Britain and North America will prove to have been advanced appreciably by the visit paid to the United States and Canada by Sir John Anderson, the Lord President of the Council, who returned to this country by air a fortnight ago after spending some ten days in Washington and Ottawa. There was no secret about the general purpose of his visit, which was said to be that of discussing with the authorities on the other side of the Atlantic the scientific matters connected with the war effort. He went first to Washington, where he arrived on August 2, remaining rather less than a week before going on to Ottawa, whence it was reported that he was taking steps to establish a committee of scientists to act (in the words of the Ottawa correspondent of *The Times*) "as a clearing house for information and reports in connection with scientific war-time-research." The committee, it was stated, would be formed in the first instance by the Governments of the English-speaking countries, and that it was hoped eventually to extend the scheme to include other countries, with a view to co-ordinating scientific research for both war and peace.

While in Ottawa, Sir John addressed a Press conference, to which he gave some indication of the collaboration already existing in scientific matters between Britain, Canada and the United States, and expressed keen appreciation of the contribution of Canada to the joint efforts in this direction. In many respects, he said, British scientific development had been in advance of German science, and the close co-operation in the scientific policies of the English-speaking nations was ensuring that this advantage was maintained; he mentioned radio-location as a branch in which British science had established a definite lead, observing that, but for the development of that technique before the war, the German air onslaught on Britain might have had very different consequences.

The initial steps towards Empire collaboration were taken in the early days of the war, when Dr. R. W. Boyle, of the National Research Council of Canada, and Sir John Madsen, of Sydney University, visited London. In 1940, Professor Hill went to Washington on behalf of the Air Ministry and took the opportunity to enlist the support of President Roosevelt to the general principle of a closer scientific liaison. The interest of Lord Lothian, the British Ambassador at Washington, was similarly engaged; and the Australian Minister in the United States, Mr. R. G. Casey, together with Sir Gerald Campbell, the High Commissioner at Ottawa, and others of like mind, tried to expedite some definite action in London. For various reasons, those in authority in London were not immediately responsive; so, in August, 1940, without waiting longer for full-scale Government action, Professor R. H. Fowler, of Trinity College, Cambridge, went to Canada to act as scientific liaison officer with the National Research Council there, and endeavoured also to improve scientific contacts with the United States, where in June a National Defence Research Committee had been formed under the chairmanship of Dr. V. Bush, of the Massachusetts Institute of Technology. In the autumn of that year, however, in response to an invitation from President Roosevelt a British scientific mission, headed by Sir Henry Tizard, went to the United States and also to Canada. It did some very valuable work in both countries; indeed, Professor A. V. Hill declared emphatically that "No words can overstress the importance of what was achieved by that mission and by Fowler's strenuous efforts."

# From Month to Month

**News of the Institute and other Societies, Comments and Correspondence, Elections and Transfers**

## PRESIDENT CAMERON'S VISIT TO TO THE WEST

Branches of the Institute in the West and in northern Ontario were visited by President Cameron last month. Leaving Toronto immediately after the joint meeting with The American Society of Mechanical Engineers on October 3rd, the president inaugurated his tour of the branches at Regina. From there he went to Calgary, Lethbridge, Kelowna, Vancouver and Victoria. On the return trip he stopped at Edmonton, Saskatoon, Winnipeg, Port Arthur and Fort William, and Sault Ste. Marie. Mrs. Cameron accompanied him all along the trip, and contributed much to the brightness of the meetings.

The general secretary was to have accompanied the president, but an urgent call from the government for the Institute to carry out an important assignment made it necessary for Dr. Wright to cancel his trip at the last minute. The assistant general secretary, however, met the president in Winnipeg on the return trip, and accompanied him in his visits to the Winnipeg, Lakehead and Sault branches.

At Winnipeg, a regional meeting of Council was held, thus affording councillors from the western branches an opportunity to secure first hand information on the manner in which the Institute is governed, and to present the western point of view in the determination of policies. All western provinces were represented at the meeting. Besides Vice-President W. P. Brereton and Councillor J. W. Sanger of Winnipeg, the following officers from outside were present: Past-President S. G. Porter from Calgary, Councillors A. M. Macgillivray from Saskatoon, E. Nelson from Edmonton, and C. E. Webb from Vancouver.

A new feature of the tour in British Columbia was the visit made by Mr. Cameron in company with Councillor Webb of Vancouver, to the engineers of the Okanagan valley. A luncheon meeting was held at Kelowna under the chairmanship of the Honourable Grote Stirling, an Honorary Member of the Institute. The success of such visits indicates that the Institute might be justified in opening new branches in certain districts.

The president continued the practice inaugurated by his predecessors of visiting the engineering students in the various colleges. He spoke at the universities of British Columbia, Alberta, Saskatchewan and Manitoba where he presented the Institute prizes to the students. Mr. Cameron also visited the Royal Canadian Naval College at Royal Roads, Victoria, where the authorities indicated a desire on the part of the students to become associated with the Institute. The response to the president's visit at the University of British Columbia was prompt. At the Winnipeg council meeting, Councillor Webb presented a petition, signed by twenty-eight students of the University of British Columbia, requesting the establishment of a Student Section of the Institute in Vancouver. The formation of the section was immediately authorized.

In the course of his addresses to the branches, the president stressed the importance of clear thinking on the problems of post-war reconstruction. He warned his listeners against the belief, current among the public, that large public construction projects were the answer to the problem of rehabilitating men and women from the services and the war industries. Private enterprise will be expected to share the responsibilities with the government, and it will be necessary to see that the figure representing producer goods in relation to consumer goods in the national income, is maintained at the level, which in the past has proved conducive to a balanced economy. Everywhere the president has found the engineers much alive to post-war problems, and well aware of their responsibilities.

At several branches, the meetings were held jointly with the provincial association, and with such groups as the chambers of commerce and others directly interested in the problems discussed. During his tour, the president also addressed branches of the McGill Graduates Society at Winnipeg, Regina, Vancouver, Victoria, Edmonton and, in Vancouver, he was the guest speaker at a luncheon meeting of the Board of Trade.

These annual visits to the branches of the Institute have proved very useful in strengthening the ties between members across our vast country, and in enhancing the prestige of the profession with the public. In spite of the physical exertion inherent to such a tour, President Cameron has carried out these two functions most successfully and has earned the gratitude of all engineers.

## WARTIME BUREAU OF TECHNICAL PERSONNEL

### Freezing Order and the Engineer

Technical persons have been enquiring if the recently announced "freezing" order applies to them and, therefore, a word of explanation seems appropriate at this time.

The "freezing" order is an amendment to Part II of the National Selective Service Civilian Regulations, P.C. 246. Therefore, it does not legally apply to technical persons whose employment is controlled under the provisions of Part III. However, as the new order applying to man-power generally is intended to minimize avoidable turn-over and ensure that important work already underway is not interrupted, it is reasonable that the controls already existing for technical persons should be applied in such a way as to have a parallel result.

In effect, such control is already incorporated in the Technical Personnel Regulations. Since March 23, 1943, the re-employment of a technical person has been subject to the approval of the Minister of Labour. In considering whether approval should be granted or withheld for new employment of an individual, the Minister of Labour (acting through the Bureau) will subject the proposed duties to even closer scrutiny than has been the case in the past.

Technical persons should therefore note that, before considering cessation from present employment, it is advisable to request guidance from a Bureau regional representative or from Ottawa.

### Advice to Employers Discharging Personnel

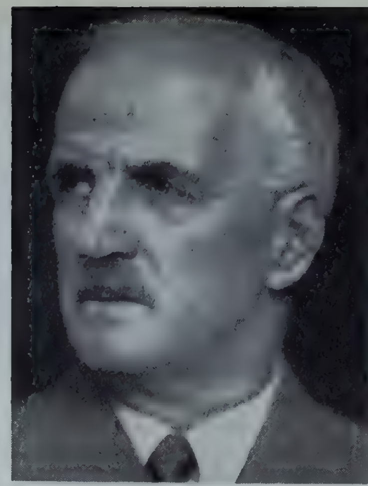
There is also a need for closer observance of the regulations by employers, particularly Section 301 (1), which calls for notification "forthwith" when a person ascertains that he will be laying off or discharging a technical person. If a company has completed a large project or work is otherwise decreasing, it is not reasonable that they should keep a technical person on their payroll doing nothing. But it is definitely expected that each employer shall make every effort to plan well in advance as to future needs for technical staff and to co-operate in so planning a lay-off as to simplify the absorption of any technical persons concerned into other activities of high labour priority.

### Maintaining University Staffs

Due to the diversion of a large number of university instructors to the Armed Forces and to various scientific projects, it has been difficult to maintain university teaching staffs at the bare minimum necessary to enable these institutions to function effectively. This is particularly true in the junior categories, such as demonstrators and lecturers. The Bureau has done what it could to provide relief in this situation and it is interesting to note that, from the graduating class of 1943, 114 junior instructors or research workers were diverted to the university field for the time being. In addition, a number of placements have been effected by the Bureau, including some for senior teaching posts, from among graduates of earlier years whose services could be made available for this important work.

### Visitors Welcomed

Numerous visitors to Bureau headquarters have expressed interest in the Bureau's procedure and methods of handling technical personnel matters. Such visits are welcomed, and it is hoped that many others will take advantage of an opportunity to call while in Ottawa. First-hand knowledge of activities will be particularly useful to employers' representatives whose duty it is to handle personnel problems relating to engineers and scientists.



**C. J. Mackenzie, M.E.I.C.**

was awarded the Sir John Kennedy Medal for 1943 by Council of the Institute. Dr. Mackenzie is acting president of the National Research Council at Ottawa and dean of engineering at the University of Saskatchewan. The presentation of the medal will be made at the Annual Meeting in Quebec City, next February.

## ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

### Annual Meeting

At the annual meeting of this society which was held in New York on October 23rd, it was reported that, in spite of the war, considerable progress had been made in all the objectives. The four main committees whose titles describe the society's principal interests presented reports showing varying progress. These are committees on Engineering Schools, Student Selection and Guidance, Professional Training and Professional Recognition.

Chairman R. E. Doherty, president of the Carnegie Institute of Technology, summarized the year's activity and drew attention particularly to progress which had been made towards the preparation of the Manual for Junior Engineers, and the tests for determining the probability of a student being able to satisfactorily complete an engineering curriculum.

The manual is part of the work of the Committee on Professional Training. Its purpose is to assist the student and young graduate to lay out a programme which will secure for him "progressive improvement in a well-rounded life." Dr. W. E. Wickenden, president of the Case School of Applied Science, has been chosen as the author of the manual which is the best guarantee of an excellent product.

The most important recent undertaking of the Committee on Student Selection and Guidance has been the counselling and guidance of high school students. Considerable experimental work has been carried out in the "application of educational measurements most appropriate for the selection and guidance of beginning students of engineering." The development of statistical technique for use in mental measurement is not a new topic, but it has been a controversial one. Recent accomplishments in the States have indicated that as a predictor the methods have considerable value. It is proposed to carry on the tests under the joint auspices of the Engineers' Council for Professional Development, the Society for the Promotion of Engineering Education and the Carnegie Foundation for the Advancement of Teaching. Ten prominent educational institutions have accepted the invitation to participate in the tests.

The annual meeting marked the termination of office of Dr. Doherty as chairman. To him belongs great credit for the progress made by the Council in recent years. He has been succeeded by Everett S. Lee, of the General Electric Company, Schenectady, who has been chairman of the Committee on Professional Training.

The Institute's representatives on E.C.P.D. are:

| | |
|---|---|
| J. B. Challies<br>A. Surveyer<br>C. R. Young | Members of Council |

| | |
|---|---|
| Student Selection and Guidance | —Harry F. Bennett, London |
| Engineering Schools | —none |
| Professional Training | —C. R. Young, Toronto |
| Junior Panel | —J. W. Brooks, Niagara Falls, Ont.<br>—W. E. Brown, Hamilton, Ont. |
| Professional Recognition | —J. A. Vance, Woodstock |

## COLLECTIVE BARGAINING FOR THE ENGINEER

Fortunately, there has been less activity of the organized labour groups among the engineers in Canada than in the United States. Nevertheless, it is well known that for some time the two larger organizations have been trying to get a foothold here.

Indications are that so far the only progress is with the sub-professional groups and with young engineers whose work is still at the sub-professional or training level. In the United States where greater progress has been made, it is still principally at the sub-professional level. Nevertheless, the movement is an important one to the engineering profession, particularly in view of the steady progress being made both in Canada and in the United States towards collective bargaining. It will bear watching and study.

The American Society of Civil Engineers has been concerned for some time with trade organizations in relationship to civil engineers, and recently approved a policy which is both revolutionary and far-reaching. It has been decided that if compulsory or collective bargaining is going to include the engineers, then the engineers had better get busy about setting up their own organization to handle their own affairs. This is the only means by which control of working conditions for the engineers can be kept out of the hands of non-professional and non-technical groups, whose policy and philosophy are so different from that of the professional man.

The A.S.C.E. has decided to appoint four new assistant secretaries, to be located strategically across the country, whose principal duties will be to advise local groups and to assist them in establishing their own bargaining units. An appropriation of $50,000 has been made for the purpose, to cover the costs for one year. It is very apparent that the

Society takes a serious view of the situtaion and means business.

Sometime ago a special committee was set up to study the problem. It has recently made very definite recommendations which have been accepted by the Board of Direction of the Society. The *Journal* presents herewith a slightly abridged copy of the committee's report which gives a clear account of how it is proposed to meet the situation. The engineers in Canada will find in this much food for thought.

THE BOARD OF DIRECTION
AMERICAN SOCIETY OF CIVIL ENGINEERS

Gentlemen:

The Committee on Employment Conditions places before you, with its recommendation for adoption, a proposal that at first consideration you may deem unusual. However, it believes that thoughtful consideration of the proposal will disclose its merit.

The Committee met in Albuquerque, New Mexico, September 11, 12, 1943, with all members present. Mr. George T. Seabury, Secretary of the Society, and Mr. Howard Peckworth, Assistant-to-the-Secretary, also were present and participated in the deliberations of the Committee.

The Committee members agree unanimously that the most important factor influencing the present and future welfare of professional engineers, and particularly those engaged in the Civil Engineering field, including the members of the American Society of Civil Engineers, is collective bargaining as provided for by National and, in some cases, State legislation.

Collective Bargaining is with us and will remain indefinitely. There is good reason to believe that the application of collective bargaining will be widened and that in the near future all employees, regardless of occupation, will be forced to adopt collective bargaining group procedures in one form or another.

If the professionally-minded engineer is not prepared to bargain collectively through representatives of his own choosing, collective bargaining will be done for him by representatives selected by an organization with which he may not wish to be identified. It is probable that not less than ninety percent of the membership of the Society would come under the classification of employees and that sooner or later, under the provision of the National Labor Relations Act, these engineers will be forced unwillingly, unless something is done to protect them, into organizations which will assume bargaining powers for them.

In fact, it is believed that unless the professionally-minded employees within our membership, and others, are identified with organizations of their own choosing, formed especiallly for collective bargaining purposes, such collective bargaining will be assumed by units composed largely of sub-professional and non-professional persons, and related to the manual trades.

The Committee on Employment Conditions is extremely conscious of the gravity of this situation as it affects the Society and its membership. The Committee believes, moreover, that the time has arrived when the Society must perform this economic function for its membership as well as those of an educational, scientific and technological nature. We believe we are fully aware of the meaning of this step and its implications, but if the professionally-minded civil engineer is to maintain his identity as such, this action is imperative.

The Committee on Employment Conditions recommends, therefore, that the American Society of Civil Engineres institute collective bargaining facilities for civil engineers. In order to accomplish this function, the Committee recommends the adoption of the following 3-phase programme by the Board of Direction as necessary in order to implement that objective: It is proposed (1) that the Constitutions of the Local Sections of the Society be amended to establish within them bargaining groups each in its own area, (2) that assistance be given those groups by the employment of four field representatives, one to be operative in each of the four Zones, and (3) that an adequate definition of professionally-minded employees be adopted as the basis for the collective bargaining groups proposed.

*(1) Each Local Section to Provide for a Collective Bargaining Agency*

In conformity with Federal Legislation, collective bargaining units must be local in character although these locals may be affiliated with one another through a national co-ordinating agency. It is therefore impracticable for the Society to attempt to establish itself as a national collective bargaining agency but it may act as the co-ordinating agency for such local collective bargaining groups as are established and it may render them guidance and financial support.

Each Local Section, therefore, to act as a focal point through which to carry out the function of a collective bargaining group, should amend its constitution, according to required Society procedure, to establish a local "Committee on Employment Conditions," using the phraseology indicated later herein.

Section IV. The Committee shall have the duty and the power to direct all activities looking towards the acquisition of adequate compensation and satisfactory working conditions for all Professional Engineering Employees resident within the geographical limits of the Local Section and shall represent them in compliance with and pertaining to any laws, relating to such matters, of the United States, or of the State or States as lie, in whole or in part, within the boundaries of the Local Sections. The Committee shall administer its functions in accordance with the general direction of those Professional Engineering Employees who have paid the dues stipulated in Section VI.

Section VI. The expenses of the Committee shall be defrayed by dues of $....*.... per year collected by the secretary-treasurer of the Committee from those Professional Engineering Employees who are members of the Section and by dues of $...**.... per year similarly collected from those who are non-members of the Section, resident within the Local Section area, who wish to be represented by the Committee and have been determined by the Board of Directors of the Section to be Professional Engineering Employees.

*(2) Field Representatives*

It is the Committee's belief that a sincere and effective effort in this matter of collective bargaining will not be of material value unless the Local Section Committees on Employment Conditions shall have the frequent aid of a man, alert to and conversant with the unsatisfactory employment conditions that undoubtedly will arise in a given area. His experience and advice will be invaluable and upon occasion his personal efforts in conciliation may be far more valuable than any formal collective bargaining procedure. It seems desirable that four such men be engaged, to be operative, for the present at least, one in each of the Society's zones.

These representatives must be "hand-picked" and must possess certain special talents necessary for the proper discharge of their duties. Their duties and functions would be to assist and advise with the various Local Section committees, as provided for in the foregoing amendment to the Local Section Constitutions, on all matters concerning collective bargaining; to organize, if necessary, and to assist

$..*.. Preferably not to exceed $1.00 annually, except as emergencies may require.

$..**.. Preferably not to exceed $5.00 annually, except as emergencies may require.

professional civil engineer employee groups; to work with and advise members concerning collective bargaining organizations; to address and advise with student groups and under-graduates in engineering schools with a view toward making prospective engineers professionally-minded. They may also very properly interview and advise non-members who seemingly are eligible for Society membership and, in general, expand the influence of the Society.

The cost to the Society of maintaining four special field representatives to function under the direction of the Secretary may not be minimized. The Committee visualizes that the salaries, travel, legal advice, and other facilities required will approximate $50,000 per year for the four new men required.

It is the belief of the Committee, however, that such an amount is really nominal compared with the benefits and objectives to be accomplished and, were the cost of such a programme to be much greater, the Committee believes it would still be a justifiable expense to be borne by the Society. The professional civil engineer must maintain his identity as such and remain in professional status.

It is *recommended* that the Board approve the employment of four Field Representatives and appropriate the sum of $50,000 per annum for the expenses that thus properly may be incurred.

*(3) Definition of "Professional Engineering Employees"*

In order that professional civil engineer employee groups be identified and segregated as such under the provisions of the National Labor Relations Act, it is necessary that the professional engineer employee be clearly and precisely defined. In other words, in order that professional engineer employees may form organizations for collective bargaining purposes, the membership of such groups must conform to definite qualifications and characteristics of such nature as will exclude from affiliation with them, persons not having those qualifications and characteristics.

The following definition of "Professional Engineering Employees" is proposed.

"The designation 'Professional Engineering Employees,' used in the sense that persons capable of being so designated may join with others similarly capable of being so designated for the purposes of collective bargaining separately from any other group composed of persons not capable of being so designated, shall be that of only those who, excepting employers or those to whom employers have delegated managerial responsibility with respect to employment conditions, possessing an intimate knowledge of mathematics and the physical sciences, gained by technological and scientific education, training and experience, and in a position of trust and responsibility, apply their knowledge in controlling and converting forces and materials to use in structures, machines, and products, and whose work requires the exercise of discretion and judgment, is creative and original and of such character that the output cannot be standardized; and those who, without the experience set forth, but having been graduated from an approved educational institution and having received the degree of Bachelor of Science or its equivalent, in Engineering, are engaged in engineering work."

It is *recommended* that the Board approve this definition of "Professional Engineering Employees".

Respectfully submitted,

Ashley G. Classen
Gail A. Hathaway
C. W. Okey,
Richard G. Tyler
A. M. Rawn, *Chairman*
*Committee on Employment Conditions*

Adopted by the Board of Direction, Oct. 11, 1943.
George T. Seabury, *Secretary.*

During the presidential visit to Vancouver, Mrs. K. M. Cameron launched the tanker *Mount Bruce Park* at West Coast Shipbuilders Limited, on October 17th. From left to right, Mrs. W. N. Kelly, Mrs. G. A. Walkem, President of the Institute K. M. Cameron, Mrs. K. M. Cameron and Mr. R. K. Walkem.

## ENGINEERS' WIVES ASSOCIATIONS

The presidential tour of the western branches last month provided an occasion for the wives of members to get together in most of the places visited. Mrs. Cameron was entertained by the wives of the engineers at several functions which were tempered by the seriousness of the times, but nevertheless proved very enjoyable both for the visitors and the local ladies.

It is interesting to note that, in Regina and Winnipeg, the arrangements were made by organizations which are permanently established. The successful operation of such associations suggests the idea that the ladies in other localities might be interested in details with a view to taking similar action.

At the time of writing, we have little information about the organization in Regina, but we are pleased to reproduce the following account of the functions held in Winnipeg on the occasion of the president's visit, and a short history of the local association, prepared by its president, Mrs. M. A. Lyons.

On October 22nd and 23rd, the Engineers' Wives Association of Winnipeg was pleased to entertain Mrs. K. M. Cameron of Ottawa and Mrs. H. N. Macpherson and C. E. Webb from Vancouver.

The Executive was very anxious to have Mrs. Cameron attend the regular monthly meeting, so that she might see what the organization is like, how it conducts meetings, what the Association has done and what it hopes to do. The meeting took the form of a luncheon on Friday, with the usual business session, and a short musical programme.

On Friday evening Mrs. E. P. Fetherstonhaugh entertained the guests and the Executive at dinner. On Saturday morning, Mrs. A. E. McDonald had a coffee party at her home and Mrs. John Dyment was hostess at a luncheon for our guests. Saturday afternoon the Association held a tea at the home of Mrs. R. A. Sara, and so ended quite a round of festivities for these sombre war days when everyone is too busy to think much about social doings.

Back in 1940, a small group of engineers' wives were spending an evening together while their husbands attended an engineering meeting. Someone had an inspiration—"Let us form an Association of Engineers' Wives and get to know each other as the men do in their association." Wives of engineers in Winnipeg were contacted and the response was overwhelming with over one hundred women anxious to join. The original group met, drew up a constitution, and appointed a nomination committee, who presented their slate of officers at the first general meeting. Mrs. E. P. Fetherstonhaugh was elected the first president of the Association.

Our Association meets once a month from September to April. This meeting is usually a luncheon, but may take any form the Executive decide—sometimes an evening meeting, occasionally with the mighty engineers themselves! A regular business meeting is held with reports of officers and committees, then a speaker, or music, or some other form of entertainment. Our present membership is one hundred and ten with membership fees at $1.00 a year. The qualifications for membership are: "Any wife or widow of any graduate engineer or of any member of a recognized professional engineering society."

The Association was formed as a purely social organization, but under wartime pressure it was felt we must contribute in some way to the war effort in order to justify our existence. We have two sewing groups and a knitting group and have turned in to Red Cross and V-Bundles of Manitoba an almost unbelievable amount of work. We are also working in Red Cross Sewing Rooms making hospital supplies and garments for our troops. We supply mostly our own materials, which we buy out of our funds. As funds become low they are augmented by various means, such as raffles, teas, etc. Since the Association was formed in May, 1940, we have spent $688.87 on war relief, and have now $65.35 in the War Relief Fund, and $176.58 in the Administration Fund—a healthy financial condition!

We have groups of workers at the United Services Centre, the Central Volunteer Bureau and the Blood Donor Clinic.

There is one professional writer in our Association and several of Winnipeg's outstanding musicians who also give of their time and talent to entertain our men in the services.

And so it goes—the goal of the present Executive being to place every woman in the organization with any spare time at her disposal, wherever she and her own particular talent can be of most use to her country, not forgetting the great value of social contact with one another, friendships formed, and the widening and enriching of women's outlook on world affairs. Engineers will have much to do in the re-construction to follow the war. Our Association feels very strongly that the engineers' wives have something very special to offer in that great effort, and want to feel that they are right in there, thinking and working with their men to make this world a better place to live.

## FAMOUS BRIDGE ENGINEER DIES

Leon S. Moisseiff, world authority on bridges, as well as a leader in structural engineering thought and development for the last half century, died at his summer home in Belmar, N.J., on September 3rd. Mr. Moisseiff, who was 70 years old, lived in New York City, where he had practiced as a consulting engineer since 1915.

Born in Riga, Latvia (then Russia), Mr. Moisseiff came to the United States in 1891, and received his civil engineering degree from Columbia University in 1895.

Although he was engaged in several important engineering projects, it was in the field of suspension bridges that Mr. Mosseiff made his greatest contribution.

He was connected with the design and construction of each of the four structures that are recognized as milestones during the past thirty-five years, the Manhattan, Philadelphia-Camden, George Washington and Tacoma Narrows bridges. The *Engineering News Record* describes as follows his achievements in that field: "As designer of the Manhattan Bridge he introduced the use of the deflection theory as a working tool; all suspension bridges since have benefited from the design procedures then used. As engineer of design on the Philadelphia-Camden Bridge, he was largely responsible for the use of two 30-in. dia. cables instead of four smaller ones which would have followed then-current practice; by thus jumping cable size over 50 per cent above any precedent he paved the way for the 36-in cables of the George Washington Bridge, upon which he was consultant. Finally, he was consultant on the Tacoma Narrows Bridge, whose failure from aerodynamic instability brought this unsuspected and dangerous condition into such prominence that it should never again figure in a suspension bridge failure.

It was typical of Mr. Moiseiff that he was among the most active students of that failure, sparing neither his energy or his reputation in supporting attempts to squeeze the last ounce of useful knowledge out of the disaster. At the time of his death he was chairman of the committee on interpretation and analysis appointed by the PRA, after the Tacoma failure, to investigate the entire range of fundamentals applying to long-span suspension bridge design."

## WASHINGTON LETTER

While it is beyond the scope of these letters to comment too specifically on interesting developments in Washington, it may not be amiss to mention as a matter of record several of the more significant events which have taken place during the last four or five weeks. The past month has been an extremely interesting one. For instance, there was the appointment of Mr. Stettinius as Undersecretary of State. Handsome, silver-haired, forty-two years old Mr. E. R. Stettinius has a brilliant record as a skilled negotiator. Starting in labour relations work, he became a vice-president of General Motors at thirty and chairman of the board of U.S. Steel at thirty-eight. He has the confidence of both labour and business and is popular with both the Congress and Senate. He is known to be a friend of Russia and China and of all other countries who have benefited as a result of his championship as Lend-Lease Administrator. Coupled with Mr. Stettinius' appointment was that of Mr. Averell Harriman as Ambassador to Russia. Then there was the amalgamation of the Office of Lend-Lease Administration, the Office of Economic Warfare, the Office of Foreign Relief and Rehabilitation under the joint direction of Mr. Leo Crowley. This amalgamation places the control of all American foreign economic dealings under one head. Mr. Crowley has great qualifications and a very interesting background and when we called upon him shortly after his appointment, he did not seem to be in the least dismayed by the magnitude of the great task which he was undertaking. The combined agency is to be known as the "Office of Foreign Economic Administration" and Mr. Crowley will report directly to the President. Then, too, there have been the important currency control conferences at which Britain has been represented by such men as Lord Keynes and Lionel Robbins. Also much in the news have been the five Senators who recently returned from their round-the-world trip. (In the last several days I have had most interesting discussions with several of these Senators.) All these events gain in importance by virtue of being timed to precede the announcement of the Moscow Conference for which Mr. Hull and Mr. Harriman have, as this is written, just landed in Russia.

* * *

Speaking of discussions with world travellers, it was an interesting experience, particularly from an engineering point of view, to discuss with General Knudsen his recent trip to the southwest Pacific. The General is reputed to be one of the leading production authorities in America and his background certainly shows in his reactions to the things and events. He told us that, when visiting industrial plants he rarely enters the office but much prefers to go directly into the shop and talk to the men at the machines. He visited a number of the same plants which I had gone through a few months previously in Australia and some of his observations and comments, based on a word here and a word there, were extremely shrewd. As opposed to this very detailed approach on the one hand, on the other his standards of measurement and judgment are almost breathtaking in their scope. Very interesting were some of the yardsticks which he used in measuring situations. He ran through the leading countries of the world in terms of their steel output per head of population; he traced the development of the modern aeroplane in terms of the average weight of all types of planes; he discussed the trend in aircraft production in terms of man-hours per pound of aircraft; and with a few basic statistics he showed the advantages of the policies of standardization and of limiting types of planes in any one plant.

* * *

At lunch the other day, Dr. Briggs, director of the National Bureau of Standards was commenting on the role of research in the next few decades. He traced a number of scientific advances which have grown out of the war into their probable ramification for peace-time usage. He ventured the opinion that the expenditure of ability and time and money in research within the next twenty years will probably pay far greater dividends than ever before. He suggested that money previously spent on advertising would, in the future, be more profitably devoted to research. His remarks reminded me of Dr. Wickenden's observation: "Ignorance, rather than perversity and greed, is still man's costliest enemy and research, in the long run, still man's most profitable investment." I recently had a very confidential talk with an official who had just returned from investigations in England in connection with the latest developments in Radar. Here is a story which will fire the imagination, when it can be told. As a matter of fact, the increasingly important role being played by the research engineer and the leading research enterprises has been a most interesting development to watch. No doubt there will be a certain amount of reaction after the war, but, in a phrase which appeared somewhere recently, "Research is King." An increasing amount of money is being devoted by both public and private enterprises over an ever widening field. Under the aegis of the National Academy of Science is the National Research Council, the National Advisory Committee for Aeronautics, the National Inventors Council and the National Roster for Scientific and Specialized Personnel. Operating on a budget of some $75,000,000 a year, is the Office of Scientific Research and Development headed by Dr. Vannevar Bush. Assisting the War Production Board is the Office of Production Research and Development headed by Dr. H. N. Davis. In the industrial field, Dr. Frank Jewett of Bell Laboratories, Dr. Gustav Egloff of the Universal Oil Products and Amory Houghton of Corning Glass are all names in the news. Another evidence of the trend is the fact that political leaders are adopting the practice of appointing outstanding scientists to the full time task of advising them on scientific matters. One of America's leading scientists is said to be acting as a full time advisor to the Secretary of War. Lord Cherwell is said to be constantly at Prime Minister Churchill's side and to spend much of his time at 10 Downing Street. He is known in England as "The Scientific Prime Minister." Not only is research coming more fully into its own in its usual fields, but the techniques of modern research are being widely extended to include the social sciences. No large industry will be able to afford to be without the guidance and stimulation of a vigorous department of research and development. Such departments will direct their attention not only to the industry's product and future developments thereof but also to social, political and economic implications as they may affect either the product or the work and future of the industry itself.

* * *

One of the interesting developments of modern war is the excellent work being done in the preparation by the Services of documentary films. An example of superb workmanship is to be found in the recent coloured film entitled "Report from the Aleutians" which was produced by the United States Signal Corps.

E. R. Jacobsen, M.E.I.C.

## LABOUR LEGISLATION IN SASKATCHEWAN

Reference was made, in the June issue of the *Journal*, to the negotiations which had taken place, a few weeks before at Toronto and Ottawa, for the enactment of compulsory collective bargaining legislation.

It is interesting to note that similar measures are being considered in Saskatchewan. During the months of July and August, the Martin Labour Commission, established by the government of that province, conducted public hearings in various cities to gather expressions of opinion on the principle of compulsory collective bargaining as set out in Bill 51. This bill purports to define the rights of employees to organize and provides for conciliation and arbitration of industrial disputes.

At the final hearing in Regina, on August 18th, the Saskatchewan Branch of The Engineering Institute of Canada and the Association of Professional Engineers of Saskatchewan were represented. W. R. Kinsman, appearing on behalf of the members of the professions, urged that the bill, if enacted, excludes from its application or operation all employees of the learned and scientific professions. This is in line with the attitude taken by the professions in Ontario. At one advanced stage in the preparation of similar legislation in that province, sufficient pressure was applied by the unions that the clause excluding the professions was withdrawn from the bill. Fortunately the immediate application of similar pressure from the professional groups caused the exclusion clause to be re-inserted. A similar stand towards such legislation was taken by the delegation which, a few weeks later, presented a brief to the National War Labour Board at Ottawa.

It is not indicated whether or not organized labour in Saskatchewan considers the learned and scientific professions as part of its field of influence, but the representations made by the engineering profession at Regina will define the attitude of the professions in this regard and will prevent, it is hoped, the enactment of such measures as nearly went through in Ontario.

## CORRESPONDENCE

Fort William,<br>Ontario, Canada,<br>October 5th, 1943.

The Editor,<br>The Engineering Journal,<br>Montreal, Que.

Dear Sir,

I read with interest the article on "Housing and Community Planning" appearing in the September issue of *The Engineering Journal* but find that I must disagree with some of the statements and sentiments expressed therein.

Firstly, concerning the "Burnham Plan," considerable public education was carried on by means of what was termed the "Wacker Manual" used in Chicago's public schools to explain to the people the Plan and its ideals. This manual was not used until 1912, which tends to show that there was not an immediate acceptance of the Plan.

Secondly, the Burnham Plan was purely a Plan for the beautification of the City of Chicago and in no way considered the deterioration of the residential districts or the replanning of the slum areas, with the resultant loss of tax income to the City; it did not conceive of a city being a pleasant place in which to *live* and *work*. From 1909 to 1929, some $300,000,000 were spent on such projects as the lake-front development, the Michigan Avenue bridge, the Roosevelt Road viaduct and the straightening of the Chicago River channel—all purely physical changes of the city, but not one cent was spent in rehabilitating the increasing loss in land values of the older residential districts or in the alleviation of conditions in the Loop district, in short there was no relationship between the physical plan of the city and the people of the city.

A city exists for its people, but the people make the city and the economic factors decide whether or not the people will remain in it or move away.

In 1940 Chicago commenced the study of a new Master Plan for the city, which is now ready and has, I believe, been accepted. Two things have led to the necessity for this new plan; one, that the 1908 plan was a physical plan and, two, that economics and sociology were not considered a necessary part of Town Planning in 1908. Therefore, to say the Burnham Plan is the most successful piece of Town Planning is hardly correct since it missed the most essential requirements of planning—that of the consideration of the people and their welfare.

The sentiment that economics and sociology are not the prime factors in Town Planning is refuted by this failure of the Burnham Plan to stand up after only some thirty years, and it will be found impossible to institute any physical plan unless the economics of the project are sound.

It is not intended by this letter to deride physical planning but rather to point out that any one form of planning is valueless and impractical without the other two, and that the three should work hand in hand.

Yours truly,

J. Murchison, M.E.I.C.,

Engineer-Secretary,
Town Planning Commission.

## MEETING OF COUNCIL

A regional meeting of the Council of the Institute was held at the Fort Garry Hotel, Winnipeg, Manitoba, on Saturday, October 23rd, 1943, convening at ten o'clock a.m.

*Present:* President K. M. Cameron (Ottawa), in the chair; Vice-President W. P. Brereton (Winnipeg); Councillors E. Nelson (Edmonton), A. M. Macgillivray (Saskatoon), J. W. Sanger (Winnipeg), C. E. Webb (Vancouver), and Assistant General Secretary Louis Trudel.

There were also present by invitation—Past-President S. G. Porter (Calgary); Past Councillors P. E. Doncaster, E. P. Fetherstonhaugh, N. M. Hall, A. E. Macdonald and W. M. Scott, all of Winnipeg; H. S. Rimmington (Winnipeg) President of the Association of Professional Engineers of the Province of Manitoba; G. A. Gaherty (Montreal), chairman of the Institute's Committee on Western Water Problems; and the following members of the Winnipeg Branch: J. T. Dyment, chairman, T. H. Kirby, vice-chairman, D. M. Stephens, past-chairman, T. E. Storey, secretary-treasurer, C. V. Antenbring, B. B. Hogarth and R. H. Robinson, members of the executive, and J. D. Peart, chairman of branch membership committee.

President Cameron expressed his pleasure at presiding over this regional meeting in Winnipeg, and extended a cordial welcome to all councillors and guests. He appreciated particularly the number of present and past councillors who had come from outside points to attend the meeting. All were invited to take part in the various discussions. Following the usual custom, the president asked each person present to rise, give his name, place of residence and Institute affiliation.

*The Engineer in the Civil Service*—The Institute's Committee on the Engineer in the Civil Service had presented to the Minister of Finance a letter urging that further consideration be given to the remuneration of engineers in the civil service. A copy of the letter and a brief report of the interview appeared in the October number of the *Journal.*

Considerable discussion took place, in which the seriousness of the situation was emphasized. It was pointed out that it was necessary that the government be on an equal footing with private enterprise in competing for engineers' services in the post-war reconstruction work.

Following the discussion, it was unanimously resolved that the Institute's committee be asked to continue its efforts and to urge upon Mr. Ilsley the necessity of some adjustment being made if the government is to secure the services of the high grade engineers who will be needed in the post-war period. It was also suggested that provincial and municipal governments might be asked to give this matter serious consideration.

The attention of the meeting was drawn to collective bargaining legislation which is being introduced in the various provinces, and the necessity of continued watchfulness on the part of engineers to insure that professional men are not disadvantageously included in such legislation.

The president pointed out that after the experience in one of the provinces a few months ago, great vigilance was being exercised by the Institute. It was unlikely that any labour legislation unfavourable to engineers would be introduced without being known to officers of the Institute.

For the information of the meeting Mr. Kirby produced a copy of *Time* for October 25th in which reference was made to the action of the American Society of Civil Engineers in setting up collective bargaining committees in their local Sections.

*Committee on Post-War Problems*—No report had been received from the Committee on Post-War Problems, but the President pointed out that the committee was preparing a brief to be presented to the House of Commons' Committee under the chairmanship of Mr. Turgeon. The committee would be glad to receive from members any suggestions regarding post-war planning.

*Committee on Professional Interests*—The president reviewed briefly the recommendations of the Committee on Professional Interests as presented in their progress report which had been accepted and approved by Council at the regional meetings in Saint John and Quebec. A further report making definite recommendations had been circulated to all councillors, and had been approved at the regional meeting of Council held in London, Ont., on September 11th. In order that the western members of Council might have an opportunity of discussing the report, this item had been placed on the agenda for this meeting.

In reviewing the committee's report, the president explained the advantages to be gained by closer co-operation with sister societies. The most important recommendation of the committee was that provincial professional associations and sister societies with whom the Institute had or might have co-operative agreements, should be represented on the Institute Council, such representatives to be members of both organizations and resident in Canada.

A period of discussion followed in which some members present expressed the opinion that in such agreements with sister societies, provision should be made so that the standards of admission to the Institute would be maintained. The question was also raised as to the possibility of outside representation on Council outweighing the representation from the Institute branches. It was pointed out, however, that this was not likely to occur; in addition, such representatives would also be members of the Institute resident in Canada.

Following further discussion, the meeting confirmed the decision of the September meeting of Council.

Following conferences between representatives of the Institute's Committee on Professional Interests and representatives of the American Society of Mechanical Engineers a report with recommendations to the Councils of the two bodies had been prepared. The assistant general secretary read the report which had been adopted by the Council of the A.S.M.E. at a meeting held in Toronto on October 2nd at the time of the joint meeting with the Institute. The report was now presented to the Council of the Institute for consideration and adoption if approved.

The report made specific recommendations for continued and more intensive co-operation between the two bodies. All members present were in favour of the proposal and the report was adopted.

*Canadian Chamber of Commerce*—At the last meeting of Council it had been left with the President and Mr. Beaubien to nominate a member of the Institute to replace Mr. Beaubien as the Institute's representative on the Board of the Canadian Chamber of Commerce. The President reported that Past-President Dr. Arthur Surveyer has been so nominated, and this nomination was unanimously approved by Council.

*Financial Statement*—It was noted that the financial statement to the end of September had been examined by the Finance Committee and found satisfactory.

*Julian C. Smith Medal*—Mr. Storey and Mr. Antenbring were appointed scrutineers to open the ballot for the Julian C. Smith Medal. Their report showed a unanimous ballot in favour of awarding two medals—one to Past-President George Joseph Desbarats, of Ottawa, and one to Dr. Frederic Henry Sexton, President of the Nova Scotia Technical College, Halifax, N.S.

*Engineers' Council for Professional Development*—Past-President J. B. Challies was nominated as the Institute's representative on the executive of the Engineers' Council for Professional Development for the next year. As the appointment was to be made at the annual meeting of E.C.P.D. being held in New York on the same day as the Council meeting, the assistant general secretary was instructed to wire the nomination.

*Student Section of the Vancouver Branch*—It was reported that the president's recent visit to the students at the University of British Columbia had been much appreciated, and as an evidence of the increased interest in Institute affairs Mr. Webb presented a petition, signed by twenty-eight members of the Civil Engineering Society at the University, asking permission to form a Student Section of the Institute. Three of the students signing the application were members of the Institute, and signed letters of application, endorsed by Dean J. N. Finlayson, were submitted from twenty-one of the students.

Council heartily approved of the formation of such a section, and in accordance with the applications received, those students at the University of British Columbia were accepted as Students of the Institute.

*Elections and Transfers*—A number of applications were considered and the following elections and transfers were effected:

*Members*

**Anderson,** Kenneth Hunter, B.Eng. (Mech.), (Univ. of Sask.), tool engr., General Engineering Co. (Canada) Ltd., Toronto, Ont.

**Archambault,** Raymond G., B.A.Sc., C.E., (Ecole Polytechnique), asst. divn. engr., Dept. of Roads, Prov. of Quebec, Boucherville, Que.

**Genest,** Adrien, B.A.Sc., C.E., (Ecole Polytechnique), technical divn., City of Montreal, Montreal, Que.

**Lenoir,** Jean Auguste, B.A.Sc., C.E., (Ecole Polytechnique), district engr., Dept. of Roads, Prov. of Quebec, St. Laurent, Que.

**MacKenzie,** Hugh, engr. mgr., West Coast Shipbuilders, Ltd., Vancouver, B.C.

**Radley,** Percy Edward, B.Sc. (Chem.), (McGill Univ.), works mgr., Aluminum Co. of Canada, Arvida, Que.

**Rubush,** James Prosser, (U.S. Naval Academy), executive engr., Swenson Evaporator Co. and Whiting Corp. (Canada) Ltd., Homewood, Illinois.

**Waite,** Matthew John, B.Sc., (Queen's Univ.), asst. mech. supt., Aluminum Co. of Canada, Arvida, Que.

**Wilson,** John Tuzo, B.A., (Univ. of Toronto), B.A., M.A., (Cantab), Ph.D., (Princeton Univ.), A/Lieut.-Colonel, R.C.E., G.S.O., I, Tech. Sec., G Branch, Canadian Military Hdqrs., Canadian Army Overseas.

*Juniors*

**Dowell,** Eugene Harris, B.Eng., (N.S. Tech. Coll.), P/O, R.C.A.F., 1470 Bernard Ave., Apt. 15, Montreal, Que.

**Jull,** Thomas Alfred, B.A.Sc., (Univ. of Toronto), test engr., pump divn., John Inglis Co. Ltd., Toronto, Ont.

**Uloth,** Milton MacRitchie, B.Eng., (Elec.), (N.S. Tech. Coll.), junior engr., motor engrg. dept., Canadian General Electric Co., Peterborough, Ont.

*Transferred from the class of Junior to that of Member*

**Fleming,** Frederick Alexander, B.A.Sc., (Univ. of Toronto), Deputy Asst. Director of Inspn. (E.E.), Inspection Board of U.K. and Canada, Ottawa, Ont.

**Macredie,** John Robert Calderwood, B.Sc., (Univ. of N.B.), tech. asst. to records engr., Allied War Supplies Corpn., Montreal, Que.

**Miller,** Donald Waters, B.Sc., (Univ. of Man.), asst. mgr., Newfoundland Fluorspar, Ltd., St. Lawrence, Nfld.

**McKibbin,** Kenneth Holdsworth, B.Sc., (Queen's Univ.), Lieut.-Colonel, R.C.O.C., (D.O.M.E.), Military District No. 6, Halifax, N.S.

**Reeve,** David Douglas, B.A.Sc., (Univ. of B.C.), chief dftsmn., Aluminum Co. of Canada, Ltd., Arvida, Que.

**Taylor,** William Russell Coates, B.Sc., (Univ. of Man.), Squadron Leader, R.C.A.F., 4685 W. 11th Ave., Vancouver, B.C.

*Transferred from the class of Student to that of Junior*

**Alexander,** Alwin Paul, B.Sc., (Univ. of Alta.), asst. to chief electrician, Iron Ore Sintering Plant of Algoma Ore Properties, Ltd., Helen Mine, Ontario.

**Allen,** Richard Thomas Webster, B.Sc., (Univ. of Alta.), engr., Gatineau Power Co., Ottawa, Ont.

**Callum,** John Park, B.Sc., (Queen's Univ.), asst. mech. supt., Algoma Steel Corp., Sault Ste. Marie, Ont.

**Duchastel,** Pierre Arthur, B.Eng., (McGill Univ.), junior research engr., National Research Council, Ottawa, Ont. (On loan from Ferranti Electric Ltd.)

**Fast,** Morris, B.E., (Univ. of Sask.), mtce. engr., Aluminum Co. of Canada, Shawinigan Falls, Que.

**Morris,** Robert McCoul, B.Eng., (N.S. Tech. Coll.), junior research engr., Dept. of Physics and Elect'l Engrg., National Research Council, Ottawa, Ont.

**Noble,** William Lawrence, B.Sc., (Univ. of Sask.), estimator, Canadian Bridge Co. Ltd., Walkerville, Ont.

*Admitted as Students*

**Cross,** Harold Morrey, B.Eng., (McGill Univ.), 2nd Lieut., R.C.E. 223 Lazard Ave., Town of Mount Royal.

**Wray,** John David, (Univ. of Toronto), 402 Huron Street, Toronto, Ont.

*Students at Ecole Polytechnique*

**Delisle,** Maurice, 6658 Iberville St., Montreal, Que.

**Martel,** Jean-Marie, 4403 St. André, Montreal, Que.

**Morin,** Joseph-Henri, 274 Bernard Ave. West, Montreal, Que.

**Nobert,** Jean-Baptiste, 2240 Bernard Ave., Montreal, Que.

**Pruneau,** Amédée, 82 St. Joseph Blvd. West, Montreal, Que.

**St. Martin,** Maurice, 982 Montcalm St., Montreal, Que.

**Tétreault,** Rolland, 1430 St. Denis St., Montreal, Que.

**Trottier,** Alfred, 8777 Routhier St., Montreal, Que.

*Students at McGill University*

**Bregman,** Asher, 5381 Esplanade Ave., Montreal, Que.

**Cooper,** Glenn Alan, 3473 University St., Montreal, Que.

**Corbet,** Villiers Sankey Blakely, 620 Prince Arthur West, Montreal, Que.

**Crowther,** Edward James, Central Y.M.C.A., Montreal, Que.

**Cumming,** Edwin Keith, 1211 Bishop St., Montreal, Que.

**Dawson,** William Frank, 3475 University St., Montreal, Que.

**McKellar,** Arthur Donald, 1818 Sherbrooke St. West, Montreal, Que.

**Payne,** Robert Law, 4818 Dornal Ave., Montreal, Que.

**Rice,** William Bothwell, 7471 de l'Epée Ave., Montreal, Que.

**Ward,** Richard Albert, 4818 Dornal Ave., Montreal, Que.

**Weinstein,** Saul Arnold, 5611 Jeanne-Mance St., Montreal, Que.

*Students at University of British Columbia*

**Anderson,** J. Douglas, 4038 West 19th Ave., Vancouver, B.C.

**Binnie,** Robert F., 4475 West 12th Ave., Vancouver, B.C.

**Bunnell,** Frank R., 1623 East 12th Ave., Vancouver, B.C.

**Calderhead,** Gordon A., Univ. of B.C., Vancouver, B.C.

**Clay,** C. H., 4570 West 9th Ave., Vancouver, B.C.

**Confutin,** J., 1743 Robson St., Vancouver, B.C.

**Cooper,** A. C., 3719 Inman Ave., New Westminster, B.C.

**Dennison,** James A., 1676 East 36th Ave., Vancouver, B.C.

**Fraser,** D. A., 4398 West 8th Ave., Vancouver, B.C.

**Graves,** H. B. R., 2867 West 44th Ave., Vancouver, B.C.

**Hicks,** John B., 6388 Adera St., Vancouver, B.C.

**Hole,** Fred, 7119 Fraser Ave., Vancouver, B.C.

**Kent,** Joseph C., 4727 Wallace St., Vancouver, B.C.

**Lefeaux,** Stuart S., 1195 Clyde Ave., West Vancouver, B.C.

**Mosher,** Vaughan L., Box 18, Lynn Creek, B.C.

**Scott,** W. B., 4635 West 12th Ave., Vancouver, B.C.

**Slater,** John S., 3741 West 35th Ave., Vancouver, B.C.

**Smith,** H. Leslie, No. 9, 1395 West 12th Ave., Vancouver, B.C.

**Stamford,** G. W., Univ. of B.C., Vancouver, B.C.
**Turley,** F. E., 4588 West 2nd Ave., Vancouver, B.C.
**Wigens,** S. O., 4082 West 8th Ave., Vancouver, B.C.

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

NOVA SCOTIA

*Members*

**Cain,** Bernard Newcombe, B.Eng., (N.S. Tech. Coll.), asst. prof., Dept. of Applied Science, Acadia University, Wolfville, N.S.

**Harrison,** William, B.Sc., (Univ. of N.B.), district mgr., Canadian Westinghouse Co. Ltd., Halifax, N.S.

**Jeffrey,** Edgar William, asst. district sales mgr., Northern Electric Co. Ltd., Halifax, N.S.

**Logan,** William Arthur, B.Eng., (N.S. Tech. Coll.), asst. transmission engr., Maritime Telegraph & Telephone Co. Ltd., Halifax, N.S.

**Mills,** Joseph Roger, B.Eng., (N.S. Tech. Coll.), engr., Foundation Maritime Ltd., Halifax, N.S.

**Shaw,** Robert Fletcher, B.Eng., (McGill Univ.), shipyard mgr., Foundation Maritime, Limited, Pictou, N.S.

**Steel,** Harold Leslie, chief dftsmn., structural steel divn., Robb Engineering Works, Amherst, N.S.

*Transferred from the class of Junior to that of Member*

**Moores,** Robert Vernon, B.Eng., (N.S. Tech. Coll.), engr. dftsmn., Canadian Comstock Co., Halifax, N.S.

*Transferred from the class of Student to that of Member*

**Archibald,** Lester Joseph, B.Eng., (N.S. Tech. Coll.), inspr. of refining equipment, Imperial Oil, Ltd., Halifax, Refinery, Dartmouth, N.S.

SASKATCHEWAN

*Students*

**Berry,** Verne Harrington, B.E., (Univ. of Sask.), Sub-Lieut., R.C.-N.V.R., c/o Fleet Mail Office, London, England.

**Wiles,** Alfred Payne, 1911 Franklin Ave., Saskatoon, Sask.

*Transferred from the class of Student to that of Junior*

**Mantle,** John Bertram, B.Eng., (Univ. of Sask.), F/O, R.C.A.F., No. 8 SFTS., Moncton, N.B.

Past-President Porter and Councillor Webb expressed their pleasure at being able to attend the meeting. They thoroughly endorsed such regional meetings of Council.

It was decided that the next meeting of Council would be held in Montreal on Saturday, November 20th, 1943.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.**

**Major-General Christopher Vokes,** D.S.O., M.E.I.C., is Canada's newest and youngest general. The announcement of his promotion to this rank and his appointment to command a division came early this month from Canadian Military Headquarters. In the recent Sicily campaign, he commanded the 2nd Brigade which was composed of the Princess Patricia's Canadian Light Infantry, the Loyal Edmonton Regiment and the Seaforth Highlanders of Canada, a Vancouver unit. General Vokes was given some of the toughest tasks to carry out in the Sicilian fighting but he always came through, Ross Munro, Canadian Press war correspondent, cabled at the time his D.S.O. was announced.

Born in Armagh, Ireland, in 1904, General Vokes was educated at the Royal Military College, Kingston, and McGill University, Montreal, where he obtained his civil engineering degree in 1927. He then joined the permanent force, in the Royal Canadian Engineers.

**Past-President C. J. Mackenzie,** M.E.I.C., was awarded the honorary degree of LL.D. at the University of Western Ontario on October 22. Past-President Mackenzie is acting president of the National Research Council and dean of engineering of the University of Saskatchewan.

**A. O. Dufresne,** M.E.I.C., deputy minister of the Department of Mines of Quebec, has recently been elected president of the ACFAS (Association Canadienne-Française pour l'Avancement des Sciences). Mr. Dufresne is also president of the Corporation of Professional Engineers of the Province of Quebec.

**Brigadier J. L. Melville,** M.C., E.D., M.E.I.C., has been appointed chairman of the Canadian Pension Commission succeeding Brigadier-General H. F. McDonald who died recently. He has also been made a member and constituted vice-chairman of the General Advisory Committee on Demobilization and Re-establishment. Brigadier Melville had been appointed chief engineer of the Canadian Army Overseas last June, and has been granted release from that post to take his new appointment. He has been an official of the Pensions and National Health Department and its predecessor, the Soldiers' Civil Re-establishment Department, since the First Great War, and was granted leave of absence to rejoin the Forces in May, 1940.

**Lt.-Col. C. N. Mitchell,** V.C., M.C., M.E.I.C., has recently returned to Canada after more than three years of overseas service in the present war.

Promoted from a captaincy, his Great War retiring rank, to a majority appointment to command the Montreal company of the 2nd Pioneer Battalion R.C.E. he went overseas and subsequently took command of a Field Company in Corps troops. Later he was promoted lieutenant-colonel and placed in charge of the training of engineer reinforcements.

Colonel Mitchell was awarded the V.C. in the last war for saving the Canal de l'Escaut bridges, outside of Cambrai.

**T. R. Loudon,** M.E.I.C., formerly professor of applied mechanics, has succeeded Dean C. R. Young as head of the Department of Civil Engineering at the University of Toronto, with the title of professor of civil engineering and aeronautics. Professor Loudon has served for the past three years on special technical duty with the R.C.A.F. In March 1940, he was granted leave of absence from the University to become commanding officer of the first school of aeronautical engineering under the British Commonwealth Air Training Plan, at Montreal, with the rank of squadron leader. After eight months of service in this capacity he was promoted to the rank of wing-commander and made chief technical officer of the Flight Research Establishment, R.C.A.F., Rockcliffe, Ottawa. In May, 1941, he was placed in command of the entire Test and Development Establishment, R.C.A.F., at the same station.

A native of Toronto, Professor Loudon graduated from the University of Toronto in 1906 with the degree of B.A.Sc. He joined the staff of the University of Toronto in 1907 as a lecturer in the Faculty of Applied Science and Engineering. He has continued his association with the University from that time and has also become widely known as a consultant. For a time he was associated with the late Dr. A. H.

Harkness in the firm of Harkness, Loudon & Hertzberg. He resigned from the firm in 1929 and since that time has practiced as a consultant on his own behalf.

During the last war, Professor Loudon served with the Royal Canadian Engineers overseas and on returning to Canada he became active in the University of Toronto Contingent, C.O.T.C., which he commanded for a time, with the rank of lieutenant-colonel. He will retain his connection with the forces as commanding officer of the University of Toronto Air Training Corps. Professor Loudon has been actively interested in aeronautics for many years, and it is largely due to his energy and foresight that aeronautical instruction has been developed in the University of Toronto.

**Captain T. Hogg,** M.E.I.C., is on loan from the Prairie Farm Rehabilitation Administration, Regina, to Major-General W. W. Foster, D.S.O., who is the Special Commissioner for Defence Projects in Northwest Canada, with offices at Edmonton. Captain Hogg's position is that of Administration Officer to General Foster. The Special Commissioner and his staff come under the immediate jurisdiction of the War Committee of the Cabinet, Ottawa.

**F. E. M. Thrupp,** M.E.I.C., who for the last few months had been stationed in Montreal, has been transferred to be supply officer in the British Ministry of Supply Mission in Washington, D.C. Before the war, Mr. Thrupp was manager for Canada and Newfoundland of the Buell Combustion Company Limited of London, England.

**R. H. Rimmer,** M.E.I.C., immediate past-chairman of the Saguenay Branch of the Institute, has recently been transferred from Arvida to Montreal where he will be manager of the technical department of the Aluminum Company of Canada. He was previously in charge of research and development work at Arvida.

**C. D. Wight,** M.E.I.C., assistant waterworks engineer of Ottawa has been appointed city works assistant.

**Fred. C. Eley,** M.E.I.C., sales engineer, Amalgamated Electric Corporation Limited, is the newly elected chairman of the Toronto section of the Illuminating Engineering Society.

**Major J. P. Carrière,** M.E.I.C., has recently returned overseas to the 3rd Battalion R.C.E.

**Lieutenant-Colonel LeSueur Brodie,** M.E.I.C., of the Department of National Defence Headquarters, Ottawa, has recently been promoted from the rank of major. He was among the first Bell Telephone men to enlist for active service during the early months of the war. Lt.-Col. Brodie, a telephone engineer, was associated with the company's rates and equipment department. He is a former manager of the company's office in the Brantford district and was in charge of switchboard operations of the royal train during the visit of Their Majesties the King and Queen in 1939.

**R. F. Legget,** M.E.I.C., has been promoted from the post of assistant professor to that of associate professor of civil engineering at the University of Toronto. Professor Legget graduated from the University of Liverpool and was engaged in the practical work of his profession for 11 years before he entered upon university work. He was appointed to the staff of the University of Toronto five years ago, after having been on the staff of Queen's University for two years.

**E. S. Holloway,** M.E.I.C., has joined the staff of Commonwealth Plywood Company at Ste-Thérèse, Que., where he is in charge of plant maintenance, repairs and construction. He was previously engaged as resident engineer on fitting out berths at Lauzon, Que., and Louise Basin, Quebec.

**Major Lyle G. Trorey,** M.E.I.C., is now officer commanding Fourth Canadian Field Survey Company, Royal Canadian Engineers, Canadian Army Overseas. Before enlisting, Major Trorey was with the Department of Public Works of British Columbia.

**Charles Miller, M.E.I.C.**

**Charles Miller,** M.E.I.C., chief engineer of Aluminum Power Company Limited is the newly elected chairman of the Saguenay Branch of the Institute. Mr. Miller has been with the Aluminum Company ever since his graduation in civil engineering from Queen's University in 1930. He first joined the engineering staff of Saguenay Power Company and in 1937 was promoted to the position of hydraulic engineer. In 1941 he was resident engineer on the construction of Lake Manouan storage dam for the Aluminum Company. From 1941 until early this year when he was promoted to resident engineer, he was assistant resident engineer on construction of the Shipshaw power development for the Aluminum Company. In June of this year, Mr. Miller was appointed chief engineer of Aluminum Power Company Limited.

**H. J. Ward, M.E.I.C.**

**H. John Ward,** M.E.I.C., consulting representative of the Holophane Company Limited, has been elected chairman of the Montreal Branch of the Illuminating Engineering Society. Mr. Ward has specialized in lighting problems for more than thirty years. He has represented the Holophane Company in Quebec and eastern Ontario since 1929.

**F. L. Black,** M.E.I.C., has recently been appointed to the staff of the Hydro-Electric Power Commission of Ontario, Toronto. For the past three years he had been employed as assistant and later acting electrical superintendent in the Belgo mill of the Consolidated Paper Corporation, at Shawinigan Falls, Que. For five years previously he had been on the staff of the New Brunswick Electric Power Commission. Mr. Black is a past secretary-treasurer of the Saint John Branch of the Institute. In 1930 he was awarded the Martin Murphy Prize of the Institute.

**H. H. James,** M.E.I.C., has been transferred from Arvida, Que., to the Montreal office of the Aluminum Company of Canada Limited.

**J. S. Macleod,** M.E.I.C., has retired from his position as superintending engineer of the Department of Transport at Sault Ste-Marie, Ont., and has moved to Toronto. Mr. Macleod has been with the canals administration of the Dominion since 1904, when he was engaged in survey work on the Trent Canal, first as a rodman and later as a draughtsman. He was promoted to assistant engineer on construction in 1909 and for a number of years before he went to Sault Ste-Marie he was located at Cornwall, Ont., with the Ontario and St. Lawrence Canals.

**H. B. Montizambert,** M.E.I.C., has joined the staff of J. L. E. Price & Company Limited and is now stationed at Arvida, Que.

**Paul Pelletier,** Jr.E.I.C., has been loaned by the LaSalle Coke Company to the Department of Munitions and Supply where he is technical adviser to the Solid Fuel Controller, in Montreal. Upon graduation from the Ecole Polytechnique, in 1938, he went to the Montreal Catholic Schools Commission where he was employed until 1940 as assistant to the chief engineer. In 1940 he joined the Montreal Coke & Manufacturing Company and in 1941 was made service manager of LaSalle Coke Company. Last year he was on loan to Collet Frères, engineers and contractors, as field engineer on construction of the Westmount Tool Works of Defence Industries Limited.

**Flying Officer J. B. Sweeney,** Jr.E.I.C., has recently been promoted from the rank of pilot officer and is at present stationed at No. 17 Service Flying Training School, at Souris, Man.

Before enlisting last year F/O Sweeney was employed with Consolidated Paper Corporation at Grand'Mère, Que., and he was secretary-treasurer of the St. Maurice Valley Branch of the Institute.

**Marcel G. Larivière,** Jr.E.I.C., a junior engineer attached to the Ottawa district office of the Department of Public Works of Canada, has returned to Ottawa after having spent two years in New Westminster, B.C., where he was on loan to the district office.

**Lionel D. Swift,** Jr.E.I.C., assistant superintendent of the Quebec terminal station of the Shawinigan Water & Power Company, has recently been appointed lecturer on relays and protection in the department of electrical engineering at Laval University, Quebec.

Mr. Swift graduated at McGill University in 1934 and has been with the Shawinigan Water & Power Company ever since.

**F. A. Masse,** Jr.E.I.C., has taken a position with the Dominion Packaging Company in Montreal. He was previously employed with Bowaters Newfoundland Pulp and Paper Company at Conerbrook, Nfld.

**T. S. McMillan,** Jr.E.I.C., is now employed as general supervisor of maintenance with Noorduyn Aviation Limited, Montreal. He was previously with the Montreal Works of Defence Industries Limited.

**Sub-Lieut. (E) A. H. Berry,** S.E.I.C., of St. Lambert, Que., is now serving with the Royal Navy after having undergone a term of initial training at a Canadian Naval College. Mr. Berry graduated from McGill University in 1943.

**B. F. Johnston,** S.E.I.C., has joined the R.C.A.F. and is at present stationed at St. Catharines, Ont.

**L. S. Mundy,** S.E.I.C., who graduated last spring in electrical engineering at the University of New Brunswick, is now enrolled for active service with the R.C.N.V.R. as an Electrical Sub-Lieutenant under the chief of Naval Equipment and Supply.

**Sub-Lieut. (E) H. A. Norton,** S.E.I.C., of Montreal, is now serving with the Royal Navy after having undergone a term of initial training at a Canadian Naval College. Mr. Norton graduated from McGill University in 1943.

**Lieut.-Commander (E) D. H. Parker,** Affiliate E.I.C., has recently been appointed to Naval Service Headquarters, Ottawa.

### VISITORS TO HEADQUARTERS

**Robert W. Tassie,** M.E.I.C., president and manager, Empresa Electrica de Guatemala, Guatemala, C.A., on October 8, 1943.

**E. R. Eaton,** M.E.I.C., superintendent, East Mill, Steel Company of Canada Limited, Hamilton, Ont., on October 12, 1943.

**L. L. Thériault,** M.E.I.C., motor vehicles department, Department of Public Works, Fredericton, N.B., and Mrs. Thériault, October 12, 1943.

**Paul Vincent,** M.E.I.C., chief, technical section, Department of Colonization, Quebec, on October 16, 1943.

**Norman W. Brenan,** M.E.I.C., West Saint John, N.B., on October 16, 1943.

**H. G. Angell,** M.E.I.C., assistant district engineer, Royal Canadian Naval Service, St. John's, Nfld., on October 18, 1943.

**Pte. J. F. Callaghan,** S.E.I.C., Yarmouth, N.S., on October 21, 1943.

**J. C. MacDonald,** M.E.I.C., Public Utilities Commission, Province of British Columbia, Victoria, B.C., on October 23, 1943.

# Obituaries

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

**Geoffrey Stead,** M.E.I.C., died at his home in Saint John, N.B., on October 10, 1943. Born at Brooklyn, N.Y., on July 12th, 1872, he was educated at the University of New Brunswick where he received his degrees in 1892. He was the first engineering graduate of the University. Upon graduation he was engaged in railway construction work in New Brunswick and Nova Scotia. In 1895 he was employed for a few months as assistant engineer on construction of the Lake George inclined railway in New York. He returned to New Brunswick in 1896 to work as assistant engineer on the Woodstock and Centreville Railway. In 1897-98 he was assistant engineer on road and sewer construction in Queen's County, New York, and in 1899 he was connected with the construction of wharf and railway terminal of the Georgia and Alabama Railway in Savannah, Ga. Later in the same year, he was in charge of construction of 15 miles of the Nova Scotia Southern Railway.

In 1900, Mr. Stead joined the Department of Public Works of Canada as an assistant engineer at Saint John, N.B. In 1904 he became engineer in charge of the Department for the northern and eastern district of New Brunswick. From 1905 to 1921 he was district engineer with headquarters at Chatham, N.B. In 1921 he became district engineer in charge of the whole territory in New Brunswick with headquarters at Saint John. In this capacity he supervised all construction work done by the Department in New Brunswick until 1939 when he retired. For the 39 years he was employed in the Department, he served under 16 different ministers of Public Works.

Mr. Stead was one of the most familiar figures at annual meetings of the Institute. From 1907 until 1942 he attended 26 such meetings not counting the several Maritimes professional meetings.

**Geoffrey Stead, M.E.I.C.**

Mr. Stead joined the Institute in 1900 as an Associate Member and was transferred to Member in 1921. He was made a Life Member in 1937. He was chairman of the Saint John Branch at one time and a councillor of the Institute, in 1927. He was also president of the Association of Professional Engineers of New Brunswick.

**LeRoy Z. Wilson,** M.E.I.C., widely known bridge and structural engineer and former vice-president of the Dominion Bridge Company Limited, died in Sydney, Australia, on September 8, 1943.

Born in Brampton, Ont., in 1889, he received his education at the University of Toronto, where he graduated in 1911. He then joined the engineering staff of the Dominion Bridge Company at Montreal.

Shortly after the outbreak of the first war, he enlisted in the Canadian Overseas Railway Construction Corps. As a result of his services he was awarded the Military Cross, and in 1918 he was seconded for special duties at the War Office in London, England.

He rejoined the Dominion Bridge Company when he returned to Canada after the end of the war. He rapidly rose to prominence in engineering circles. He was vice-president in charge of engineering for the company where he performed his most outstanding achievement, construction of the Jacques-Cartier bridge in Montreal.

Accepting an invitation from the Australian firm of Evans, Deakin, Hornibrook Construction, Pty., Limited, in 1935, he went to Australia to construct the Brisbane Harbour bridge which is similar to the Montreal Harbour structure. Interests which had been prominent in promoting the Brisbane bridge persuaded him to remain in Australia after its completion, and up to the time of his death he was associated with Hume Steel Limited, of Sydney, Australia.

Mr. Wilson joined the Institute as a Student in 1910, transferring to Junior in 1913. He became Associate Member in 1915 and transferred to Member in 1933.

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## CALGARY BRANCH

K. W. Mitchell, M.E.I.C. - *Secretary-Treasurer*
A. B. Geddes, M.E.I.C. - *Branch News Editor*

On Friday, October 8th, the Calgary Branch was honoured with a visit by our president Mr. K. M. Cameron and Mrs. Cameron.

The executive of the branch had lunch with Mr. Cameron while the ladies entertainment committee entertained Mrs. Cameron at a luncheon at the Calgary Golf and Country Club. Following the luncheon Mr. and Mrs. Cameron were taken for a drive around the city.

At 6 o'clock, a dinner meeting was held in the main dining room of the Palliser Hotel, which was well attended by members and their wives. Following the dinner the ladies adjourned to an adjacent room to enjoy an evening of bridge while the members re-assembled to hear an outstanding and inspiring address by Mr. Cameron on **Post-War Planning.**

Mr. Cameron stressed the fact that engineers must take a hand in the post-war picture, and all architects, conservationists, engineers, town and community planners and all technical men must be enlisted in the task of building our post-war world.

He traced the history following the first world war which was followed by a short boom and then a short depression. After this a period of expanding business during the nineteen twenties followed by the crash in 1929.

Then followed the last depression with its unemployment from which we were emerging in 1939 when the present war broke upon us.

Our president quoted some figures showing the growth of the armed services from 10,200 in pre-war times to 722,000 to-day, including 20,000 women. This combined with direct war workers made a total of 1,750,000, for which re-employment would have to be found.

The amount of planning that business did now would determine the extent of Government control in the post-war period and he urged business to give thought and consideration to careful planning for times of peace.

The necessity of real co-operation between business and government were stressed and the need of keeping our construction industry active after the cessation of hostilities.

It was pointed out that normally about 20 per cent of our entire national income or one dollar in five goes into durable goods and that when this ratio drops we have a depression and when it rises periods of prosperity.

The errors in our policy of public works during the last depression were pointed out, lack of proper co-ordination and planning, the practice of rotating labour and the fact that most projects were "dirt-moving" jobs suitable for unskilled labour only.

Mr. Cameron did not look for any revolutionary changes at the end of the war but rather evolutionary developments which if we are ready with a well-planned programme from an engineering, technical and legal standpoint, would avoid our major post-war difficulties.

Mr. Cameron was introduced to the meeting by J. G. MacGregor, president of the Calgary Branch, and at the conclusion a vote of thanks was extended on behalf of the meeting by S. G. Coultis.

Other guests who were introduced to the meeting and spoke briefly were: B. L. Thorne, past-president of the Canadian Institute of Mining and Metallurgy; P. M. Sauder, Edmonton, director of Alberta Water Resources; G. A. Gaherty, Montreal, president of the Calgary Power Company, and J. A. Tweddle, City Commissioner.

## PRESIDENTIAL VISIT TO CALGARY

Mrs. J. G. MacGregor, President K. M. Cameron, Mrs. Cameron, Branch Chairman J. G. MacGregor.

Past-President S. G. Porter chats with President K. M. Cameron.

The dinner meeting at the Palliser Hotel.

Branch Secretary K. W. Mitchell, Chairman J. G. MacGregor, President K. M. Cameron, Councillor S. G. Coultis.

### HALIFAX BRANCH

S. W. Gray, m.e.i.c. - - *Secretary-Treasurer*
D. C. V. Duff, m.e.i.c. - *Branch News Editor*

The monthly joint dinner meeting of The Engineering Institute of Canada, Halifax Branch, and the Association of Professional Engineers of Nova Scotia, was held in the Nova Scotian Hotel on Thursday, October 28, 1943. G. J. Currie, vice-chairman of the Branch, was in the chair.

The guest speaker for the evening was F. A. Ryan, of the General Electric Company. He gave a very interesting talk on **The Science of Electronics** which has played such an important part in the present war. He made reference to one of the most important adaptations of the science, that of radar, which was in a great measure responsible for enabling Britain to survive the "blitz".

The Very Reverend F. C. Smith, president of St. Mary's College, was present as a guest of the Branch. He gave a short talk before the guest speaker, Mr. Ryan, was introduced. Also present as guests were several students from the Nova Scotia Technical College.

The meeting was attended by 65 members and guests.

### HAMILTON BRANCH

W. E. Brown, m.e.i.c. - *Secretary-Treasurer*
L. C. Sentance, m.e.i.c. - *Branch News Editor*

On Thursday, October 14th, 110 members of the Hamilton Group of the American Institute of Electrical Engineers and the Hamilton Branch of the Institute met jointly to hear an interesting and informative address on **The Ogoki Diversion** by J. R. Montague, c.e., m.e.i.c., assistant hydraulic engineer for the Hydro Electric Power Commission of Ontario.

The speaker, who had been closely associated with the project since its conception, traced its history from 1923 when first preliminary surveys were made, up to 1943 when water actually flowed in the new channels. Subsequent to the signing of an international agreement regarding the diversion of some 5,000 c.f.s., actual construction work on the $5,000,000 project began in December, 1940.

The completion of the "Ogoki" project has accomplished the diversion of a considerable portion of Ogoki river water from its normal course to the Albany river and James Bay and has redirected it through a chain of rivers and lakes such as Lake Nipigon, Nipigon River, the Great Lakes and the St. Lawrence, to the Atlantic Ocean.

A careful topographic and economic study dictated the construction of a main dam 50 feet high and 1,700 feet long at Waboose Rapids on the Ogoki; two auxiliary dams at nearby points served to close low contours. The control dam, for regulating the flow of water over the height of land, was located at South Summit Lake while other auxiliary dams at Chappais Lake and Snake Creek helped create a new lake 120 square miles in extent. The several dams and channel improvements were designed to carry a maximum of 10,000 second feet.

In describing constructional problems, the speaker noted that the extent of swamp and muskeg necessitated that movement of all heavy equipment and supplies be accomplished in winter, and for this purpose roads of hard packed snow and ice were built. Some 20,000 tons of material, including 800 tons of foodstuffs, were transported thus. Planes, in both summer and winter flights, carried 900 tons of freight and 2,600 passengers during the construction period. Efficient control of all operations was maintained through the medium of radio.

The benefits accruing from the finished project include navigational gains due to the expected rise in level of the Great Lakes and the addition of some 360,000 horsepower to be developed and potential water-power sites between Lake Nipigon and the mouth of the St. Lawrence. Some of this power is at present being generated at the Hydro's Cameron Falls, Alexander, and DeCew Falls developments.

Mr. Montague illustrated his talk with numerous charts and colour photographs which greatly enhanced the audience's appreciation of the topographical and constructional problems encountered in the consummation of this unique project.

The speaker was introduced by Mr. Arthur Frampton, and the meeting was conducted under the joint chairmanship of J. T. Thwaites, A.I.E.E., and C. Hutton, M.E.I.C.

## LAKEHEAD BRANCH

W. C. Byers, Jr.E.I.C. - - *Secretary-Treasurer*

The Fall schedule of meetings to be held by the Lakehead Branch of the Engineering Institute of Canada opened Wednesday evening, October 6th, with a dinner meeting in the Royal Edward Hotel, Fort William, at which Mr. Otto Holden, chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, was the guest speaker.

Mr. Holden spoke on the **Ogoki Diversion** and his address was illustrated with slides and graphs.

In his address Mr. Holden spoke of the original suggestions made by Mr. Ralph Keemle in 1923 to the effect that water from the Ogoki River flowing north of Lake Nipigon into the Albany River and thence to James Bay could be diverted over the height of land near Waboose Rapids and turned south into the Great Lakes System.

Reconnaissance surveys made by Ontario Hydro in 1924 showed the project feasible and now in 1943 the diversion was an accomplished fact.

Numerous charts and diagrams showing the estimated and actual run-off from the watershed, also the methods used to determine graphically the most economical height of main reservoir dam and depth of diversion channels were explained by the speaker. The estimated diverted water will be approximately 4,000 cubic feet per second.

Mr. Holden also presented figures on costs and material quantities and gave a brief résumé of the benefits that would accrue from the standpoint of extra hydro-electric power at various sites on the Nipigon River and points along the Great Lakes and connecting river system to Montreal.

R. B. Chandler, chairman of the Lakehead Branch, presided and gave special welcome to engineers in uniform.

Gordon O'Leary, in introducing Mr. Holden, mentioned the fact that among other degrees and honours held by the speaker he was the sitting president of the Royal Canadian Institute.

Mr. J. M. Fleming thanked the speaker for his most interesting address.

Some 57 members and guests were in attendance.

## LETHBRIDGE BRANCH

R. B. McKenzie, Jr.E.I.C. - *Secretary-Treasurer*
A. J. Branch, M.E.I.C. - - *Branch News Editor*

The president of the Institute, Mr. K. M. Cameron, paid a brief visit to the Lethbridge Branch on Saturday, Oct. 9th. He arrived at shortly after noon accompanied by Mrs. Cameron, and Messrs. Gaherty, H. Sherman and P. M. Sauder.

Following a lunch with some of the Executive members Mr. Sauder drove Mr. Cameron through a portion of the irrigated district showing him the harvesting of the last of the irrigated crops—sugar beets—and their disposal at one of the beet dumps.

Returning to Lethbridge, the president met the members of the Branch and addressed them on general Institute affairs, expressing the regret of the secretary, Mr. L. Austin Wright, who was unable to accompany him in the West due to a hurried recall to Headquarters on more urgent business.

**The president at Lethbridge, *left to right, front row:* Councillor J. Haimes, President Cameron, Chairman J. M. Davidson, Vice-Chairman C. S. Donaldson, A. L. H. Somerville. *Rear row:* A. J. Branch, G. S. Brown, J. M. Campbell, Wm. Meldrum, C. S. Clendening, A. G. Donaldson, D. F. Hamelin, P. E. Kirkpatrick and R. S. Lawrence.**

The president made reference to various other engineering features and was tendered a hearty vote of thanks, following which the party returned to Calgary to entrain for the coastal cities.

Whilst the president attended to business matters, Mrs. Cameron was entertained by a few of the members' wives.

## LONDON BRANCH

H. G. Stead, M.E.I.C. - - *Secretary-Treasurer*
A. L. Furanna, Jr.E.I.C. - *Branch News Editor*

On Saturday, September 11th, the London Branch was host to the Council of the Institute. Members of the Council and visitors were guests of the branch at a luncheon held in a private dining room of the Hotel London, where K. M. Crawford, city clerk, welcomed the Council and particularly President K. M. Cameron. Mr. Cameron lived in London in his youth and Mr. Crawford referred in a jovial manner to a couple of instances he remembered. Mr. Cameron replied by telling of his early life in Middlesex County and the City of London. Following the luncheon the Council Meeting was held in a committee room of the City Hall. A considerable number of the London and district members attended and gained considerably in their knowledge of Institute affairs.

Following the Council meeting the branch held their monthly meeting. This took the form of a courtesy dinner to Mr. Cameron and the general secretary, L. Austin Wright. Mr. Cameron was introduced by H. F. Bennett, district engineer, Department of Public Works. Mr. Bennett told the audience that the Institute had had chief engineers of the Public Works as presidents before and that he considered this particularly significant of the close relationship of the engineer in public life and the Institute. Mr. Cameron spoke on **Post-war Reconstruction.** It was a particularly timely subject and due to the fact of his being chairman of the Sub-Committee on Construction Projects of the James Committee on Post-war Reconstruction, he was able to give the audience a most interesting and correct picture of the work that has been done and what should be done to keep our country on an even keel when peace is declared. A vote of thanks was moved by E. V. Buchanan, past vice-president for Ontario.

Chairman T. L. McManamna introduces President K. M. Cameron.

**Councillor E. V. Gage of Montreal, V. A. McKillop and Councillor Nicol MacNicol listen to H. F. Bennett.**

Mr. Wright, general secretary, then spoke on Institute affairs. He described the many complex and difficult problems facing the Institute at present. He particularly referred to the problem of recognition of the engineer in the armed services and discussed the wonderful work being done by the R.E.M.E. in the British Army. Following the meeting a social get-together was held which was enjoyed by both visitors and members.

### MONTREAL BRANCH

L. A. Duchastel, M.E.I.C. - *Secretary-Treasurer*
H. H. Schwartz, S.E.I.C. - *Branch News Editor*

On October 7th, Mr. M. V. Sauer delivered a talk on **St. Lawrence River Control and Remedial Dams—Soulanges Section.** In the course of the talk, Mr. Sauer gave the complete details on the construction of the works. This paper will appear shortly in the *Journal*.

The paper aroused considerable discussion from the members. Mr. McCrory mentioned that the problem of the flow of water in pipes, and that of the ice pressure to be expected on dam gates is still unsettled. Some engineers quote 10,000 pounds per lineal foot as a reasonable ice pressure to assume.

Mr. F. W. Cowley addressed the meeting and underlined the importance of the St. Lawrence to Canada. Mr. Cowley has made the study of the St. Lawrence his life work since 1886. During all those years the chief difficulty to the exploitation of the St. Lawrence has been the danger of frazile ice. And it is by carefully considered structures such as that outlined by Mr. Sauer, that frazile ice can be controlled and the St. Lawrence successfully harnessed.

**Part of the group who visited the Noorduyn Aviation plant at Cartierville.**

On October 14th, the Montreal Branch of the E.I.C. accepted an invitation from the Noorduyn Aviation Ltd. to visit their plant in the north end of Montreal, near Cartierville. Around 300 to 400 members made the trip.

On arrival at the plant, Mr. R. B. C. Noorduyn welcomed the group and discussed the type of work that was going on in the factory. Two types of planes are manufactured there—the Harvard Trainer and the Norseman.

In the plant, the planes are built along mass production lines. Around 11,000 people are employed.

The buildings are of modern design, heated to a uniform temperature of 70° F. The lighting level is very high, 30 foot candles. All the buildings are protected by sprinklers.

During the tour, the fabrication of an aeroplane from the raw materials right through to the finished and tested product was shown. Many of the components are made at the plant, but several items, such as the engine, etc., are purchased.

An interesting point that was observed was the care taken to ensure the safety of the operators, with photo-electric cells and guards, etc., at the punches and shears.

### OTTAWA BRANCH

A. A. Swinnerton, M.E.I.C. - *Secretary-Treasurer*
R. C. Purser, M.E.I.C. - - *Branch News Editor*

At the first noon luncheon of the fall and winter season, held at the Chateau Laurier on October 28, Captain A. C. Rayment, M.E.I.C., gave an address on **Our Chief Needs, Military and Industrial.** G. H. Ferguson, chairman of the Ottawa Branch, presided. Captain Rayment served with the Australian forces in the last war in a technical advisory capacity and since then has held a number of technical positions, both civil and military, in this country and Great Britain.

Captain Rayment stressed the danger of growing optimism among Canadians as to the progress of the war. "The more we relax our war effort," he said, "the longer the war will last. It isn't going to be the pushover some of us may think."

Captain Rayment said there was too much complacency, too much absenteeism in the factories, too many people going fishing when they should be at work. He has not yet talked to one man with battle experience in this war who believes that the Allies will win soon with a quick victory.

After reviewing the change that has come over the war situation during the past year, the speaker said there are still gaps in production, still a lack of co-operation in plans and supply, for the utilization of man-power, and the utilization of technical ability. This is something that should not be after four years of war. He estimated that there should be an increase of at least fifty per cent in production next year to carry on a proper offensive.

"Adequate reinforcements are vital," he said. "The outstanding results of Dieppe serve to demonstrate that. There were highly trained men at Dieppe yet we lost 67 per cent of them. Now that our forces are engaged in full-speed offensives, it is more important than ever that we have more reserve, trained man-power." Reinforcements to the extent of at least 100 per cent of attacking forces were necessary, in his opinion.

"As for weapons," he continued, "we must continue to supply better weapons than those of the enemy, and more of them. Figures, contracts, mean nothing. All that matters is that each and every fighting man is well armed with the very best weapons possible and in sufficient quantities, and that he should continue to be so armed."

The man-power problem, he declared, really goes far beyond the factories and the forces. Those who hang on to their personal comfort at the nation's expense are committing a crime against the country. In modern warfare the advantage belongs to the attacker and everything should be done to allow the Allies to strike harder than they are doing to-day.

# QUEBEC BRANCH ANNUAL GOLF TOURNAMENT

Branch Chairman René Dupuis questions the general secretary's score card.

*Below:* There was a tournament for ladies. *Left to right:* Mesdames Paul Vincent, Léo Roy, J. M. Paquet, P. Laframboise and J. Marchand.

You may win a prize with any kind of a score when the distribution is handled by Gustave St-Jacques, Chairman René Dupuis and Secretary-Treasurer Paul Vincent.

*Below:* The tournament was followed by a dinner. *Immediately in front,* Mr. and Mrs. Yvon De Guise; *Left to right:* in background: Mrs. and Mr. Jacques Limoges; Mrs. and Mr. Gédéon Legault, Mrs. and Mr. Guillaume Piette.

## QUEBEC BRANCH

Paul Vincent, M.E.I.C. - *Secretary-Treasurer*

La Section de Québec de l'Institut tenait lundi, le 20 septembre dernier, au Royal Quebec Golf Club son troisième tournoi annuel de golf.

Par un beau soleil d'automne, une quarantaine de concurrents se disputèrent le championnat.

La coupe "Challenge" de Geo. T. Davie & Sons, emblème du championnat chez les golfeurs de l'Engineering Institute of Canada, section de Québec, fut gagnée pour une troisième année consécutive par P. A. Dupuis.

Une douzaine de dames à l'esprit aussi sportif que leurs maris, prirent part à un tournoi de neuf trous, spécialement organisé pour elles.

Après le traditionnel dix-neuvième trou que tous et chacun n'ont pas manqué de jouer, un excellent buffet fut servi dans la salle à manger du Club.

La présentation des prix fut ensuite faite avec humour par René Dupuis, président de la section.

P.-A. Dupuis, ingénieur sénior au Ministère des Travaux Publics de Québec, remporta haut la main le championnat en enregistrant le meilleur score brut et également le meilleur net de tous les concurrents.

MM. Ernest Roy, J. des R. Tessier, Claude Robillard, Gustave St-Jacques, Huet Massue, Léo Roy et Guillaume Piette se sont fait une lutte serrée et ont obtenu les autres prix.

Parmi les débutants qui se sont le plus distingués et qui ont décroché des prix, citons: notre populaire secrétaire-général, L. Austin Wright; Hector Cimon, vice-président pour la province de Québec; MM. René Rioux, Marcel Levert, et Paul de LaMirande.

Chez les dames, Madame Ernest Roy décrocha le premier prix pour avoir enregistré le meilleur score. Mesdames Léo Roy et J. Marchand prenaient les honneurs suivants.

Après la distribution des magnifiques prix gracieusement offerts par des maisons de commerce de Québec et de Montréal, la soirée se termina dans les salons du Royal Quebec Golf Club où tous s'en donnèrent à coeur-joie aux sons mélodieux d'un orchestre de danse.

# PRESIDENTIAL VISIT TO REGINA

At the Executive Meeting of the Professional Association and the Saskatchewan Branch. *Seated:* A. C. Garner, K. M. Cameron, A. M. Macgillivray, Stewart Young, I. G. Schaeffer, J. McD. Patton. *Standing:* J. B. de Hart, G. L. MacKenzie.

The ladies entertained Mrs. Cameron at tea. In the group, Mrs. H. E. Jones, M. J. Spratt, D. D. Low, H. J. Woodman, R. J. Fyfe.

The head table at the dinner: L. A. Thornton, K. M. Cameron, A. M. Macgillivray, H. S. Carpenter.

In the group, C. W. Doody, W. H. Bentley, J. R. Young, W. D. Longworthy, W. E. Crossley, S. G. Dethridge.

Mrs. Cameron with the ladies of the Engineers Wives Association: Mrs. J. W. D. Farrell, G. L. MacKenzie, S. R. Muirhead, J. I. Mutchler, Stewart Young, W. M. Stewart, T. G. Tyrer, H. S. Carpenter, E. J. Durnin, F. E. Estlin, H. R. MacKenzie.

Stewart Young and G. E. Kent.

## SASKATCHEWAN BRANCH

Stewart Young, m.e.i.c. - *Secretary-Treasurer*

The Saskatchewan Branch of the Institute, jointly with the Association of Professional Engineers of Saskatchewan, met at dinner in the Hotel Saskatchewan, Regina, at 6.30 p.m. on Wednesday, October 6, 1943, the occasion being the official visit of the president, K. M. Cameron. The attendance was 52. A. M. Macgillivray, branch chairman, presided.

After expressing regret at the inability of the general secretary, L. A. Wright, to be present, Mr. Macgillivray requested Past Vice-President Carpenter to introduce Mr. Cameron. In so doing, Mr. Carpenter recalled the advice of the late Dean Galbraith to all young engineers "to shop around till they found the job most suited to their abilities." He suggested that Mr. Cameron evidently had followed a similar course and for the past twenty or more years had occupied the position of chief engineer, Department of Public Works, Canada.

President Cameron expressed regret at the absence of General Secretary Wright stating that this was due to the pressing emergency of a challenge to the Institute membership in the solution of a problem of immediate importance and of which the members would learn very shortly. He conveyed greetings from Mr. Wright and from Past President Dean Mackenzie.

After sketching the trend of development within the Institute and stating that the old retiring attitude of the engineer was giving way to a realization of public responsibility, Mr. Cameron dealt briefly with **Post-War Reconstruction.** He stated that the outstanding cause of delay in all public engineering work was lack of preparedness—the bringing of individual projects to the "blueprint" stage; now is the time to prepare. He stated further that, notwithstanding much public discussion, evolutionary and not revolutionary methods would obtain.

Mr. L. A. Thornton, the first chairman of the Branch, commented on our activities in Saskatchewan and stated that our agreement with the Institute was entirely successful. He suggested however that the Institute still had a job to do—the creation of co-operation between the various branches and other engineering bodies in Canada.

A hearty vote of thanks was tendered Mr. Cameron on motion of J. W. D. Farrell.

## TORONTO BRANCH

S. H. DeJong, m.e.i.c. - *Secretary-Treasurer*
G. L. White, affil.e.i.c. - *Branch News Editor*

### Junior Section

The Junior Section had an attendance of 110 at its first regular monthly meeting for the 1943-44 season which took the form of a dinner at Diana Sweets, Toronto, on Monday evening, October 4th. The feature of the meeting, which was conducted by Chairman J. M. Van Winckle, was an interesting and complete coloured motion picture "Vision Fulfilled" covering operations in the plant of Atlas Steels, Ltd., at Welland, Ont., and presented by R. G. Collins of that company.

The work of the membership, programme, publicity, and publications committees was discussed by the respective chairmen and a general discussion was held regarding a salary survey to be made at the November 1st meeting of the section.

## VANCOUVER BRANCH

P. B. Stroyan, m.e.i.c. - - *Secretary-Treasurer*
Archibald Peebles, m.e.i.c. - *Branch News Editor*

The Vancouver Branch opened its season's programme during the visit of Mr. K. M. Cameron, president of the Institute, to the western branches. A dinner was given in his honor on Tuesday, Oct. 12, at the Hotel Georgia. Prior to this meeting Mr. Cameron met the executive of the branch with whom he discussed several items of importance to the Institute and to the engineering profession. With the president were C. K. McLeod, vice-president for Quebec province and chairman of the finance committee, and G. A. Gaherty of Montreal, a member of the Council.

At the dinner meeting Mr. Cameron spoke first on Institute affairs, a subject usually handled by Austin Wright, the general secretary. Unfortunately Mr. Wright was unable to accompany the president on his western trip so that Mr. Cameron had to do double duty in speaking to the branches. He gave progress reports on the most significant activities of Council, especially those in which the Institute is co-operating with government departments. He paid a special tribute to the progress of the Institute committee on the Welfare of the Young Engineer.

Following his outline of Institute affairs the speaker turned to his main topic, which was an excellent exposition of his views on post-war reconstruction. As chairman of the sub-committee on construction of the James Reconstruction Committee, Mr. Cameron has given much time and study to this phase of the rehabilitation programme. He first gave an estimate of the number of persons in Canada who will have to be transferred to peace-time employment, including those demobilized from the armed forces. By comparison with pre-war years he showed just what place construction work will take in that picture; a relatively small place in dollar value, but an extremely vital one since new construction expenditure puts into circulation that portion of the national income which remains after the necessities of life have been produced and distributed, and therefore becomes to a large degree the determining factor in a difference between prosperity and depression. Construction is both public and private however, and private construction must provide for at least its normal share of this expenditure, while public construction may be used to smooth out the differences due to minor changes in the level of business activity. It is Mr. Cameron's opinion that much public construction can be regulated by government bodies, in such a way that it can be brought forward when the total volume of work begins to drop below a desirable level.

In other terms, governments, federal, provincial and municipal should prepare in advance a programme of work which can be implemented when private construction work is not able to maintain a satisfactory volume. The total volume of construction should utilize one dollar in five of the national income. If it falls appreciably below this figure, depression conditions will prevail, while if it is allowed to go much above this figure, there is likely to be an undesirable reaction to an abnormally low level in later years.

The speaker expressed his view that, with adequate regulation of government construction, and with proper government stimulus to private enterprise it will be possible to prevent periods of abnormal expansion followed by business slumps, and to maintain a volume of economic activity which will provide security and a reasonable standard of living for the people of Canada.

Others who spoke briefly at the meeting were C. K. McLeod, G. A. Gaherty, Major George Walkem, C. Webb, Dean J. N. Finlayson, and H. N. Macpherson, who moved a hearty vote of thanks to Mr. Cameron. Fifty-one members were present.

# Library Notes

## Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications

### ADDITIONS TO THE LIBRARY

#### TECHNICAL BOOKS

**Electrical Engineering—Basic Analysis:**
*Everett M. Strong. N.Y., John Wiley and Sons, Inc., 1943. 5½ x 8½ in. $4.00.*

**Metallography of Aluminium Alloys:**
*Lucio F. Mondolfo. N.Y., John Wiley and Sons, Inc., 1943. 5¾ x 8½ in. $4.50.*

**Primer of Ship Blueprint Reading—Glossary of Shipyard Terms:**
*Claude Clark. N.Y., Cornell Maritime Press, 1942. 5 x 7¼ in. $1.50.*

**Modern Marine Refrigeration:**
*Earl S. Shulters. N.Y., Cornell Maritime Press, 1943. 5 x 7½ in. $1.50.*

**Materials and Methods of Architectural Construction:**
*2nd ed. Charles Merrick Gay and Harry Parker. N.Y., John Wiley and Sons, Inc., 1943. 5½ x 8½ in. $6.00.*

**Tungsten:**
*Its history, geology, ore-dressing, metallurgy, chemistry, analysis, applications and economics. K. C. Li and Chung Yu Wang. N.Y., Reinhold Publishing Corporation, 1943 (American Chemical Society Monograph Series). 6 x 9¼ in. $7.00.*

**Practical Principles of Naval Architecture:**
*S. S. Rabl. N.Y., Cornell Maritime Press, 1942. 5 x 7¼ in. $2.00.*

**Patent Law:**
*For chemists, engineers and students. N.Y., John Wiley and Sons, Inc., 1943. 5¾ x 8¾ in. $2.75.*

**Maximum Utilization of Employed Manpower:**
*A check list of compay practice. Princeton University, Industrial Relations Section, 1943. 6 x 9¼ in. $1.00.*

**Workshop Practice in the Light Repair Shop:**
*A. F. Wilby. Toronto, Longmans Green and Co. (1943). 4¾ x 7¼ in. $0.50.*

**Metals and Alloys Data Book:**
*Samuel L. Hoyt. N.Y., Reinhold Publishing Corporation, 1943. 7 x 10¼ in. $4.75.*

**Ship and Aircraft Fairing and Development:**
*For draftsmen and loftsmen and sheet metal workers. S. S. Rabl. N.Y., Cornell Maritime Press, 1941. 12 x 8½ in. $2.50.*

**The Use of Part-Time Workers in the War Effort:**
*Helen Baker and Rita B. Friedman. Princeton University, Industrial Relations Section, 1943. 6¾ x 9¾ in. $1.00.*

**By Water and the Word:**
*Mrs. F. P. Shearwood. Toronto, MacMillan Company, 1943. 5½ x 8 in. $2.50.*

This book is a transcription of the diary of the Right Reverend J. A. Newnham while plying the waters and ice fields of northern Canada in the Diocese of Moosonee. From 1891 to 1904 this young man travelled thousands of miles by canoe and portage; on foot and on snowshoes; by dog train and ship, visiting the outposts of his large Missionary Diocese of Moosonee. In these days when the aeroplane has made such trips a thing of the past, it is stimulating to read how less than fifty years ago travelling in northern Canada was such a perilous and arduous undertaking. The book pays tribute to the skill and industry of the Cree Indians and to the great assistance given the Church by the Hudson's Bay Company. Not only is it a great tribute to the man himself but also to the countless people of Canada's northland who have laboured so long and so untiringly in its development.

**An Introduction to Heat Engines:**
*E. A. Allcut. Toronto, The University of Toronto Press, 1943. 6 x 9¼ in. $2.75.*

#### TRANSACTIONS, PROCEEDINGS

**Institution of Mining and Metallurgy:**
*Fifty-first session 1941-1942.*

**Canadian Electrical Association:**
*Proceedings of the fifty-third annual meeting 1943.*

**British Engineers' Association:**
*Classified handbook of members and their manufactures 1943.*

#### REPORTS

**Queen's University—Industrial Relations Section—Bulletin:**
*No. 7; Recent Canadian collective bargaining agreements. No. 8.*
*The right to organize; recent Canadian legislation.*

**U.S.—National Research Council—Highway Research Board:**
*Wartime road problems No. 6.—Patching concrete pavements with concrete.*

**Toronto Harbour Commissioners:**
*Annual report 1942.*

**Edison Electric Institute:**
*Publication No. K6—Cable operation 1941.*

**The Electrochemical Society—Preprints:**
*No. 84-1; Electrolytic reduction of trinitro aromatic compounds to triamines by use of a carrier catalyst. 84-2: The electrolytic reduction of p-aminobenzoic acid. 84-3: Corrosion resistance of silver plated steel; phosphating the steel plating. 84-4: Electrolytic reduction of cinnamic acid. 84-5: Iron plating. 84-6: Study of the deposition potentials and microstructures of electrodeposited nickel-zinc alloys. 84-7: Corrosion of lead-indium diffusion alloys. 84-8: The electrolytic reduction of amides. 84-9: Novelties in electroplating. 84-10: The electrolytic oxidation of thiosulfate in ethylene glycol solution. 84-11: Electroorganic chemistry in the patent office.*

### BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters or may be sent direct to the publishers.**

**(The) CHEMISTRY OF LARGE MOLECULES. (Frontiers in Chemistry, Vol. 1)**
*Edited by R. E. Burk and O. Grummitt. Interscience Publishers, New York, 1943. 313 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.50.*

A series of lectures by authorities within the field indicated by the title is presented here in book form. Individual lectures cover the mechanism of polyreactions, various investigations of high polymers, colloidal behavior, ultracentrifuge applications, elastic-viscous properties of matter, and the chemistry of cellulose and its derivatives.

**CIRCUIT ANALYSIS OF A-C POWER SYSTEMS, Vol. I. Symmetrical and Related Components**
*By E. Clarke. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 540 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $6.00.*

In the two-volume set of which this is the first volume, the methods of solving unbalanced power system problems by means of components are analyzed and discussed in detail. Vol. I deals largely with the determination of currents and voltages of fundamental frequency in power systems, by means of symmetrical and related components, including overhead transmission circuits, transformers and synchronous machines. The use of equivalent circuits and the solution of practical problems are emphasized.

**ELECTRICAL ENGINEERING, Basic Analysis**
*By E. M. Strong. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 391 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $4.00.*

An introductory presentation of basic concepts essential to the clear understanding of electrical engineering problems. It includes an introduction to alternating-current and voltage as part of this basic material. A knowledge of the calculus is required of the student. Detachable work sheets containing useful graphs are provided at the end of the book.

**ENGINEERING DRAWING PROBLEMS**
*By I. N. Carter and H. L. Thompson. International Textbook Co., Scranton, Pa., 1943. 142 plates, diagrs., charts, tables, 8½ x 12 in., stiff paper, $2.25.*

A carefully selected group of drafting exercises is presented, designed to be used with the text, "Engineering Drawing—Practice and Theory," by the same authors. In addition to the problem plates already made up, there are several blank plates for special work, and a number of sheets of tracing paper are provided for tracing practice.

**FLUID MECHANICS**
*By R. C. Binder. Prentice-Hall, New York, 1943. 307 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $5.00.*

The aim of this book is to present the fundamentals of fluid mechanics. Both liquids and gases are dealt with, and the general cases of flow in pipes and in open channels are considered. The general arrangement is logical, beginning with statics, then kinematics, then dynamics which receives the fullest treatment. Applications to such practical subjects as lubrication and pumping are discussed.

**FOUNDATIONS, ABUTMENTS AND FOOTINGS**
*Compiled by a staff of specialists, editors-in-chief, G. A. Hool and W. S. Kinne: revised by R. R. Zipprodt and E. J. Kilcawley. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 417 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.00.*

This standard textbook covers soil investigation, excavation, foundations, spread footings, underpinning, bridge piers and abutments. There is a section devoted to foundations requiring special consideration, and a section on the application of the law relative to the engineer. Since there has been a period of twenty years since the revised edition, the book has been extensively revised with much rewriting.

**GENERAL PHYSICS, a Textbook for Colleges**

*By O. Blackwood. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 622 pp., illus., diagrs., charts, tables, maps, 8½ x 5½ in., cloth, $3.75.*

The whole field of college physics is covered in this elementary text. The arrangement of major divisions is as follows: mechanics; molecular physics and heat; vibrations, wave motion and sound; light; electricity and magnetism; the new physics. Emphasis is placed on the practical illustration of physical principles of examples from everyday life.

**LABOUR PROBLEMS IN BOLIVIA**

*Report of the Joint Bolivian-United States Labour Commission, English and Spanish Texts. International Labour Office, Montreal, Canada, 1943. 45 pp., illus., tables, 9 x 6 in., paper, 2s. (0.50).*

Published with parallel text in English and Spanish, this report of the Joint Bolivian-United States Labour Commission deals with the conditions of life and work of Bolivian laborers. Recommendations are made for improvement in housing, health, educational facilities, hour and wage regulation, and other labor problems.

**MANAGEMENT OF MANPOWER**

*By A. S. Knowles and R. D. Thomson. The Macmillan Co., New York, 1943. 248 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $2.25.*

The text, part of a larger volume on industrial management, is reproduced for those whose primary attention is devoted to handling workers. It discusses the modern tools and techniques available for the effective and intelligent handling of man-power problems leading toward greater efficiency, higher production and better co-operation of the workers. Job evaluation and merit rating are emphasized.

**MANUAL OF A.S.T.M. STANDARDS ON REFRACTORY MATERIALS, prepared by A.S.T.M. Committee C-8 on Refractories**

*American Society for Testing Materials, 260 S. Broad St., Phila., Pa., June 1943. 201 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $1.50; cloth, $1.75.*

Designed to give all of the A.S.T.M. standards on refractory materials—specifications, methods of physical tests, chemical analysis, and definitions—this extensively revised and enlarged publication also includes pertinent data developed by the committee and gives other supplementary information of service to those concerned with refractories.

**MARCONI, PIONEER OF RADIO**

*By D. Coe. Julian Messner, New York. 272 pp., illus., diagrs., 9 x 6 in., cloth, $2.50.*

Marconi's great influence on the development of wireless transmission is told in narrative style. Much biographical detail is included, and the character of the man himself is emphasized. Important and dramatic incidents connected with Marconi's life and the rise of radio as a useful science increase the interest of the book.

**MATERIALS AND METHODS OF ARCHITECTURAL CONSTRUCTION**

*By C. M. Gay and H. Parker. 2 ed. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 636 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $6.00.*

Part I discusses the composition, characteristics, production and uses of the commonly used materials of construction. Part II covers the mechanics of materials, methods of combining them for architectural construction, and the computation of dimensions. The present edition has been revised in accordance with current standards and practice.

**MAXIMUM UTILIZATION OF EMPLOYED MANPOWER, a Check List of Company Practice. (Research Report Series No. 68)**

*Princeton University, Industrial Relations Section, Princeton, New Jersey, 1943. 46 pp., 9½ x 6 in., paper, $1.00.*

This publication constitutes an outline listing a wide range of symptoms or ailments which are likely to accompany or cause underutilization of employed labor. Most of the sub-headings, however, indicate positive steps, drawn from widespread company experience, which have proved successful remedies. A detailed bibliography is appended.

**METAL FORMING BY FLEXIBLE TOOLS**

*By C. J. Frey and S. S. Kogut. Pitman Publishing Corp., New York and Chicago, 1943. 193 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00.*

The characteristics of the flexible tool, developed and mainly applied in the aircraft industry, are low first cost and rapidity of manufacture, to meet the frequent changes in design necessitated by war, and the ability to adhere to sheet-metal tolerances so as to permit interchangeability. The answer to the need for flexible tooling has been found in the rubber press, the drop hammer, the power brake, the stretch press and the Anderson method of forming by drawing, all described in detail in this book.

**MUNICIPAL AND RURAL SANITATION**

*By V. M. Ehlers and E. W. Steel. 3 ed. McGraw-Hill Book Co., New York and London, 1943. 449 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $4.00.*

The varied subjects dealt with by the sanitary engineer are discussed in this elementary textbook. Sewerage and sewage disposal and the development and purification of water supplies are standard topics. Other activities covered include the sanitation of milk and other foods, refuse collection and disposal, the control of mosquitoes, flies and rodents, plumbing, and other aspects of public health work.

**ON YOUR OWN, How to Take Care of Yourself in Wild Country, a Manual for Field and Service Men**

*By S. A. Graham and E. C. O'Roke. University of Minnesota Press, Minneapolis, Minn., 1943. 149 pp., diagrs., tables, 8 x 5 in., cloth, $2.00.*

This little manual, prepared by two experienced foresters, is intended to assist field workers in avoiding trouble in wild country. Suggestions on meeting extremes of temperature, on preventing and treating minor injuries and infection, on avoiding quicksand, quagmire and water hazards, on food, on catching wild animals, on protection from poisonous plants and from insects, on dangerous animals and on parasites are provided. The book should be most useful to travellers.

**OPTICAL CRYSTALLOGRAPHY**

*By E. E. Wahlstrom. John Wiley & Sons, New York; Chapman & Hall, London, 206 pp., illus., diagrs., charts, table, 8½ x 5½ in., cloth, $3.00.*

It is the purpose of this textbook to review the principles of optical crystallographic theory. Practical applications are treated briefly, as the emphasis is placed on the thorough presentation of fundamental concepts. Some space is given to a description of the techniques for the measurement of refractive indices. The text is profusely illustrated, a particularly helpful feature in a book on this subject.

**PRODUCTION CONTROL**

*By A. S. Knowles and R. D. Thomson. The Macmillan Co., New York, 1943. 271 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $2.50.*

Part I of this book deals with the problems which arise in establishing and administering operating controls, covering storeskeeping, development and engineering of the manufacturing processes, and planning. Part II deals with the control of those elements of total costs of manufacturing about which the manager needs particular knowledge but which require no specialized accounting background. The text is a reproduction of two sections of a larger volume on industrial management.

**SLIDE RULE SIMPLIFIED**

*By C. O. Harris. American Technical Society, Chicago, Ill., 1943. 250 pp., diagrs., tables, 8½ x 5½ in., cloth, $2.50; with slide rule, $3.50.*

The practical manipulation of the slide rule is explained in detail. The first eight chapters cover the relatively simple straight arithmetical operations for the beginner. Succeeding chapters deal with the handling of trigonometrical relations and other more complex operations. The logarithmic basis of the functioning of the slide rule is explained for those who are interested.

**STRESS ANALYSIS FOR AIRPLANE DRAFTSMEN**

*By E. J. Greenwood and J. R. Silverman. McGraw-Hill Book Co., New York and London, 1943. 291 pp., diagrs., charts, tables, 8½ x 5 in., cloth, $3.00.*

In addition to basic information on the properties and mechanics of materials for airplane construction this book provides the following design procedures: the determination of the loads on the structure: the determination of the resulting stresses in the members; and the investigation and comparison of types of construction suitable for carrying these loads and stresses. The application of these principles to everyday problems is indicated.

**STRUCTURAL FRAMEWORKS**

*By C. T. Morris and S. T. Carpenter. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 272 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $4.00.*

This book, which is intended for advanced students, is concerned with the analysis of some complex problems that arise in the design of buildings and structural frameworks, including industrial buildings and radio and transmission towers. Numerous examples are worked out to illustrate the methods used.

**STRUCTURE OF METALS, Crystallographic Methods, Principles and Data**

*By C. S. Barrett. McGraw-Hill Book Co., New York and London, 1943. 567 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, $6.00.*

Crystallographic methods for investigating the structure of metals are discussed. The first four chapters explain the fundamentals of crystal lattices and projections and the general principles of the diffraction of x-rays from crystals. Chapters V to VII cover the technique of x-ray diffraction. The latter half of the book is devoted to the results of research along specific lines of current interest, including a chapter on electron diffraction. The book is intended for graduate courses.

**TREATMENT OF EXPERIMENTAL DATA**

*By A. G. Worthing and J. Geffner. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 342 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $4.50.*

As an aid to scientists and engineers in presenting experimental data clearly and usefully, this book presents and discusses the following topics: rules for graphing; methods of smoothing and tabulating; a moderately extended treatment of precision indexes; the essentials of correlation; Fourier series and harmonic analysis as a means of representing data; and the use of determinants as a means of simplifying computations.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

October 28th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the December meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

**FOR ADMISSION**

BEGG—ROBERT ARTHUR, of 50 East Avenue South, Hamilton, Ont. Born at Regina, Sask., Dec. 1st, 1918; Educ.: B.Sc. (Mech.), Queen's Univ., 1943; 1940 (summer), chainman, Dept. of Highways, Ont.; 1941 and 1942 (summers), fitter, machine shops, The John Bertram & Sons Co. Ltd.; May, 1943, to date, dftsman., armoured car engrg. dept., Hamilton Bridge Co. Ltd.

References: H. G. Bertram, L. S. MacDonald, W. S. Macnamara, W. B. Nicol, L. T. Rutledge.

BRIERLEY—JOHN PAUL, of 299 Eastern Ave., Toronto. Born at Port Sunlight, England, June 11, 1899; Educ.: M.Sc. (Chem.), Liverpool Univ., 1920; With Lever Bros. Ltd., as follows: 1920-25, chemist, Port Sunlight, 1925-26, asst. to wks. mgr., Port Sunlight, 1926-30, tech. adviser, South African Administration Board, Johannesburg, S.A., 1930-39, tech. director, controlling factories at Durban, Johannesburg and Cape Town, S.A., 1940 to date, tech. director, Toronto, Ont., controlling soap, glycerine, edible fat and margarine factories at Toronto, Winnipeg, Calgary, Vancouver, St. Stephen & St. John's, Nfld., with direction of all manufacturing, technical & personnel arrangements.

References: E. A. Allcut, S. Ball, Wills Maclachlan.

BROWNLEE—WILLIAM DANIEL, of Griffith St., Welland, Ont. Born at Collingwood, Ont., July 23rd, 1907; Educ.: B.A.Sc., Univ. of Toronto, 1931; 1931-32 municipal engrg. for Town of Midland; with the Province of Ontario as follows: 1932-33, instr'man., Dept. of Highways, 1933-36, res. engr. on highway constrn. and 1936-37, locating engr., on highway location for the Dept. of Northern Development, 1937-39, res. engr., Dept. of Highways, on highway constrn.; 1939-40, acting res. engr., Dept. of Transport, Civil Aviation Branch, on airport constrn.; 1940 to date, engr., Electro Metallurgical Co. of Canada, on design, layout and cost estimating of bldgs., sewer and paving constrn.

References: T. L. Hughes, T. F. Francis, W. Bishop, H. E. Barnett, N. K. Cameron, D. S. Scrymgeour, E. M. MacQuarrie.

CLIMO—CECIL, of 2226 Dawlish Ave., Niagara Falls, Ont. Born at Cobourg, Ont., Sept. 22nd, 1898; Educ.: B.Sc., Queen's Univ., 1923; R.P.E. of Ont.; 1921 (summer) instr'man., Chippawa Power Canal; 1922 (summer), field engr., street paving, Cobourg; with the Carborundum Co., Niagara Falls, N.Y., as follows: 1923-37, field engr., i/c all constrn., 1937 to date, asst. constrn. engr., i/c design & constrn. of new plants & equipment.

References: M. F. Ker, W. D. Bracken, A. W. F. McQueen, J. F. Wickenden

COWAN—GEORGE ARCHIBALD, of 549 Campbell St., Winnipeg, Man. Born at Kennedy, Sask., Dec. 8th, 1916; Educ.: B.Eng. (Mech.), Univ. of Sask., 1938; 1938-40, sales promotion, International Harvester Co., Brandon, Man.; 1941 to date, sales engr., (engrg. sales & service on elec. motors & control apparatus, steels, mining & industrial equipment & aircraft equipment & supplies), Railway & Power Engineering Corp'n., Ltd., Winnipeg, Man.

References: H. L. Briggs, T. E. Storey, S. G. Harknett, C. P. Haltalin, I. W. Beverly.

FAIRFIELD—ROBERT CALVIN, of 432 Nelson Street, Ottawa, Ont. Born at St. Catharines, Ont., July 31st, 1918; Educ.: B.Arch., Univ. of Toronto, 1943; 1937-38, inspection dept., General Motors, St. Catharines, Ont., testing axels, transmission gears, differential gears, knee-action shocks, etc., production line operations of lathes, milling, tapping, etc., also case hardening operations on transmission & differential gears; 1939 (summer) carpenter's ap'tice, with A. S. Jones (contractor); 1942-43, design & dfting. of aircraft hangars, mining structures, torpedo boat repair, & bldgs. for Dept. of National Defence, 1943 to date, asst. engr. in the structural dept. of the Works and Bldgs. Branch, Naval Services, Ottawa.

References: C. F. Morrison, W. S. Wilson, D. D. Whitson, S. H. deJong, C. R. Young, R. H. Self.

KARN—WILLIAM MATHESON, of Buckingham, Que., Born at Woodstock, Ont., Sept. 17th, 1917; Educ.: B.A.Sc., Univ. of Toronto, 1940; 1938-39, (summers), with the Cumbustion Engineering Corp'n. Ltd., at Canadian Industries, Ltd., and at the Ford Motor Co. of Canada, Ltd., Windsor, Ont., during the erection of high pressure steam generating units; With the Electric Reduction Co. of Canada, Ltd., as follows: 1940-42, as asst. to sales mgr. at Toronto (during this time spent approx. one year in the works control & research lab. at Buckingham, Que.), 1942 to date, asst. research chemist, engaged in chemical research and tech. service work at Buckingham, Que.

References: I. R. Tait, H. C. Karn, C. R. Bown, J. A. Vance, H. M. Esdaile.

KERR—ANGUS DOUGLAS, of 2193-West 19th Ave., Vancouver, B.C. Born at Sturgeon Falls, Ont., July 17th, 1906; Educ.: 1923-25, S.P.S., Univ. of Toronto; 1923-25 (summers), with Hollinger Consldt. Gold Mines & McIntyre Porcupine Gold Mines as surveyor's helper, ass't mine surveyor, etc.; also surveys on power & pulp locations in northern Ontario for Spruce Falls Co.; 1925-27, transit man, constrn. engr., asst. res. engr., Carr & MacFadden, Inc., Florida; 1927-28, field engr., placer mine development in B.C. for F.A. Sutton, C.E.; 1928-29, mine surveyor & asst. engr., Granby Consldt. Mining, Smelting & Power Co., Hidden Creek, B.C.; 1929-30, res. constrn. engr., E. J. Ryan Contracting Co.; 1930, res. engr., B.C. Electric Rly. & Power Co., Barriere Power plant; 1930-32, asst. city engr., City of Nanaimo; 1933-36, mine engr. & mine supt., Savona Gold Mines Ltd.; 1936 to date, principal dftsman. & asst. to chief engr., Vancouver Harbour, National Harbours Board.

References: E. G. Cameron, H. W. Frith, W. G. Swan, C. Brakenridge, E. A. Cleveland, W. H. Powell, P. B. Stroyan, A. G. Graham.

McLELLAND—E. RUSSELL, of 453 Rideau St., Ottawa, Ont. Born at Montreal Que., March 26th, 1905; 1923-27, dftsmn., & junior engr., Northern Electric Co., Montreal; 1928 (8 mos.), heating & ventilating work with E. A. Ryan, Consulting Engr., Montreal; 1928-29, mech. design bldg. trades, Chapman & Oxley, architects, Toronto; 1929-30, inspecting pipe fitting, International Nickel Smelter & Ontario Refinery, Copper Cliff, Ont., for Fraser Brace Constrn. Co., Montreal; 1930-31, checker, junior engr. & asst. supt. on mech. install'n of equipm't. of a fertilizer plant at Consolidated Mining & Smelting Co., Trail, B.C., for Dorr Engrg. Co. of New York; 1934-37, architect'l. & mech. design, field superv'n., etc., with Harle B. Long, architect, Kirkland Lake, Ont., 1938, mech. & piping design at surface mills, East Malartic Gold Mines, Uchi Gold Mines, Desantis-Porcupine Mine for General Engrg. Co. of Canada, Toronto; 1939-41, with T. Pringle & Son, Industrial Engrs., Montreal, mech. design & responsible for mech. superv'n on all major work such as, install'n. of 60000 lb. per hour steam generating unit for Dominion Woolens & Worsteds, Hespeler, Ont., mech. install'ns. at Dominion Arsenals, Que., & Dominion Tank Arsenal, Montreal Locomotive Co., Montreal, 1941-43, office engr., E. G. M. Cape & Co., General Contractors, Montreal, at St. John's, Nfld., supervising field engrs., also field superv'n of all trades in constrn. for the Dept. of Munitions & Supply & other gov't services in Nfld.; 1943 (Feb.-April) on loan from Cape & Co. to Quebec Sugar Refineries, St. Hilaire, on design of dryer furnaces, plant layout, line shaft drives, etc.; 1943 (May) to date, with Dept. of National Defence (Navy), Works & Bldgs. Branch, as chief estimator & at present, acting dist. engr., supervising all navy constrn., from Quebec City to the Rocky Mountains.

References: E. A. Ryan, J. B. Stirling, B. R. Perry, A. A. Young.

NICHOLSON—RALPH ARDREY VALANCE, of 61 Cartier St., Ottawa, Ont. Born at Toronto, Ont., April 16th, 1891; Educ.: 1909-14, 3 special sessions (Architecture) McGill University; Member, Ont. Assoc. of Architects; Member, R.A.I.C.; sec., Military Engrs. Assoc. of Canada; 1908-14, drftsman., with various architects in Quebec, Montreal, Ottawa and with Experimental Farm, Dept. of Agriculture, Ottawa; 1914-29, junior architect, Experimental Farm, Ottawa, i/c design of farm bldgs.; 1929-40, asst. architect, engineer services branch, Dept. of National Defence; 1940, administrative asst. to G.S.O. Surveys; Sept., 1940 to date, Lieut.-Col., O.C. Survey Section, R.C.E., Ottawa, Ont.

References: D. S. Ellis, C. C. Lindsay, J. L. H. Bogart, W. F. M. Bryce, N. B. MacRostie, D. M. Jemmett, F. B. Reid, V. H. Patriarche.

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## NOTICE

**Technical personnel should not reply to any of the advertisements for situations vacant unless—**

1. **They are registered with the Wartime Bureau of Technical Personnel.**
2. **Their services are available.**

**A person's services are considered available only if he is—**

- **(a) unemployed;**
- **(b) engaged in work other than of an engineering or scientific nature;**
- **(c) has given notice as of a definite date; or**
- **(d) has permission from his present employer to negotiate for work elsewhere while still in the service of that employer.**

**Applicants will help to expedite negotiations by stating in their application whether or not they have complied with the above regulations.**

### SITUATIONS VACANT

EXPERIENCED STRUCTURAL STEEL DRAUGHTSMEN. Location Windsor, Ontario. Apply to Box No. 2662-V.

ENGINEER, graduate, for manufacturing company in the Eastern Townships, Province of Quebec; peacetime product: pulp and paper machinery, but presently engaged in war work. Some pulp and paper experience preferred. Permanent position and good opportunity. Apply to Box No. 2670-V.

ELECTRICAL SUPERINTENDENT for newsprint mill in the Province of Quebec. Graduate in electrical engineering with three or four years experience in electrical work preferred. Good starting salary. Apply to Box No. 2671-V.

DRAUGHTSMAN required by firm engaged in light manufacturing in immediate vicinity of Montreal. Apply to Box No. 2675-V.

LABORATORY ASSISTANT, to be engaged principally in wood testing, required by light manufacturing firm located near Montreal. Apply to Box No. 2676-V.

CIVIL ENGINEER to act as assistant to general contractor, experience in handling outside work and labour as well as knowledge of cost, estimating and design would be desirable. In replying please give complete information and salary expected. Apply to Box No. 2678-V.

### SITUATIONS WANTED

GRADUATE CIVIL ENGINEER, age 55, over thirty years' experience as engineer and construction executive in charge railway, highway, bridge and foundations and general heavy construction projects. Capable of taking charge organization and management. Wishes to make permanent connection with view to immediate and post-war developments. Apply to Box No. 278-W.

TECHNICALLY TRAINED EXECUTIVE: general experience administrative—organization and management—business and industrial fields; most recently general manager large war industry; plant maintenance, modernization, production and personnel; industrial surveys and economic studies; company reorganizations and amalgamations, valuations; heavy construction including railroad, highway, hydro, pulp, newsprint, housing. B.Sc. degree in engineering, age 54, married, Canadian. Apply to Box No. 1175-W.

ENGINEER, M.E.I.C., twenty years' experience. Factory planning and design of parts for mass production in U.S.A., England and Canada. Responsible position desired. Apply to Box 2406-W.

GRADUATE CIVIL ENGINEER, Queen's University, age 43, 20 years experience highways, bridges, buildings, docks, municipal pavements, sewers and waterworks. Surveying, estimating and design; emphasis on economy in earthwork and concrete. Versatile, practical and good personality for meeting the public. Presently employed, desires position as municipal engineer or with general contractor. Apply to Box No. 2453-W.

GRADUATE ENGINEER, B.Sc. in E.E. 1927, M.E.I.C. with 16 years engineering and sales experience, also office and accounting including 2-year apprentice course. West preferred. At present employed but work running out. Available on short notice. Apply to Box No. 2454-W.

BUILDING ENGINEER, twenty years' experience with well known firm of consulting engineers and contractors in design and supervision of industrial work. Desires change of employment to permanent position with industry on maintenance, alterations or extensions. Age 45. Apply to Box 2455-W.

PRODUCTION ENGINEER or shop supervisor in heavy plate work, machine shop or structural steel plant. Sixteen years experience. Excellent knowledge of production control systems, tool design and shop practice. Available under regulations of Wartime Bureau of Technical Personnel. Apply to Box No. 2456-W.

ELECTRICAL ENGINEER, B.Sc. '37, M.E.I.C. Age 33, married. Six years' experience covering power station and paper mill operation and maintenance, includes main dam reconstruction, highway, railway, water canal and snow surveys, construction design and layout for paper mill buildings, machinery, piping, high and low voltage, power distribution, assistant superintendent. Previous to graduation, five years experience as electrician's mate, departmental records, time and cost studies. Wants opportunity where knowledge and experience can be used to better advancement. Apply to Box No. 2457-W.

### WANTED

THERMOMETERS for Ascania magnetometer or any thermometers 4 in. long or less, with a range of -10° to -35° or -40° Centigrade. Would also buy MAGNETOMETER, preferably Ascania.

TRANSIT, second-hand, also wanted, with 1½ in. or larger objective for polar observations. Apply to Box 53-S.

---

NICKLE—DONALD COLLAMER, of Toronto, Ont. Born at Kingston, Ont., Sept. 7, 1902; Educ.: M.Sc., Mass. Inst. of Tech., 1927; 1923-25 (summers), paving foreman, City of Kingston; 1926 (6 mos.), Mass. Inst. Tech. practice school; 1927 (6 mos.), training in labs. of Kimberly-Clark Co., Neenah, Wis., and Niagara Falls, N.Y.; 1927-28, control supt., i/c of all lab & plant control, Spruce Falls Power & Paper Co., Ltd., Kapuskasing, Ont.; 1928-29, control supt., Donnacona Paper Co. Ltd., Donnacona, Que.; 1929-42, sales engr., Gypsum, Lime & Alabastine, Canada, Ltd., Toronto, i/c industrial sales; 1942-43, regional representative, Wartime Bureau of Technical Personnel, Toronto, 1943 to date, sales engr., Gypsum, Lime & Alabastine, Canada, Ltd., Toronto, Ont.

References: R. J. Askin, S. R. Frost, D. S. Ellis, H. W. Lea, W. L. Cassels, A. E. MacRae.

WILDWOOD—HARRY VERNON, of Fonthill, Ont. Born at Chatham, Ont. Aug. 17th, 1907; Educ.: B.Sc., Queen's Univ., 1936; 1926-30, ap'tice toolmaker, Detroit Accessories Corp'n, Detroit, Mich.; 1935-37, mill operator & refiner, Macassa Mines; 1937-41, asst. in metallurgical lab., Steel Co. of Canada; 1941 (9 mos.), toolroom foreman, Hamilton Munitions; 1941 to date, field engr., Electro-Metallurgical Co. of Canada.

References: N. K. Cameron, J. H. Ings, D. S. Scrymgeour, H. L. Weaver, J. C. Street.

#### FOR TRANSFER FROM THE CLASS OF JUNIOR

CASSIDY—STANLEY BERNARD, of R.R. No. 1, Fredericton, N.B. Born at Sussex, N.B., March 7, 1913; Educ.: B.Sc., 1933, M.Sc., 1939, Univ. of N.B. 1932-33 (during senior year), asst. in elect'l engrg., Univ. of N.B.; 1933 (6 mos.), head of geophysical party, N.B. Gas & Oilfields, Ltd.; 1935 (1½ mos.), asst. on geological survey, (1 mo.) geological computations; 1937-39, radio operator and engr., and 1939 to date, chief engr., Radio Station CFNB, Fredericton; also 1940 to date, professor at R.C.A.F. and R.C.N. Radio School, Univ. of N.B. (Jr. 1936)

References: J. Stephens, W. J. Lawson, E. O. Turner, A. F. Baird, J. H. Moore.

McGUIRE—JAMES FRANCIS, of 1593A Ducharme Ave., Outremont, Que. Born at Montreal, November 23, 1908; Educ.: B.E. McGill Univ., 1934; 1935 to date, sales and welding engr., Lincoln Electric Co., Montreal. (Jr. 1935).

References: F. P. Shearwood, F. Bowman, S. G. Lochhead, P. G. A. Brault, J. J. R. Scanlan.

#### FOR TRANSFER FROM THE CLASS OF STUDENT

CLOUTIER—JEAN PAUL, of Sorel, Quebec. Born at Montreal, July 3, 1916; Educ.: Completed dftsmn's course, completing mech. engrg. course, I.C.S., 1935 to date; 1932-34, farm machinery; With Singer Co., St. Johns, Que., as follows: 1934-37, production, piece work, 1937-38, departmental accounting, 1938-40, assistant foreman, machine mtce., jig fixtures, gauges, setting up time study, routing; 1940-43, tool engr., tool design, operating, routing, estimating, tool procurement and war time follow-up, Sorel Industries, Ltd., Sorel, Que. (St. 1942).

References: J. A. Lalonde, W. B. McLean.

DEMERS—CHARLES EUGENE, of Kenogami, Que. Born at Quebec, P.Q., June 3, 1916; B.Sc., Queen's Univ., 1941; Summers, 1938, chairman & levelman for P. M. H. LeBlanc, Federal Surveyor, 1939-40, instr'man and office man, Highway Dept., Quebec; 1941-42, asst. field engr., Chute-à-Caron Power House extension, Foundation Co. of Canada; May, 1942 to date, asst. field engr. on Shipshaw Power Development, for H. G. Acres & Co. (St. 1941).

References: C. Miller, P. C. Kirkpatrick, G. R. Adams, D. S. Ellis, R. A. Low, J. B. Baty.

MARSOLAIS—J. IRENEE W., of Quebec, P.Q. Born at St-Jacques l'Achigan, Quebec, August 15, 1916; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1942, Summers: 1937-41, concrete inspr., senior asst. on geological party, i/c survey and constrn. of road No. 18, res. engr. on highway constrn., and a course in Ordnance Mechanical Engrg., Canadian Army; 1942 to date, res. inspr. of ordnance material, Dominion Arsenal, Quebec City, for the United States Army, Detroit Ordnance District (U.S. War Dept.). (St. 1941).

References: R. Boucher, A. Gratton, P. P. Vinet, S. A. Baulne, T. J. Lafrenière, O. Mathieu.

MAZUR—JOHN T., of 123 Pinewood, Toronto, Ont. Born at Melrose, Man., June 24, 1916; Educ.: 1B Standing final year, Univ. of Man., 1940; Summers: 1937-38, rodman, chainman, Manitoba Good Roads, 1939, drftsmn. and designer, Cowin & Co., Winnipeg; 1940-41, tool designer, MacDonald Bros. Aircraft, St. James, Man., 1941 to date engrg. supervisor, Plant No. 1, Massey-Harris Aircraft, Weston, Ont. (St. 1939).

References: C. V. Antenbring, E. S. Kent, A. E. MacDonald, G. H. Herriot, S. H. deJong.

POOLE—JOHN EDWARD, of Montreal, Que. Born at Regina, Sask., Feb. 18, 1916. Educ.: B.Sc., (Civil) Univ. of Alta., 1937. 1935 (summer) rodman City of Edmonton Engrg. Dept.; 1934 and 1936 (summers) and 1938-39, crusher greaser, dragline graser, and asst. engr., constrn. bldgs. and dam, Poole Construction Co. Ltd., Edmonton; 1937-38, asst. struct'l designer, City of Edmonton Power Plant; 1939-40, designing dftsmn. 1940-41, asst. project engr., 1942 to date constrn. cost control engr., Defence Industries, Ltd., Montreal; 1941-42, res. engr., constrn. chemical plant, Canadian Industries Ltd., Montreal. (St. 1937).

References: R. S. L. Wilson, R. G. Watson, A. W. Haddow, C. H. Jackson, D. A. Killam.

SMITH—ARTHUR DALE, of St. Catharines, Ont. Born at Aberfoyle, Ont., May 12, 1916; Educ.: B.A.Sc.: Univ. of Toronto, 1939, 1939 to date, Foster Wheeler, Ltd., Proposal Dept., preparation of replies to inquiries, tenders, etc. Preparation of layout drawings, gradually assuming charge of this work. Also general engineering and purchasing for complete oil refinery. (St. 1939).

References: R. W. Angus, E. A. Allcut, J. E. Neilson, D. V. McIntyre, W. C. Lorimer.

SOLOMON—JULIUS DENISON, of 76 Proctor Blvd., Hamilton, Ont. Born at Dartmouth, N.S., March 22, 1921; Educ.: B.A.Sc., (Civil) Univ. of Toronto, 1942; 1940 (summer), ship's fitter, layout, lofting and erecting for naval vessel, Halifax Shipyards, Ltd., Halifax; 1941 (summer), design & dfting. for mechanized equipment, and 1942 to date, development engr. on design of armoured fighting vehicles, Hamilton Bridge Co. Ltd., Hamilton, Ont. (St. 1942).

References: W. P. Copp, H. R. Theakston, R. F. Legget, H. J. A. Chambers.

TIMMS—REGINALD HAROLD, of Fonthill, Ont. Born at Welland, Ont., July 11, 1916; Educ.: B.A.Sc., Univ. of Toronto, 1942; 1930-42 (summers) general constrn. in summer months and 1942 to 1943, vice-pres. and gen. mgr., i/c field engrg. and general field supervision of constrn. for the R. Timms Construction Ltd.; At present Sub. Lieut. i/c naval constrn. party on west coast, R.C.N.V.R. (St. 1942).

References: R. F. Legget, D. S. Scrymgeour, J. Stirling, W. B. Redfern, Wm. Storrie.

### CERAMIC DUST COLLECTOR

Thermix Engineering Co., Greenwich, Conn., have issued a folder describing and illustrating a tubular dust collector made of non-priority ceramic fire clay. No fixed model is offered as units are assembled and constructed on the job from ceramic clay components mounted in a concrete structure, and design and specifications for which are submitted to best suit each local situation.

### MANUFACTURING RIGHTS

An agreement was recently concluded between the Federal Machine & Welder Co., Warren, Ohio, and the Ferranti Electric Ltd., Toronto, Ont., whereby the latter company will manufacture in Canada a complete line of Federal resistance welding machines. The equipment includes spot, flash, projection, seam, and barrel welders, also uni-pulse spot welders, embracing the condenser discharge method for spot welding aluminum alloys in aircraft fabrication. This equipment will be sold and serviced as in the past by The Canadian Fairbanks-Morse Co. Ltd., through its branches throughout Canada.

### RECENT ANNOUNCEMENT

Announcement has been made that Bakelite Corporation of Canada Ltd. has transferred all of its assets and business to its affiliated company, Carbide & Carbon Chemicals Ltd., which also is a wholly owned subsidiary of Union Carbide & Carbon Corporation. The business will be operated under the name of Carbide & Carbon Chemicals Ltd., Bakelite Division, and will continue to be operated under the same management and personnel.

### PAINT IN STICK FORM

The Markal Company, 6 E. Lake St., Chicago, Ill., have recently issued a bulletin describing the characteristics and uses of their line of Markal paint sticks for marking various surfaces of metal, lumber, glass, stone, cloth, paper, etc., with a genuine permanent paint mark which does away with the inconvenience of the paint pot and brush where these are not required for any other purpose other than lettering, numbering or applying identifying marks. Special paint sticks are available for varying surface conditions, such as wet or moist, oily or greasy, hot or cold. Samples are offered to interested industrial officials.

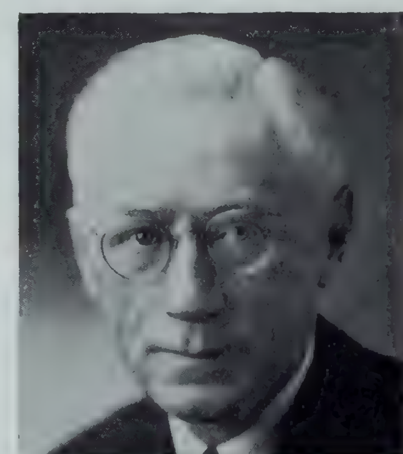
### LINK-BELT APPOINTMENTS

According to a recent announcement by Link-Belt Limited, Mr. John Farley, vice-president, and for the last eighteen years head of the Montreal Office, has been appointed general manager of all the company's operations at Toronto, Elmira, Montreal, Swastika and Vancouver, with headquarters in Toronto.

Mr. Lloyd Huber, heretofore chief engineer at Montreal, succeeds Mr. Farley as manager of the Montreal office. Mr. Huber has been a member of the Montreal office since 1929.

**John Farley**





**J. Howard Morgan**

### NEW APPOINTMENT

Jenkins Bros. Limited recently announced the appointment of Mr. J. Howard Morgan as district sales executive for the province of British Columbia. He will be located at, and in charge of the company's warehouse and branch at 1084 Homer St., Vancouver, B.C. Previous to his recent appointment, Mr. Morgan served on the sales staff of the company, covering the Maritime provinces, Quebec and Eastern Ontario. His record of service totals thirty-one years with the Jenkins organization.

### TURBOCHARGERS

Elliott Company, Jeannette, Pa., have issued bulletin M-5, which is published for the special information of companies and services engaged in the manufacture or use of four-cycle Diesel engines. The bulletin describes the Buchi system of turbocharging as embodied in the "Elliott-Buchi Turbocharger." This turbocharger is for application to four-cycle engines above 250 b.h.p. for marine, railroad and stationary service. Photos of typical applications in well-known companies and a cut-away view showing the internal construction of a complete assembly, make for complete understanding of the functions and value of this equipment in the field of Diesel power generation.

### NEW PLANT

To augment their recently built oxygen plant at Montreal the Wall Chemical Corporation Ltd. (division of the Liquid Carbonic Corporation) have announced the completion of a new plant to produce acetylene gas customarily supplied in cylinders to the steel and welding trades. The location of the new plant is in the town of Ville LaSalle, P.Q. The new unit is conveniently located to accommodate the demand for acetylene in the metropolitan area of Montreal, the province of Quebec and that portion of Eastern Ontario adjacent to the Ottawa valley. The most modern designs have been incorporated into the new Wall Chemical plant where all the latest devices have been employed to provide the utmost in safety in the manufacturing process.

### CASH AWARDS

B. W. Deane & Company, Ltd., in co-operation with Metallizing Engineering Co. Inc., announce a new series of cash awards for maintenance and production work done with the metallizing process.

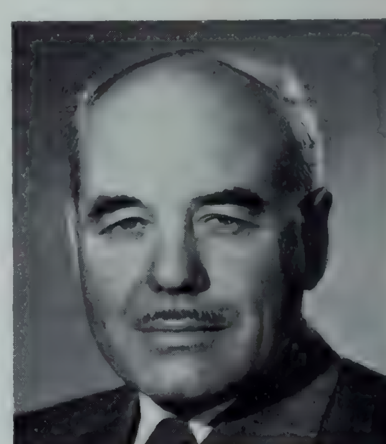
These new conservation awards will be presented for the most outstanding examples of any metallizing work done in any industry. They are offered for the best descriptions of (a) maintenance jobs done inside or outside the plant, (b) salvage of mis-machined or other new, but imperfect parts, or (c) purely production applications where metallizing is an integral part of the actual manufacturing setup.

First prize is $200.00, second prize $100.00, and there are four prizes of $50.00 each and four prizes of $25.00 each. In addition to these prizes, which are offered by Metallizing Engineering Co. Inc., B. W. Deane & Co. Ltd., will present $100.00 in Victory Bonds to any Canadian entrant winning one of the standard awards.

Complete information, together with simplified rules and regulations, may be obtained from the sponsors, Metallizing Engineering Co. Inc., Long Island City 1, New York, or from this company's Canadian distributors, B. W. Deane & Co. Ltd., McIntyre Building, Montreal, Que.

### BOX-TYPE ELECTRIC FURNACES

Bulletin 2936A, 4 pages, issued by Canadian General Electric Co. Ltd., Toronto, Ont., describes construction and operating features of types of electric furnaces for heat-treating, carburizing and annealing metals at temperatures up to 1,850 deg. F. max. Ratings range from 11 to 75 kw., capacities from 80 to 750 lbs. of steel per hour at 1,500 deg. F.



**Lloyd Huber**

# THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

VOLUME 26 MONTREAL, DECEMBER 1943 NUMBER 12

"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."

★ ★ ★

PUBLISHED MONTHLY BY

THE ENGINEERING INSTITUTE OF CANADA

2050 MANSFIELD STREET - MONTREAL



Price 50 cents a copy, $3.00 a year: in Canada, British Possessions, United States and Mexico. $4.50 a year in Foreign Countries. To members and Affiliates, 25 cents a copy, $2.00 a year. —Entered at the Post Office, Montreal, as Second Class Matter.



## CONTENTS

# THE ENGINEERING INSTITUTE OF CANADA

## MEMBERS OF COUNCIL - 1943

**PRESIDENT**
K. M. CAMERON, Ottawa, Ont.

**VICE-PRESIDENTS**
†W. P BRERETON, Winnipeg, Man.
*H. CIMON, Quebec, Que.
†L. F. GRANT, Kingston, Ont.
*J. L. LANG, Sault Ste. Marie, Ont.
†C. K. McLEOD, Montreal, Que
*G. G. MURDOCH, Saint John, N.B.

**PAST-PRESIDENTS**
*T. H. HOGG, Toronto, Ont.
†C. J. MACKENZIE, Ottawa, Ont.
‡C. R. YOUNG, Toronto, Ont.

**COUNCILLORS**
†J. E. ARMSTRONG, Montreal, Que.
†H. E. BRANDON, Toronto, Ont.
*S. G. COULTIS, Calgary, Alta.
*G. L. DICKSON, Moncton, N.B.
‡E. V. GAGE, Montreal, Que.
*F. W. GRAY, Sydney, N.S.
*E. D. GRAY-DONALD, Quebec, Que.
*J. HAIMES, Lethbridge, Alta.
†R. E. HEARTZ, Montreal, Que.
*W. G. HUNT, Montreal, Que.
*E. W. IZARD, Victoria, B.C.
†A. JACKSON, Kingston, Ont.
*J. R. KAYE, Halifax, N.S.
‡J. A. LALONDE, Sorel, Que.
†A. M. MACGILLIVRAY, Saskatoon, Sask.
*N. MacNICOL, Toronto, Ont.
†N. B. MacROSTIE, Ottawa, Ont.
*T. A. McELHANNEY, Ottawa, Ont.
*A. W. F. McQUEEN, Niagara Falls, Ont
†G. E. MEDLAR, Windsor, Ont.
†J. P. MOONEY, Saint John, N.B.
†E. NELSON, Edmonton, Alta.
†H. G. O'LEARY, Fort William, Ont.
*A. E. PICKERING, Sault Ste. Marie, Ont.
*G. MacL. PITTS, Montreal, Que.
*W. J. W. REID, Hamilton, Ont.
*J. W. SANGER, Winnipeg, Man.
†C. SCRYMGEOUR, Dartmouth, N.S.
*H. R. SILLS, Peterborough, Ont.
†J. A. VANCE, Woodstock, Ont.
†H. J. WARD, Shawinigan Falls, Que.
†J. W. WARD, Beauharnois, Que.
†C. E. WEBB, Vancouver, B.C.

* For 1943. † For 1943-44 ‡ For 1943-44-45

**TREASURER**
C. V. CHRISTIE, Montreal, Que.

**GENERAL SECRETARY**
L. AUSTIN WRIGHT, Montreal, Que.

**SECRETARY-EMERITUS**
R. J. DURLEY, Montreal, Que.

**ASSISTANT GENERAL SECRETARY**
LOUIS TRUDEL, Montreal, Que.

## STANDING COMMITTEES

**FINANCE**
C. K. McLEOD, *Chairman*
J. E. ARMSTRONG
deG. BEAUBIEN
C. V. CHRISTIE
G. A. GAHERTY

**LEGISLATION**
J. L. LANG, *Chairman*
R. L. DOBBIN
R. J. DURLEY

**PAPERS**
L. F. GRANT, *Chairman*

**LIBRARY AND HOUSE**
E. V. GAGE, *Chairman*
A. T. BONE
J. S. HEWSON
M. S. NELSON
G. V. RONEY

**PUBLICATION**
J. A. LALONDE, *Chairman*
R. DeL. FRENCH, *Vice-Chairman*
A. C. D. BLANCHARD
H. F. FINNEMORE
T. J. LAFRENIERE

## SPECIAL COMMITTEES

**BOARD OF EXAMINERS AND EDUCATION**
R. A. SPENCER, *Chairman*
I. M. FRASER
W. E. LOVELL
A. P. LINTON
H. R. MacKENZIE
E. K. PHILLIPS

**GZOWSKI MEDAL**
W. H. POWELL, *Chairman*
H. V. ANDERSON
T. H. JENKINS
V. A. McKILLOP
E. O. TURNER

**DUGGAN MEDAL AND PRIZE**
J. M. FLEMING, *Chairman*
R. C. FLITTON
H. M. WHITE

**PLUMMER MEDAL**
O. W. ELLIS, *Chairman*
J. CAMERON
R. L. DOBBIN
R. E. GILMORE
L. E. WESTMAN

**LEONARD MEDAL**
A. E. CAMERON, *Chairman*
A. E. MacRAE
F. V. SEIBERT
E. STANSFIELD
G. W. WADDINGTON

**JULIAN C. SMITH MEDAL**
K. M. CAMERON, *Chairman*
C. J. MACKENZIE
C. R. YOUNG

**MEMBERSHIP**
J. G. HALL, *Chairman*
S. R. FROST
N. MacNICOL

**PROFESSIONAL INTERESTS**
J. B. CHALLIES, *Chairman*
O. O. LEFEBVRE, *Vice-Chairman*
J. E. ARMSTRONG
G. A. GAHERTY,
H. W. McKIEL
J. A. VANCE

**STUDENTS' AND JUNIORS' PRIZES**

**Zone A (Western Provinces)**
**H. N. Ruttan Prize**
W. P. BRERETON, *Chairman*
A. M. MACGILLIVRAY
C. E. WEBB

**Zone B (Province of Ontario)**
**John Galbraith Prize**
L. F. GRANT, *Chairman*
H. E. BRANDON
N. B. MacROSTIE

**Zone C (Province of Quebec)**
**Phelps Johnson Prize (English)**
C. K. McLEOD, *Chairman*
R. E. HEARTZ
W. G. HUNT

**Ernest Marceau Prize (French)**
H. CIMON, *Chairman*
J. A. LALONDE
E. D. GRAY-DONALD

**Zone D (Maritime Provinces)**
**Martin Murphy Prize**
G. G. MURDOCH, *Chairman*
G. L. DICKSON
J. R. KAYE

**INTERNATIONAL RELATIONS**
M. J. McHENRY, *Chairman*
R. W. ANGUS
E. A. ALLCUT
A. E. BERRY
C. CAMSELL
J. B. CHALLIES
J. M. R. FAIRBAIRN
O. O. LEFEBVRE
W. H. MUNRO
C. E. WEBB
C. R. YOUNG

**THE YOUNG ENGINEER**
H. F. BENNETT, *Chairman*
J. BENOIT
D. S. ELLIS
J. N. FINLAYSON
R. DeL. FRENCH
R. F. LEGGET
A. E. MACDONALD
H. W. McKIEL

**POST-WAR PROBLEMS**
W. C. MILLER, *Chairman*
F. ALPORT
J. S. BATES
deGASPE BEAUBIEN
A. L. CARRUTHERS
J. M. FLEMING
E. R. JACOBSEN
G. R. LANGLEY
H. MASSUE
G. L. MacKENZIE
D. A. R. McCANNEL
A. W. F. McQUEEN
G. MacL. PITTS
P. M. SAUDER
D. C. TENNANT
H. G. WELSFORD

**WESTERN WATER PROBLEMS**
G. A. GAHERTY, *Chairman*
C. H. ATTWOOD
L. C. CHARLESWORTH
A. GRIFFIN
D. W. HAYS
G. N. HOUSTON
T. H. HOGG
O. O. LEFEBVRE
C. J. MACKENZIE
H. J. McLEAN
F. H. PETERS
S. G. PORTER
P. M. SAUDER
J. M. WARDLE

**ENGINEERING FEATURES OF CIVIL DEFENCE**
J. E. ARMSTRONG, *Chairman*
P. E. ADAMS
J. N. ANDERSON
S. R. BANKS
H. F. BENNETT
W. D. BRACKEN
W. P. BRERETON
J. M. DAVIDSON
R. S. EADIE
E. V. GAGE
G. A. GAHERTY
R. J. GIBB
A. GRAY
J. GRIEVE
J. L. LANG
R. F. LEGGET
I. P. MACNAB
J. A. McCRORY
H. J. McEWEN
C. B. MUIR
W. H. MUNRO
J. A. A. PICHÉ
G. MacL. PITTS
C. J. PORTER
M. G. SAUNDERS
W. O. SCOTT
T. G. TYRER
H. K. WYMAN

**INDUSTRIAL RELATIONS**
WILLS MACLACHLAN, *Chairman*
E. A. ALLCUT
D. BOYD
J. P. BRIERLEY
J. C. CAMERON
E. R. COMPLIN
J. A. COOTE
R. DUPUIS
S. M. GOSSAGE
F. W. GRAY
E. G. HEWSON
I. F. McRAE
A. M. REID
W. J. W. REID

**DETERIORATION OF CONCRETE STRUCTURES**
R. B. YOUNG, *Chairman*
E. VIENS, *Vice-Chairman*
G. P. F. BOESE
A. G. FLEMING
W. G. C. GLIDDON
O. O. LEFEBVRE
J. A. McCRORY
C. J. MACKENZIE
J. H. McKINNEY
R. M. SMITH

# THE ENGINEERING INSTITUTE OF CANADA

## OFFICERS OF BRANCHES

**BORDER CITIES**
*Chairman,* G. G. HENDERSON
*Vice-Chair.,* J. B. DOWLER
*Executive,* J. F. BLOWEY, A. H. PASK, A. H. MacQUARRIE
*(Ex-Officio),* G. E. MEDLAR, H. L. JOHNSTON
*Sec.-Treas.,* W. R. STICKNEY, 1614 Ontario Street, Walkerville Ont.

**CALGARY**
*Chairman,* J. G. MacGREGOR
*Executive,* F. A. BROWNIE, H. R. HAYES, A. HIGGINS, W. E. ROBINSON
*(Ex-Officio),* S. G. COULTIS, G. P. F. BOESE, H. J. McEWEN
*Sec.-Treas.,* K. W. MITCHELL, 803-17th Ave. N.W., Calgary, Alta.

**CAPE BRETON**
*Chairman,* J. A. MacLEOD
*Executive,* J. A. RUSSELL, M. F. COSSITT
*(Ex-Officio),* F. W. GRAY
*Sec.-Treas.,* S. C. MIFFLEN, 60 Whitney Ave., Sydney, N.S.

**EDMONTON**
*Chairman,* C. W. CARRY
*Vice-Chair.,* B. W. PITFIELD
*Executive,* J. A. ALLAN, J. W. JUDGE, E. D. ROBERTSON, J. D. A. MACDONALD, I. F. MORRISON, H. W. TYE
*(Ex-Officio),* D. HUTCHISON, E. NELSON
*Sec.-Treas.,* F. R. BURFIELD, Water Resources Office, Provincial Government, Edmonton, Alta.

**HALIFAX**
*Chairman,* A. E. FLYNN
*Executive,* G. T. CLARKE, D. C. V. DUFF, G. J. CURRIE, L. E. MITCHELL, J. D. FRASER, P. A. LOVETT, J. W. MacDONALD, G. T. MEDFORTH, J. E. CLARKE, R. B. STEWART, K. L. DAWSON
*(Ex-Officio),* J. R. KAYE, S. SCRYMGEOUR
*Sec.-Treas.,* S. W. GRAY, Wartime Bureau of Technical Personnel, 84 Hollis Street, Halifax, N.S.

**HAMILTON**
*Chairman,* T. S. GLOVER
*Vice-Chair.,* H. A. COOCH
*Executive,* C. H. HUTTON, R. J. G. SCHOFIELD, NORMAN EAGER, A. H. WINGFIELD
*(Ex-Officio),* W. J. W. REID, STANLEY SHUPE, A. R. HANNAFORD
*Sec. Treas.,* W. E. BROWN, 91 Barnesdale Blvd., Hamilton, Ont.

**KINGSTON**
*Chairman,* S. D. LASH
*Vice-Chair.,* H. W. HARKNESS
*Executive,* R. J. CARTER, D. C. MACPHERSON, H. R. ROGERS, F. A. ATHEY
*(Ex-Officio),* L. F. GRANT, A. JACKSON, K. M. WINSLOW
*Sec.-Treas.,* R. A. LOW, Dept. of Civil Engineering, Queen's University, Kingston, Ont.

**LAKEHEAD**
*Chairman,* R. B. CHANDLER
*Vice-Chair.,* S. T. McCAVOUR
*Executive,* S. E. FLOOK, O. J. KOREEN, E. L. GOODALL, J. I. CARMICHAEL, W. H. SMALL, A. D. NORTON, E. A. KELLY, J. S. WILSON
*(Ex-Officio),* E. M. G. MacGILL (Mrs. E. J. Soulsby), E. J. DAVIES, H. G. O'LEARY
*Sec.-Treas.,* W. C. BYERS, c/o C. D. Howe Co. Ltd., Port Arthur, Ont.

**LETHBRIDGE**
*Chairman,* J. M. DAVIDSON
*Vice-Chair.,* C. S. DONALDSON
*Executive,* A. G. DONALDSON, G. S. BROWN, N. H. BRADLEY
*(Ex-Officio),* J. HAIMES
*Sec.-Treas.,* R. B. McKENZIE, McKenzie Electric Ltd., 706, 3rd Ave. S., Lethbridge, Alta.

**LONDON**
*Chairman,* T. L. McMANAMNA
*Vice-Chair.,* R. S. CHARLES
*Executive,* H. F. BENNETT, W. C. MILLER, F. T. TAYLOR, F. C. BALL, V. A. McKILLOP
*(Ex-Officio),* F. T. JULIAN, J. A. VANCE
*Sec. Treas.,* H. G. STEAD, 60 Alexandra Street, London, Ont.

**MONCTON**
*Chairman,* J. A. GODFREY
*Vice-Chair.,* A. S. DONALD
*Executive,* E. R. EVANS, H. W. HOLE, A. GORDON, G. C. TORRENS, G. E. SMITH
*(Ex-Officio),* H. J. CRUDGE, G. L. DICKSON
*Sec.-Treas.,* V. C. BLACKETT, Engrg. Dept., C.N.R. Moncton, N.B.

**MONTREAL**
*Chairman,* R. S. EADIE
*Vice-Chair.,* C. C. LINDSAY
*Executive,* H. F. FINNEMORE, R. C. FLITTON, G. D. HULME, C. E. GELINAS, K. G. CAMERON, G. H. MIDGLEY
*(Ex-Officio),* C. K. McLEOD, J. E. ARMSTRONG, R. E. HEARTZ, W. G. HUNT, J. A. LALONDE, G. MacL. PITTS, E. V. GAGE
*Sec.-Treas.,* L. A. DUCHASTEL, 40 Kelvin Avenue, Outremont, Que.

**NIAGARA PENINSULA**
*Chairman,* G. E. GRIFFITHS
*Vice-Chair.,* W. D. BRACKEN
*Executive,* A. G. HERR, C. G. MOON, G. F. VOLLMER, H. E. BARNETT, J. W. BROOKS, G. MORRISON, D. S. SCRYMGEOUR
*(Ex-Officio),* C. G. CLINE, A. W. F. McQUEEN
*Sec.-Treas.,* J. H. INGS, 2135 Culp Street, Niagara Falls, Ont.

**OTTAWA**
*Chairman,* G. H. FERGUSON
*Executive,* W. H. G. FLAY, G. A. LINDSAY, R. YUILL, W. H. B. BEVAN, J. H. BYRNE
*(Ex-Officio),* T. A. McELHANNEY, K. M. CAMERON, N. B. MacROSTIE
*Sec. Treas.,* A. A. SWINNERTON, Dept. of Mines & Resources, Ottawa, Ont.

**PETERBOROUGH**
*Chairman,* A. R. JONES
*Executive,* R. L. DOBBIN, A. L. MALBY, F. R. POPE, C. R. WHITTEMORE
*(Ex-Officio),* D. J. EMERY, H. R. SILLS
*Sec.-Treas.,* A. J. GIRDWOOD, 308 Monaghan Road, Peterborough, Ont.

**QUEBEC**
*Life Hon.-Chair.,* A. R. DÉCARY
*Chairman,* RENÉ DUPUIS
*Vice-Chair.,* E. D. GRAY-DONALD
*Executive,* S. PICARD, G. ST-JACQUES, L. GAGNON, A. E. PARÉ, G. W. WADDINGTON, Y. R. TASSÉ
*(Ex-Officio),* H. CIMON, R. B. McDUNNOUGH, P. MÉTHÉ, L. C. DUPUIS
*Sec.-Treas.,* PAUL VINCENT, Colonization Department, Room 333-A, Parliament Bldgs., Quebec, Que.

**SAGUENAY**
*Chairman,* CHAS. MILLER
*Vice-Chair.,* G. B. MOXON
*Executive,* J. FRISCH, W. E. COOPER, F. T. BOUTILIER
*(Ex-Officio),* R. H. RIMMER, J. W. WARD, ALEX. T. CAIRNCROSS
*Sec.-Treas.,* ALEX. T. CAIRNCROSS, 8-C Brittany Row, Arvida, Que.

**SAINT JOHN**
*Chairman,* A. O. WOLFF
*Vice-Chair.,* C. D. McALLISTER
*Executive,* G. M. BROWN, C. C. KIRBY
*(Ex-Officio),* G. G. MURDOCH, J. P. MOONEY, D. R. SMITH, G. W. GRIFFIN
*Sec.-Treas.,* F. A. PATRIQUEN, P. O. Box 1417, Saint John, N.B

**ST. MAURICE VALLEY**
*Chairman,* J. H. FREGEAU
*Vice-Chair.,* R. DORION
*Executive,* G. B. BAXTER, E. BUTLER, A. G. JACQUES, R. D. PACKARD, M. EATON, E. T. BUCHANAN, J. JOYAL, W. E. A. McLEISH, H. G. TIMMIS
*(Ex-Officio),* VIGGO JEPSEN, H. J. WARD
*Sec.-Treas.,* DAVID E. ELLIS, Shawinigan Water & Power Company, P.O. Box 190, Three Rivers, Que.

**SASKATCHEWAN**
*Chairman,* A. M. MACGILLIVRAY
*Vice-Chair.,* J. McD. PATTON
*Executive,* F. E. ESTLIN, E. K. PHILLIPS, J. I. STRONG, F. C. DEMPSEY, N. B. HUTCHEON, J. G. SCHAEFFER, R. A. SPENCER
*(Ex-Officio),* A. P. LINTON
*Sec. Treas.,* STEWART YOUNG, P.O. Box 101, Regina, Sask.

**SAULT STE. MARIE**
*Chairman,* N. C. COWIE
*Vice-Chair.,* A. M. WILSON
*Executive,* C. O. MADDOCK, C. R. MURDOCK, G. W. MacLEOD, K. G. ROSS, H. W. SUTCLIFFE
*(Ex-Officio),* J. L. LANG, A. E. PICKERING, L. R. BROWN
*Sec. Treas.,* O. A. EVANS, 159 Upton Road. Sault Ste. Marie

**TORONTO**
*Chairman,* W. H. M. LAUGHLIN
*Vice-Chair.,* S. R. FROST
*Executive,* F. J. BLAIR, R. F. LEGGET, E. G. HEWSON, A. H. HULL, C. F. MORRISON, E. A. CROSS
*(Ex-Officio),* H. E. BRANDON, W. S. WILSON, T. H. HOGG, C. R. YOUNG, N. MacNICOL, J. M. VAN WINCKLE
*Sec.-Treas.,* S. H. deJONG, Dept. of Civil Engineering, University of Toronto, Toronto, Ont.

**VANCOUVER**
*Chairman,* T. V. BERRY
*Vice-Chair.,* A. PEEBLES
*Executive,* J. P. FRASER, F. H. BALLOU, E. S. JONES, R. C. PYBUS, G. W. ALLAN, J. A. TAMES
*(Ex-Officio),* C. E. WEBB, W. N. KELLY
*Sec.-Treas.,* P. B. STROYAN, 2099 Beach Avenue, Vancouver, B.C.

**VICTORIA**
*Chairman,* KENNETH REID
*Vice-Chair.,* A. L. FORD
*Executive,* H. L. SHERWOOD, A. N. ANDERSON, F. C. GREEN, J. H. BLAKE
*(Ex-Officio),* E. W. IZARD, A. S. G. MUSGRAVE
*Sec.-Treas.,* R. BOWERING, 41 Gorge Road West, Victoria, B.C.

**WINNIPEG**
*Chairman,* J. T. DYMENT
*Vice-Chair.,* T. H. KIRBY
*Executive,* C. V. ANTENBRING, N. M. HALL, B. B. HOGARTH, R. H. ROBINSON, R. A. SARA
*(Ex-Officio),* W. P. BRERETON, J. W. SANGER, D. M. STEPHENS
*Sec.-Treas.,* T. E. STOREY, 55 Princess Street, Winnipeg, Man.

# SOME DESIGN FEATURES OF THE MOSQUITO AEROPLANE

R. B. McINTYRE

*Project Engineer, The de Havilland Aircraft of Canada, Limited, Toronto, Ont.*

**A paper delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, at Toronto, Ont., on September 30th, 1943**

The Mosquito aeroplane is, perhaps, the outstanding aeronautical achievement of this war. While the latest performance figures are still held secret, it may be told that it is the fastest aircraft in operation in the world. The design was not started until after the war began, so that it represents another world record—time from drawing board to operations against the enemy: 22 months—and the prototype flight trials took place only eleven months after design began.

The Mosquito is in service in several versions: as a day and night bomber, a long range day and night fighter, as a fighter-bomber and intruder. It has full fighter strength factors, fighter manoeuvrability, light handling, with straightforward flying and landing qualities.

The reason for this exceptional performance is not any single new, revolutionary or "secret" device. It is simply the result of long experience, excellent design and careful attention to details. Of course, from the North American point of view, particular interest is aroused by the fact that its whole basic load-carrying structure is made of wood.

Wood was chosen for several reasons:

(i) to get more quickly through design and prototype stages and into production;
(ii) to use the long experience of the de Havilland Company in wood design;
(iii) to secure a structure with a high volume per pound ratio—(this yields a "buckle-free" structure and one which is less susceptible to damage from gun and shrapnel fire).
(iv) to obtain a structure capable of easy and quick repair;
(v) to employ a fresh labour group;
(vi) to tap new material supplies.

The latter reasons enabled the production to be widely dispersed and sub-contracted; for example, in Great Britain, the de Havilland Company has about 400 sub-contractors making components, and here in Canada, a similar condition obtains.

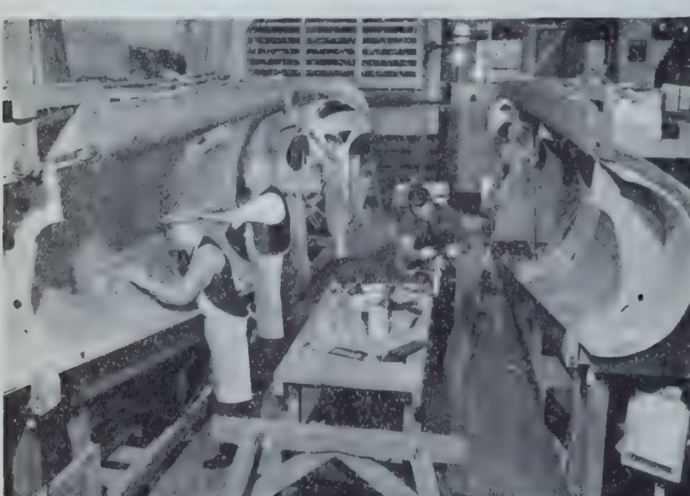
## Principal Characteristics of Plane

The Mosquito is a mid-wing twin-engine monoplane, with a span of 54 ft. and an over-all length of about 41 ft. The wing is continuous through the fuselage and is based on two spars running from tip to tip. The wing is characterized by a pronounced taper (3.2 to 1.0) and is aerodynamically swept forward. It has a single fin and rudder, and in side elevation this is noticeably tall. The machine is powered with two Rolls-Royce Packard Merlin engines. This engine is a 12-cylinder "V" type, liquid cooled. The coolant radiators are housed in the forward portion of the inboard wing, the cooling air being drawn from the leading edge and ejected through a controlled exit in the wing undersurface. This gives a very clean cooling arrangement, and a virtually zero cooling drag at speed. The undercarriage retracts aft and upwards into the engine nacelle and the tail wheel also retracts, resulting in a very clean wetted surface with a minimum of parasite drag. It will be noted that the engine nacelles are perhaps unusually long. This has been done to secure a greater directional stability than would otherwise obtain with the use of the single fin.

The gross wing area of the Mosquito is 440 sq. ft., and this wing operates at loadings between 40 to 50 lb. per sq. ft. The landing speed is a trifle high at 130 m.p.h. and, in order to reduce this, slotted flaps are incorporated which reduce this figure to about 110 m.p.h. The stall, incidentally, is not violent and the machine shows no tendency to drop a wing suddenly; a reasonable warning of the stall approach can be felt. The ailerons are of the Frise type, and do not cause the usual aileron troubles experienced on high speed aircraft. Aileron control can be maintained right down to the stall. There is no tendency toward aileron reversal at the higher speeds, and while the controls naturally become heavier in dive, they may still be operated successfully at Mach numbers up to about 0.65.

It should be mentioned here that a great deal of development work went into the flying control systems on the Mosquito. Many full-scale flight tests were done on geometrically similar aircraft in order to iron out as many snags as possible before completing the prototype.

The control surfaces are all cable-operated, and variable ratio gearing is secured by the use of elliptical sprockets and pulleys. Troubles due to surface deformation on elevators and ailerons have been overcome by the use of metal skin coverings on these two control surfaces.



**Here are two component fuselage pieces which joined together make a complete fuselage proper. A lath strip, tongue and groove fitting, and special adhesives bind them together so neatly and firmly that the join is not only invisible, but as strong as any part of the fuselage.**

## Use of Wood in Fuselage, Wings and Control Systems

The wing, fuselage, tail plane, fin and flaps are fabricated entirely in wood. The skins are fully stressed throughout. The fuselage, as usual, due to the depth available, carries a relatively light skin stress so that the problems are those of producing a "buckle-free" structure, and of satisfactorily carrying stress around holes and cut-outs. It is for these reasons that wood is particularly advantageous in the fuselage construction, since due to its low density, greater thicknesses of material must be used to carry the given loads than would be the case in a corresponding metal machine; and since it is primarily the thickness which determines the buckling load, the wooden structure can be made buckle-free. In the case of the Mosquito, the thickness of the fuselage shell was made even greater by dividing the required plywood thickness in two, and separating these skins by a core of balsa wood. The balsa is not a load-carrying material, but simply a continuous supporting medium for the stress-carrying skins. It must, however, be shear-connected to these skins. Hence the only requirements for the core material are that it shall glue easily to the birch, be light in weight, and not absorb excessive quantities of moisture during the gluing operations.

Where it is necessary to strengthen the shell locally for concentrated loads, or to stiffen the edges of cut-outs, this is readily done by replacing the balsa at any given point by spruce or moulded birch inserts, between the ply skins.

The total thickness of the fuselage shell is about 7⁄16 in. and this is constant throughout.

The plywood used over the after (more heavily stressed) section of the fuselage, is birch 3-ply, while that in the nose section is 3-ply spruce. All plywood is phenolic bonded.

The structural weight of the finished fuselage is about 600 lb. which represents about 3½ per cent of the all-up weight of the aircraft.

### Loads, Construction Features, and Weights

All Mosquito models are designed to an ultimate factor of 8.0 (C.P.F.*). The wing loading is between 40-50 lb. per sq. ft. This calls for rather careful detail design treatment of the wing structure, since the shearing, bending and torsional loads must be resisted in a structure having a maximum depth of about 20 in. The design is such that the shearing, bending and torsional resistances are provided by the "spar box structure." This "box" is made up of the front and rear spars, together with the top and bottom flanges of each spar.

Complications are introduced on the bottom, or tension side of this structure, by the fact that there are four removable wing panels and an open wheel-well. The panels are, of course, bolted home in such a way that they are stress-connected to the adjacent spar and skin edges; but across the wheel-well all the skin stresses must be fed into the spars which are therefore strengthened locally to accept these additional loads. The main spar flanges are spruce, while the shear webs are 3-ply birch with face grain at 45 deg. to the longitudinal axes in the spars. The top and bottom skins are also 3-ply birch, with the outboard sections at 45 deg. to the long axis of the wing, and the inboard sections having a spanwise grain.

In order to provide a buckle-resistant compression skin on the top side, a shell type of construction has again been employed. This consists of Douglas fir stringers, glued between inner and outer ¼ in. ply skins. This gives an over-all top skin thickness of about 1¾ in. The stringers are continuous spanwise and Douglas fir has been used because of its higher compression value. On the tension side, where additional strength is required, especially at, and inboard of, the engines—white ash is employed.

Woodscrews are employed throughout the entire structure, and all woodscrews are driven while the glue between the joints is still wet.

The nose and trailing edge sections of the wing are relatively light, the ply thickness being about ⅛ in., since these structures are called upon simply to resist their own local loads.

Concentrated loads such as those arising from the engine, undercarriage, radiator and fuel tanks are conducted into the primary wing structure by metal fittings, bolted through the ribs or spars. Where the bolt bearing stresses in the timber may be excessive, special fabric-base Bakelite blocks are glued to the timber under the fittings so that the attaching bolts bear in the Bakelite blocks. Since the Bakelite has a bearing strength of about 30,000 lb. per sq. in., this enables fewer and smaller diameter attaching bolts to be employed.

The total structure weight of the wing, not including fuel tanks, engine mounts, or radiators is 2,200 lb. which represents about 10 per cent of the all-up weight of the aircraft. For comparison purposes, it should be noted that the total structure weight (wings, empennage, undercarriage, and fuselage) totals about 4,500 lb. divided approximately as follows:

| | |
|---|---|
| Wing | 49.5% |
| Empennage | 8.2% |
| Undercarriage | 28.6% |
| Fuselage | 13.7% |

*Centre of pressure forward.

The total of 4,500 lb. represents about 21.5 per cent of the all-up weight of the machine. The crew's gear, controls, instruments, electrical and hydraulic gear, amount to about 1,300 lb. or 6 per cent of the all-up weight. The power units complete account for about 5,700 lb., which is about 27 per cent.

An interesting figure, perhaps, is the weight of crew—two men, which is just over 1½ per cent of the all-up weight. This may indicate why "so few can do so much."

### Aerodynamic Data

The best way to indicate aerodynamic excellence is to quote all-out level speed figures. The British Air Ministry has ruled that such data shall not be quoted for the Mosquito. However, as a result of tests carried out on all types of aircraft at the Aircraft and Armament Experimental Establishment, Boscombe Down, England, the fact has been established that the Mosquito is the fastest aeroplane in operation in the world to-day. As a general indication of the cruising performance of this machine, it may be said that it is not unusual for aircraft to leave our aerodrome at Downsview, and be landing at Dorval, near Montreal, within 55 minutes.

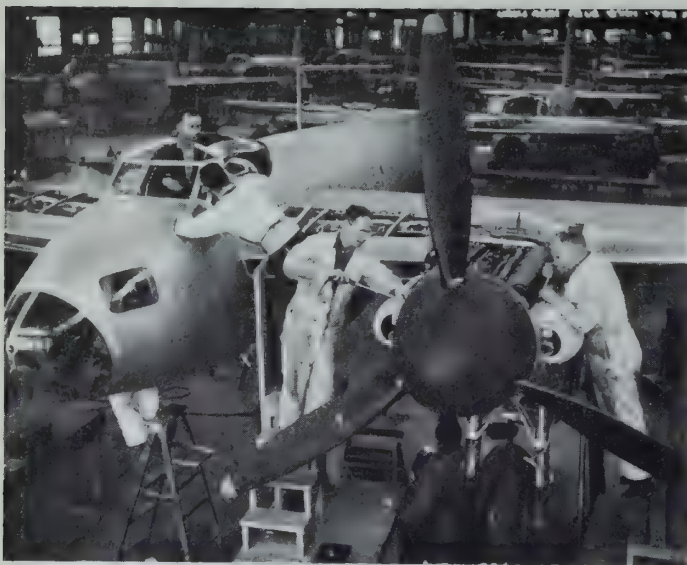
While not being able to give speed figures, there are other ways of showing the aerodynamic cleanness of this aeroplane, and this data will, perhaps, be even more interesting to those familiar with aerodynamic computations.

The Packard-built Rolls-Royce engines with two-speed supercharger have a maximum power rating in high gear of 1,120 b.h.p. at 3,000 r.p.m. at 18,500 ft. The Mosquito actually develops its greatest all-out level speed at an altitude of nearly 22,000 ft. This difference in height of 3,500 ft. between flight and test-bench figures, is the result of ram on the forward facing carburettor air intakes. Incidentally, this shows how carefully the air intake scoop was designed in order to recover almost all the dynamic head at the maximum speed.

The equivalent flat plate drag area for the extra-to-wing surfaces is approximately 5 sq. ft. and, of this, the two nacelles account for about 50 per cent. On a total wetted area basis, the theoretical turbulent skin friction coefficient is about 0.0024, and the ratio of actual skin friction to theoretical skin friction is 2.1. When it is remembered that the de Havilland "Albatross," a commercial passenger-carrying aeroplane, and perhaps one of the cleanest yet built, had a ratio of 1.9, it may be seen that the Mosquito, a purely military aeroplane, is exceptionally free from parasite drag and interferences. This accounts for its high performance with standard military engines.

People who have been close to the design side of the aircraft industry know only too well how difficult it is to secure such cleanness—it requires the most careful attention to all details and a very firm control from the chief designer. Naturally, the Mosquito, being fabricated in wood, is com-

Glued together the forms now make a complete fuselage.



**Final assembly line. Mechanics install one of the powerful Packard-built Rolls-Royce engines.**

pletely free of all external rivet heads and small protuberances, and, being a fabric covered machine, enables a reasonably thick coat of dope to be held which, when sanded down, produces a very smooth wetted surface.

It is also interesting from an aerodynamic point of view to note that the wing operates normally at Reynolds' numbers up to 30 million, and Mach numbers of 0.70 have been attained.

With this sort of performance, the Mosquito has enabled us to explore, from the practical side, new and interesting regimes in the field of fluid motion.

### Measurement Difficulties with Speeds Near That of Sound

The sub-sonic region does not lend itself to complete mathematical resolution, and facts which are now being brought to light as a result of flight tests, made with the Mosquito, are of immeasurable value in assisting in the solution of problems associated with speeds approaching that of sound.

One of the queer facts connected with the advent of such speeds, is that we have discovered how difficult it is to measure such speeds accurately. Much work has been done since the war began in trying to develop methods which will give speed figures accurate within guaranteed limits. The Mosquito enables this study to be carried on, and such methods to be developed. The main reason, of course, for this difficulty, is the pressure changes which are encountered in the flow pattern as the Mach numbers goes beyond about 0.6. Certain local regions of the aeroplane may, in fact, induce shock waves in which the pressure changes are virtually instantaneous. This means that our ordinary pitot-static method for speed measurement is rendered completely inaccurate, should either the pitot or static hole lie in a region subject to such a flow.

Even in normal operations with aircraft such as the Mosquito, the static hole cannot be relied on too much to transmit accurate pressures, and it is always desirable to do a position error check on any given aeroplane at frequent intervals.

Strangely enough, one of the most difficult figures to obtain is the temperature of the air surrounding the machine during flight. Due to the high speeds, adiabatic compression takes place on the thermometer bulb or indicating unit. At indicated speeds above 200 m.p.h. this is great enough to register a higher temperature than that which is actually present. When it is said that these corrections may sometimes amount to 10 or 15 deg. C. with an ordinary mercury or alcohol thermometer placed normal to the flow, it will be appreciated that the error is not small enough to neglect.

### Reliability in Service, Ease of Repairs

It was mentioned previously that one of the reasons wood was selected is its ability to withstand serious punishment in service, especially from gun fire and shrapnel. This has been borne out by operational experience, as some of the reports from the European sector clearly indicate. Cases are on record of machines having returned safely to England with considerable portions of their structure shot away. In one case, there was a huge hole in the side of the fuselage, just aft of the wing. The only thing which the crew noticed following the impact of the burst was merely a cold draught in the cockpit. The aeroplane flew and handled normally. Another case reports that the elevators were shot away, removing that control completely, but the pilot was able to bring his machine safely home, simply by manipulating the throttles and flaps. Machines frequently return with bullet holes through the spars and through the top and bottom skins.

Wood also has the distinct advantage of making a clean hole; so that the characteristic "flowering" of all-metal structures does not take place. It is this "flowering" of the metal machine which makes bullet-proofed tanks so vulnerable, for the metal simply forms a funnel holding the sealing material away, and allowing the fuel to run out.

Wood also, with its ability to absorb energy, transmits less vibration from the power units, and at the same time is able to withstand the heavy buffetting which the aeroplane encounters while coming in through flak on a bomb run.

That the wooden structure should be easier to repair is fairly obvious, since the repairs can be effected with standard wood-working tools and with standard journeymen carpenters. It is not easy to bend a wooden structure permanently. The stresses will either crack the timber or it will return to its normal position. For this reason it is seldom necessary to return components to the factory for re-jigging, since by suitable support of the structure on trestles and jacks, spliced joints can be made *in situ*, yielding a perfectly repaired component.

For all these reasons, and there are many more, the Mosquito is well-liked in the services. We believe it is one of the best, if not the best, aeroplane of its type in operation to-day.

# ST. LAWRENCE RIVER CONTROL AND REMEDIAL DAMS — SOULANGES SECTION

M. V. SAUER, M.E.I.C.
*Hydraulic Engineer and General Superintendent, Generating Stations, Montreal Light, Heat & Power Consolidated*

**Paper presented before the Montreal Branch of The Engineering Institute of Canada, on October 7th, 1943**

In the past twenty years many exhaustive studies, both economic and technical, have been made on the development of the St. Lawrence river for power and navigation. The control and regulation of water levels in the several reaches has been a major feature of the technical investigations and the determination of the limits of such levels after completion of the various proposed developments has presented some unique hydraulic problems.

In the development of the Beauharnois power project these problems were encountered, and it is the purpose of this paper to describe the manner in which they were met, to outline the basis under which the control structures have been designed, to show some of the construction features and methods adopted, and to discuss some of the operating results.

### Location of the Work

Figure 1 is a map of the St. Lawrence river between Lake Ontario and Montreal, and shows the locations of the proposed ultimate developments. The Soulanges section, as referred to in the various reports of the International Boards which have investigated the complete development of the St. Lawrence river, comprises the 15-mile stretch between Lake St. Francis and Lake St. Louis in which there is a total drop of approximately 82 ft. This drop occurs in three rapids with intervening pools of quiet water. The Coteau rapids are at the outlet of Lake St. Francis and extend for one mile with a drop of 20 ft. Following is a four-mile stretch of quiet water to the head of Cedars rapids. The Cedars rapids extend for two miles with a drop of 35 ft. There then follows another pool of four miles, with the Cascades rapids at the lower end discharging the water into Lake St. Louis. Figure 2 shows the section from Lake St. Francis to Lake St. Louis, in which are located all of the works described herein.

### Development of the Soulanges Section

The Beauharnois development utilizes the total head of 82 ft. available in the Soulanges section by means of a canal by-passing the river between Lakes St. Francis and St. Louis; the power house being located on the shore of Lake St. Louis. The canal, 15 miles long and 3,300 ft. wide, is so located that it can be enlarged by dredging as the demands for power increase. At the present time the company is utilizing a flow of 83,000 cu. ft. per sec., which is the total diversion presently authorized by the Dominion and Quebec governments. This diversion from the Soulanges section has necessitated the construction of compensating and control works at the outlet of Lake St. Francis to maintain normal levels on that lake, and at the upper end of Cedars rapids to compensate the Cedars power development as well as the riparian interests along the river. The works at the outlet of Lake St. Francis are known as "Coteau Control Works" and at the head of the Cedars rapids as "Ile Juillet Remedial Works."

The natural flow of the river fluctuates from a normal minimum of 180,000 to a normal maximum of 360,000 cu. ft. per sec., and the Government engineers have fixed an amount of 392,000 cu. ft. per sec. as an extreme flood flow that must be provided for in any works built in this section of the river. The Coteau control works have been designed to discharge this flood flow, less an amount of 53,000 cu. ft. per sec. (which at all times can be passed through the Beauharnois canal), and to maintain the water levels of Lake St. Francis which would occur under the natural regimen of the river. Their general plan is shown on Fig. 3.

The Cedars development, constructed during the period from 1912 to 1924 by The Cedars Rapids Power and Manufacturing Company, utilizes the natural flow of the river between Ile Aux Vaches and the north shore and operates under a head of about 33 ft. Owing to the gradually increasing Beauharnois diversions, the water levels at the entrance to the Cedars canal were being lowered, and as a temporary measure to compensate for withdrawals up to 53,000 cu. ft. per sec. by Beauharnois, a temporary submerged weir of rock-filled timber crib construction was built entirely across the river a short distance downstream from the entrance to the Cedars canal. This work was carried out during 1934. When the authorized Beauharnois diversion was increased to 83,000 cu. ft. per sec. in 1940, it became necessary to provide a permanent regulating dam across the river near this point, and during 1940 and 1941 the Ile Juillet remedial works were constructed. These works, shown in Fig. 4, were designed to discharge 285,000 cu. ft. per sec., which, together with 80,000 cu. ft. per sec. spillway capacity at Cedars and 53,000 cu. ft. per sec. at Beauharnois, provides a large factor of safety during flood flows even with both plants shut down.

The hydraulic studies leading up to the design of these works involved an analysis of the backwater curves in the natural channels upstream from the structures, as well as the discharge capacities of the dams, and the structural

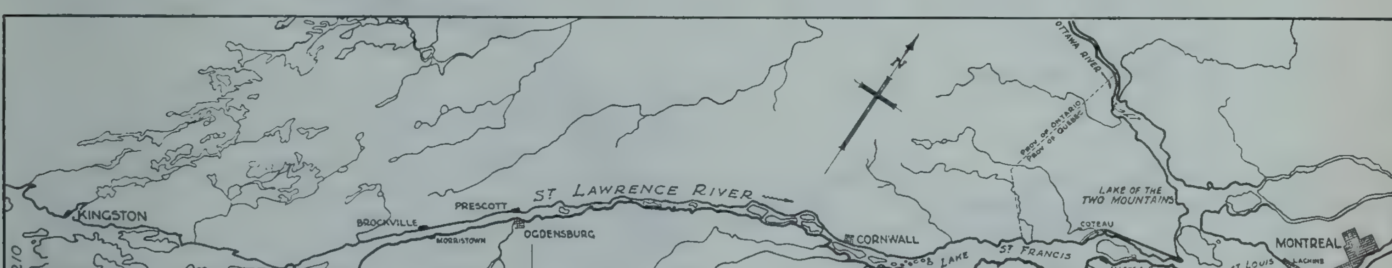



**Fig. 1—St. Lawrence river between Lake Ontario and Montreal.**

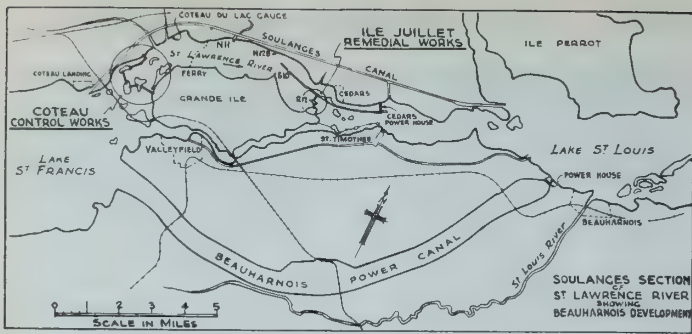



**Fig. 2—Soulanges Section of St. Lawrence river showing Beauharnois development.**

designs. Prior to the start of construction of the Beauharnois development, an Engineering Board consisting of Messrs. R. S. Lea, M.E.I.C., T. H. Hogg, M.E.I.C., and S. S. Scovil, M.E.I.C., was appointed by the Beauharnois Company to make a study and report on the necessary control and remedial works required in the river to compensate for the intended diversions. Extensive measurements were made of the natural distributions of flows through the different channels by stream gaugings, and water level-discharge relationships were obtained for strategic points along the river. In order to compute future water level-discharge relationships under the various conditions that would exist after the construction of the dams, 'slope-discharge' curves were developed from the natural water level-discharge relationships. Since the whole hydraulic design of both the Coteau and Ile Juillet dams is based on these 'slope-discharge' curves, it may be of interest to explain the method in some detail.

### Slope-discharge Curve Method for Backwater Computations

This method of computing the backwater levels along any river, caused by the construction and operation of a dam, was developed by Mr. S. S. Scovil for the study and design of control and remedial works in many developments throughout the country. The method assumes that in considering a reach of the river between any two gauge points, the mean area, mean hydraulic radius, and roughness factor being constant for the same mid-point water level, these elements can be eliminated from the calculations and a simple relation between slope and discharge derived. (See Fig. 5.)

By Chezy formula $v = C\sqrt{rs} = C\sqrt{r\frac{H}{l}}$

or $$Q = A\,C\sqrt{r\frac{H}{l}}$$

If mean area $(A)$, mean hydraulic radius $(r)$, and coefficient $(C)$ are constant, then:

$$\frac{Q}{Q_x} = \sqrt{\frac{H}{H_x}}$$

or $$H_x = H\left(\frac{Q_x}{Q}\right)^2$$

where $Q$ and $H$ are respectively discharge and drop in water level between two gauge points under natural conditions, and $O_x$ and $H_x$ are the same for conditions after construction of the dam and having the same midpoint water level.

For any water level at the dam (controllable by the number of sluice gates open) and for any discharge, the water levels at the various gauges working up the river can be computed by the above formula. Gauging points were so located that the river was split up into reaches of relatively uniform characteristics. Rather than computing the water levels by formula (requiring trial and error steps) from gauge to gauge and for each given combination of conditions, much time was saved by plotting slope-discharge curves for each successive pair of gauges and for the whole range of conditions covered. From these curves the backwater for any specific conditions was read directly, working from gauge to gauge and going either upstream or downstream.

The basic data required for computing the slope-discharge curves are the natural water level-discharge relationships for the series of gauging points along the length of the river under consideration. The records for plotting these natural curves were obtained for a wide range of flows. The following computations show the method of making up the slope-discharge curves for the section of the river between gauge R12 and gauge S10, the locations of which are shown on Fig. 2. Figure 6 shows the slope-discharge curves for the relationship between gauges S10 and R12.

| | |
|---|---|
| For natural discharge................ | 180,000 c.f.s. |
| W.L. at S10...................... | 131.2 |
| W.L. at R12...................... | 127.6 |
| therefore, natural drop............... | 3.6 ft. |

and W.L. at mid-point between S10 and R12 = 129.4

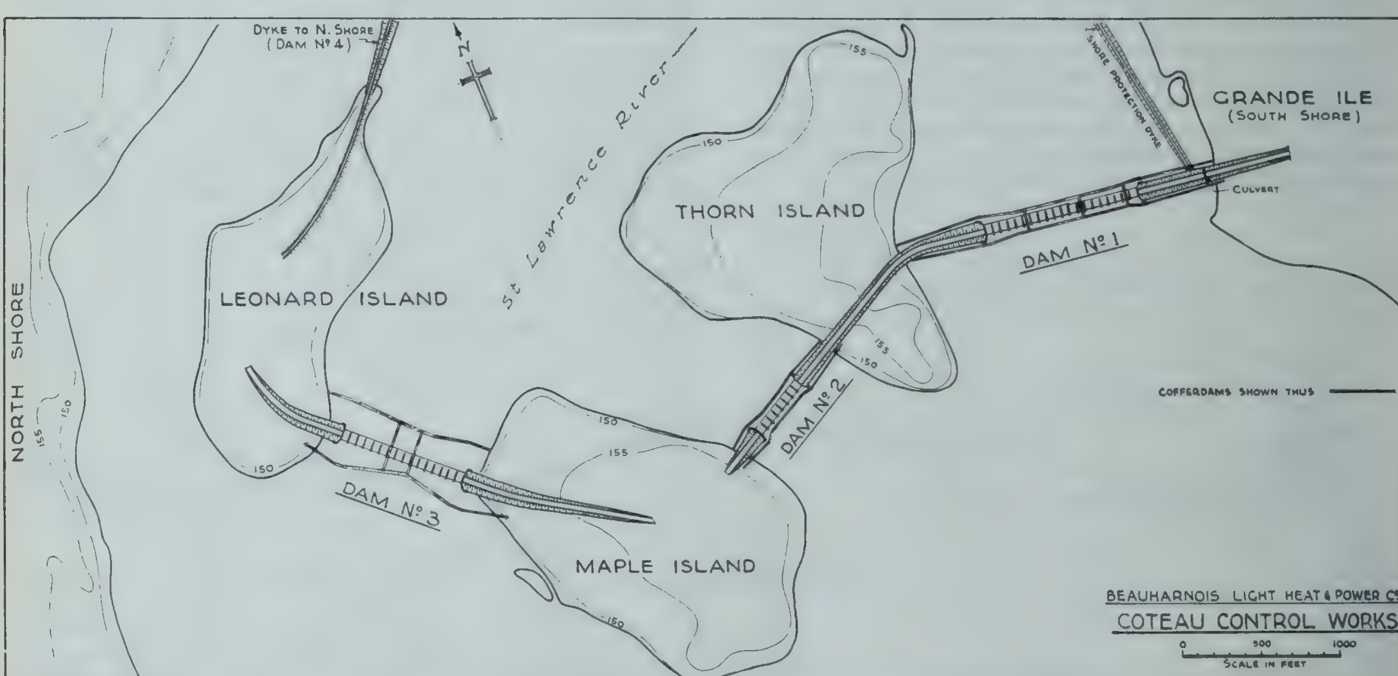



**Fig. 3—Plan of Coteau control works.**

The drop in W.L. for any other discharge having the same mid-point W.L. is therefore:

$$H_x = 3.6 \left( \frac{Q_x}{180,000} \right)^2$$

By assuming a series of discharges from zero to 180,000 cu. ft. per sec. the corresponding drop ($H_x$) is obtained for each discharge, and as the mid-point for the series is at El. 129.4 the actual levels at S10 and R12 are thus determined. Similarly a like series is worked out for mid-points corresponding to natural flows of 200,000 cu. ft. per sec., 220,000 cu. ft. per sec., etc., and the computed points of equal discharge plotted and joined by curves.

Other slope-discharge curves were computed in a similar manner for the relationships between pairs of key gauges such as N12B and S10, N11 and N12B, etc.

### Use of the Slope-discharge Curves

The use of the curves is simple and rapid. Starting with a definite water level at any one gauge, the corresponding water levels at the adjacent gauges upstream and downstream are read directly from the curves for the flow being considered, and so on, from gauge to gauge.

For the design of the sluice capacity of the Coteau dams, the slope-discharge curves were mainly used to determine the water levels at the structures which would correspond with the natural maximum high water level on Lake St. Francis and with the flood discharge through the Coteau rapids.

For the design of the sluice capacity of the Ile Juillet dams, the curves were used to find the water levels at the structures corresponding to natural high water level at the foot of Coteau rapids, and at the entrance to the Cedars canal.

A considerable number of gauge records have been obtained since the construction of the dams which verify the accuracy of the slope-discharge method of backwater computations. The results of two sets of these gauge readings are presented herewith to show the comparison between the computed and actual water levels.

Figures 7a and 7b show water surface profiles from Ile Juillet upstream to the foot of Coteau rapids (Coteau du Lac wharf and gauge) for total St. Lawrence river flows of 226,000 and 291,000 cu. ft. per sec. respectively. The total flows out of Lake St. Francis on the dates shown were distributed as follows:

| Date | Nov. 12, 1942 | May 30, 1943 (Sunday) |
|---|---|---|
| Total river flow | 226,000 | 291,000 |
| Beauharnois diversions | 74,000 | 61,000 |
| Misc. minor diversions | 7,000 | 7,000 |
| Through Coteau dams | 145,000 | 223,000 |
| Cedars diversion | 56,000 | 43,000 |
| Through Ile Juillet dams | 89,000 | 180,000 |
| Gates open at Ile Juillet: | | |
| South dam | 3 | 5 |
| North dam | None | 9 |


Placing steel crib in the south channel at Ile Juillet.

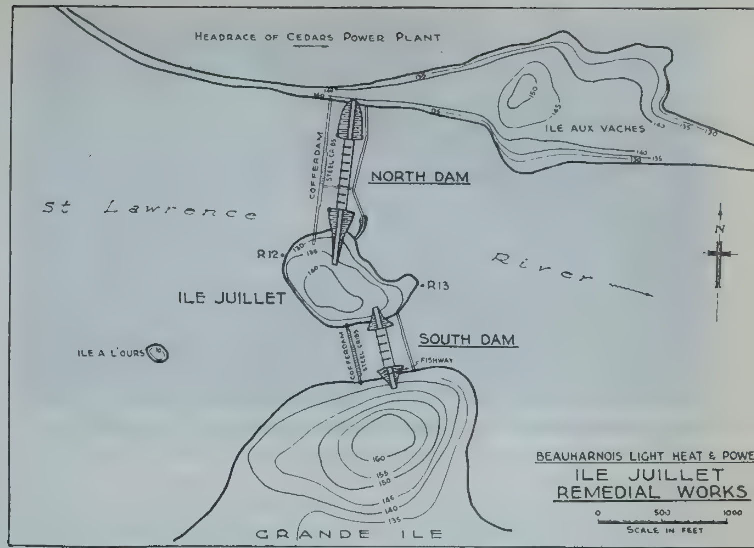


Fig. 4—Plan of Ile Juillet remedial works.

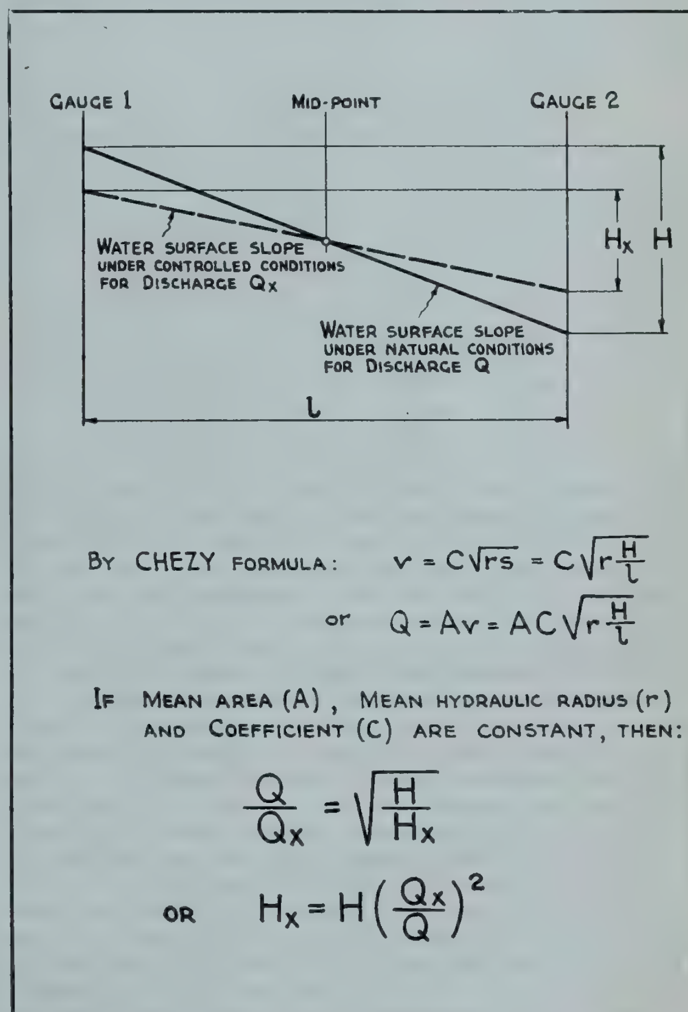


Fig. 5—Diagram for discharge between gauge points for derivation of "slope-discharge" relationships.

On each figure there are profiles marked 1, 2, 3, and 4, corresponding to various conditions, but all based on the same total river flow and the same Cedars diversion.

It will be noted that in both cases the computed backwater curve by the slope-discharge method is slightly higher than the actual water profile, indicating that the computations have provided a slight factor of safety.

In regard to flood flow capacity of the Ile Juillet dams, it will be noted that the restriction of the channel caused

**Steel cribs all placed across south channel at Ile Juillet with 20,000 cu. ft. per sec. flowing through open cribs prior to filling with rock.**

by the structures with all gates open causes a rise in water level at the head of Ile Juillet (gauge R12) of only 0.6 ft., as is evident from a comparison of profiles "2" and "3" in Fig. 7b, which are for identical flows. For Gauge N12B and upstream, the construction of the dams at Ile Juillet causes practically no rise in water level when all sluice gates are open.

### Design of Dam Structures

The structures at Coteau and Ile Juillet are all of similar type, and the general features and design factors are essentially the same in each dam. Dams 1, 2, and 3 at Coteau and the South and North dams at Ile Juillet all consist of mass concrete sluiceways with steel gates of the fixed roller type operated by travelling gantries. In all, there are five concrete structures with a total of 58 steel sluice gates.

The flood flows to be passed down the Coteau and Cedars rapids require sluiceway areas almost as large as the original river channels. The sill elevations of the sluices in each of the dams have been made to fit approximately the natural river bottom rock elevations. The foundations were excavated to sound rock and the concrete sills placed in monolithic blocks for each pier, having the construction joints located approximately midway between piers. Checks were left in the sill slabs for keying to the piers. All pier concrete was placed continuously in each form, and there are no construction joints in the piers. A grout curtain wall was provided along the upstream face of the sills by drilling the rock foundations and forcing cement grout under pressure into all openings and fissures. The solid nature of the limestone rock was evident from the fact that only in few cases was more grout required than would fill the drilled holes. This was further confirmed by diamond drill explorations. The abutments are of the gravity type with vertical water faces and sloped backwalls provided with deep concrete keys to form water-tight joints between the approach embankments and the abutments. A typical section through the Ile Juillet south dam is shown in Fig. 8.

The structures have been designed for hydrostatic pressure up to the maximum high water level assuming no water on the downstream side of the dam; uplift on the base varying from full head at the heel to zero at the toe; and an ice pressure of 10,000 lb. per lin. ft. of dam. In considering overturning, the piers were designed to have the resultant within the middle-third when carrying the total pressures applied directly to the piers plus the pressure transmitted from the adjoining gates. In considering sliding, the pier and its sill slab have been figured as a unit with a coefficient of friction between the concrete and the foundation assumed as 0.50. Downstream from the gate sill beam the sill slabs have been thoroughly drained to avoid any possibility of full uplift under this portion of the slab. At the Ile Juillet dams and at Coteau dam No. 3, a concrete apron has been carried about 30 ft. downstream from the edge of the sill slab to provide protection against erosion.

The only reinforcing in the piers consists of horizontal bars sufficient to tie the whole pier together as a unit, considering the gate load to be applied to the pier at the downstream check; and shear reinforcing for the portion of concrete between the two guides to provide for the gate reaction in its upstream position.

While the piers have been designed for an ice pressure of 10,000 lb. per lin. ft. against the piers and gates, the gates themselves have been designed for an ice pressure of 6,000 lb. per lin. ft. of gate with the steel stressed to 18,000 lb. per sq. in. As a matter of interest, one gate of Coteau Dam No. 1 failed under ice load, and another gate in the same dam was slightly buckled. No damage was caused to the piers. This failure occurred during a spring break-up when a very large sheet of heavy shore ice broke away from a bay a short distance above the dam. Two groups of gates were open at the time, with four gates closed between the groups, and the ice sheet was large enough to overlap the intermediate closed sluices so that the momentum of the whole mass caused the ice to crush into two closed gates with the result above mentioned.

All structures are designed with two sets of gate guides, and all the gates in any one dam are interchangeable. Thus, when the gate failed due to ice pressure and became jammed between the piers, another gate was lowered into the upstream guides and it was possible to get at the damaged gate and remove it. The damaged gate has since been replaced by a set of concrete stoplogs.

Each dam has one travelling gantry crane for handling the gates as shown in Fig. 8. Consideration was given to the provision of a second gantry on some of the dams with the larger numbers of gates, but it was thought that an ample factor of safety was already provided by the number of separate dams making up the whole works. Dual sources of electric power supply each gantry.

### Coteau Control Works

These consist of four dams, of which numbers 1, 2, and 3, designated respectively from the south shore, are sluice structures. Dam 4, closing the small north channel, is a rockfill dam with a gravel and clay blanket on the upstream side. The sluices in Dams 1, 2, and 3 are all 42 ft. wide, clear distance between faces of piers. In Dam 1, there are 20 sluices; 9 of the gates being 18 ft. high, and the other

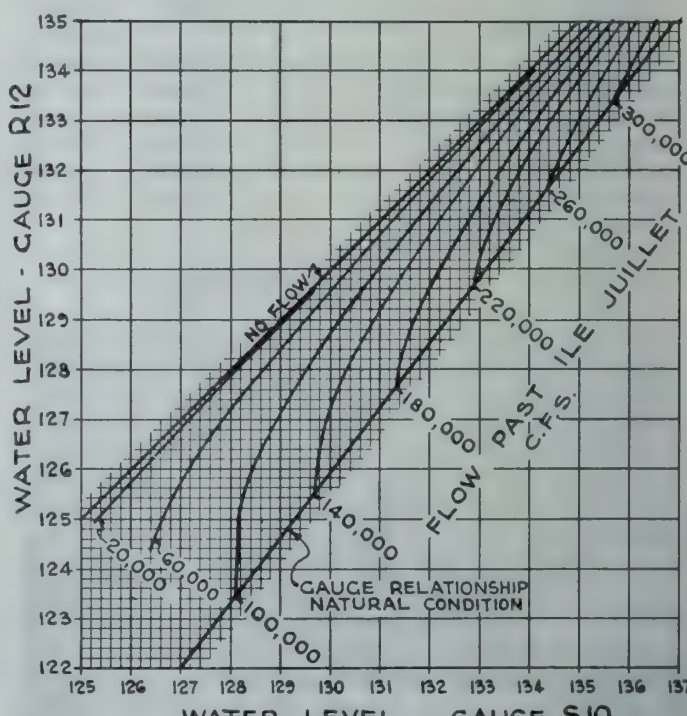



**Fig. 6—Slope-discharge curves for the reach of river between gauges R12 and S10.**

11 being 20 ft. high. The piers are 8 ft. wide. In Dam 2 there are 8 sluices, all gates being 16 ft. high and with piers 8 ft. in width. In Dam 3 there are 16 sluices, all gates being 26 ft. high with piers 9 ft. in width. In all cases the tops of the gates are at elevation 154.0, or about 2 ft. above maximum high water level at the dam. Maximum high water level on Lake St. Francis is almost 155.0, but for such flood conditions all gates would be open in the dams.

The lengths of the piers are governed by the stability requirements referred to previously, with certain modifications to provide for a future highway bridge. The gravity section abutments have vertical faces on the water side, and a slope of 7:12 on the back face. The approach embankments were planned to have a 40-ft. top width with 3:1 slopes, and with the upstream and downstream portions built of boulder clay and rock from the foundation excavation, and with an impervious puddled core. The actual widths as built were considerably larger in most cases on account of the excess amount of excavated material to be disposed of.

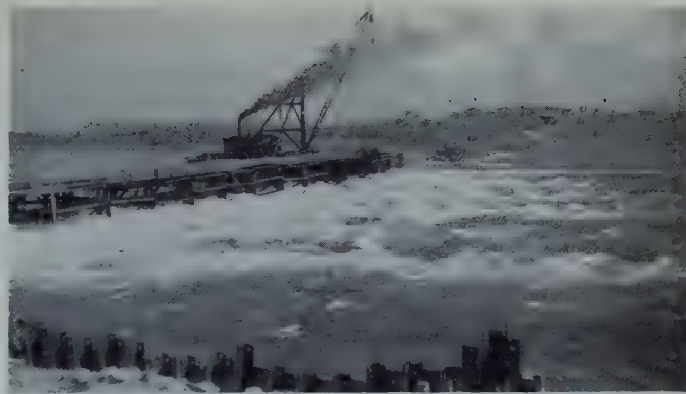
On account of the large area of Lake St. Francis and the numbers and sizes of sluice gates in the structures, close control of the water level of the lake can be maintained by adjusting a few gates twice a day. Good control is facilitated by use of the flow records as obtained by the Dominion Government at Iroquois (50 miles up the river), and furnished daily to the company; and by knowledge of the anticipated flow to be used by the plant. It has not been necessary to operate with gates part open, as the individual sluices have capacities under maximum head conditions ranging from 6,000 cu. ft. per sec. for a small gate, to 12,000 cu. ft. per sec. for large gate.

### Ile Juillet Remedial Works

The river at this point is divided into two channels by Ile Juillet, and the works consist of the South and the North dams as shown on Fig. 4. The South dam has five 50-ft. sluices with sill elevation 98.0, and the North dam has nine 50-ft. sluices with sill elevation 104.8. The top of the gates at each dam is at elévation 133.0. The piers for both dams are 12 ft. wide. The abutments are of gravity section with the same front and back slopes as at Coteau. The approach embankments are similar to Coteau, being 40 ft. wide on top and with 3:1 slopes front and back. This is the embankment section which was adopted by the Joint Board of Engineers on the St. Lawrence Waterway Project as a standard for all embankment works in the St. Lawrence development.

The area of the four-mile stretch of river above Ile Juillet is small in comparison with Lake St. Francis, and as there are relatively few gates all of which are of large dimensions, close control of the water levels is more difficult than at Coteau and requires more frequent changes in the gate openings. It is usually necessary to operate with one of the gates partially open. Fortunately the necessity for close regulation is much less critical, as there are no navigation interests, and no international problem as in the case of

Steel crib cofferdam unwatered, showing typical river bottom.



Placing cribs across north channel at Ile Juillet.

Lake St. Francis. In the design of the equipment for these structures, consideration was given to splitting the gates into two sections which could be separated, when desired, for the purpose of discharging the flow over a wide sluice area of shallow depth instead of through a few deep sluices, thus reducing the head variations for any changes in river discharge. However, it was thought that during winter conditions a flow through the top halves of a number of gates would be more likely to damage the gates than if a few of them were wide open. Mechanical features involved in designing a split gate, and considerable operational problems of connecting and disconnecting them, weighed in favour of adopting a single gate with fixed rollers.

It may be desirable at some time to provide a set of half gates of very simple design without rollers. Except in times of flood flows, the half gates would be left in place in the downstream set of guides. The roller gates would be used for all operations, but there would be the advantage of a large number of shallow sluices to carry the water rather than a few deep ones. The Ile Juillet remedial works are normally operated to maintain a water level of about 133 at the upper end of the pool.

### Gates and Operating Equipment

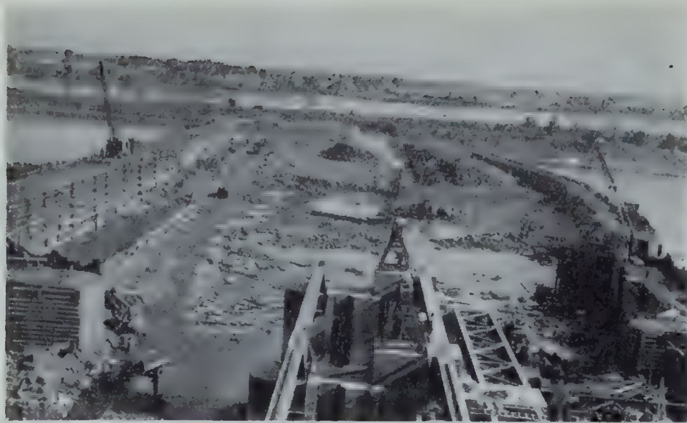
The arrangement of gates and operating equipment is essentially the same for each of the dams. The gates are supported on holding dogs when in the open position, and the clearances are arranged so that gates are completely interchangeable between one sluice and another in the same dam. Figure 8 shows the arrangement of gate and gantry at Ile Juillet south dam.

There is one gantry crane for each dam. The type is similar in all cases except for the range in size and capacity to handle the various sizes of gates. The gantry travels over the length of the dam on heavy section railway rails, and the trolley travels across the gantry a sufficient distance to place a gate in either guide. The gantries have been designed for lifting the gates against full hydraulic pressure allowing for the rolling friction factor. The structural design has been based on carrying a gate with a transverse wind of 30 lb. per sq. ft. on the exposed surface of gantry and gate. The travel speed of the gantries is 100 ft. per min. The hoisting speeds are 5 ft. per min. for Coteau and 4 ft. per min. for Ile Juillet. The Ile Juillet gantries have a rated capacity of 150 tons. The gantry for Coteau Dam No. 3 has a rated capacity of 90 tons.

Provision has been made for heating all the gates electrically but heaters have been installed in only 28 of the 58 gates. During the winter, the flow of the river is at its minimum and operation of half of the total number of gates is ample to meet all requirements. Heat is applied both to the body of the gate and to the guides.

### Discharge Coefficients

Since the structures have been completed and placed in operation, various records of water levels and discharge have been kept, one purpose of these records being to assem-



**North channel at Ile Juillet unwatered in one large cofferdam.**

ble discharge data for all the combinations of gate openings. Up to the present time, data are available for the Ile Juillet sluices for a few flow conditions, and two cases are presented herewith in summarized form. The flow through Ile Juillet has not been obtained by direct metering, but has been derived by using the Federal Government's rating curve for the Soulanges section of the river and deducting the upstream diversions. The water levels used for rating these sluices are gauge R12 at the head of Ile Juillet and the mean water levels at the downstream corners of the two abutments of each dam. Records are presented for the following gate openings:

1. All gates open in both dams.
2. Four gates open in North dam—South dam closed.

| Test | Gates open | | W.L. at R12 | W.L. Below dams | | Head | | Discharge through Dams | Coeff. $C$ |
|---|---|---|---|---|---|---|---|---|---|
| | South | North | | South | North | S | N | | |
| 1. | 5 | 9 | 128.25 | 125.85 | 126.15 | 2.4 | 2.1 | 180,000 | .91 |
| 2. | 0 | 4 | 131.30 | — | 122.20 | 0 | 9.1 | 76,000 | .90 |

$C$ is the coefficient of discharge where $Q = A\ C\ \sqrt{2gh}$

By using the water level at R12 there may be a small friction loss in the approach channels, but for operating purposes it is desirable to have one upstream gauge which can be applied to both dams. For flows up to the point where the tailwater level rises to 2/3 of the total depth on the sill, the discharge of the sluices can be directly related to gauge R12 alone.

Additional data will be accumulated on the Ile Juillet sluices covering many other gate opening combinations for the full range of water levels at R12.

Up to the present time no records are available for Coteau as the final cofferdam closure at Dam 3 was made only recently.

### Winter Conditions on the River Above Ile Juillet

The conditions that have occurred along the river during the past two winters since the construction of the dams at Ile Juillet may be of interest. Before construction of the remedial dams no ice cover formed on the reach above Ile Juillet. An ice cover will form across the river when the surface velocity is not much over one foot per second, and will readily build back upstream even when the velocity exceeds two feet per second. After construction of the dams, and in order to hold the desired water levels at the entrance to the Cedars canal, it was necessary to raise the water level at R12 by nearly eight feet. This increase in depth, together with the reduction in flow due to Beauharnois diversions, was sufficient to lower the velocity to a point where an ice cover formed across the river in the stretch between Ile Juillet and the foot of Coteau rapids. The Coteau rapids remain open all winter up to the outlet of Lake St. Francis, a total length of open water of about two miles. The width of this open channel averages 2,000 ft. It was evident that frazil ice would be formed in this open water area, and that it would build up under the ice cover downstream in the form of hanging dams.

The estimate of the flood levels that would occur was primarily based on the studies and conclusions made by Mr. D. W. McLachlan, M.E.I.C., as set out in the 1926 Report of the Joint Board of Engineers for the St. Lawrence Waterway Project. Mr. McLachlan gives the following as observed results under natural conditions:

> Frazil ice formed during the season—15 to 16 cu. ft. per sq. ft. of open water area.
>
> Limiting velocity at which frazil ice will continue to build up the ice mass under the ice cover— 4 ft. per second.
>
> River slope with frazil under the ice—2 to 4 ft. per mile.

With open water in the Coteau rapids area of approximately 20 million sq. ft., there should be produced about 320,000,000 cu. ft. of frazil ice. Based on the cross-sectional area of the river and assuming a velocity of 4 ft. per second under the ice for a flow of 120,000 cu. ft. per sec. it was estimated that the total frazil formed would be stored in the section between Coteau du Lac and gauge N11, and taking the slope of the water profile to be 4 ft. per mile the maximum winter water level at Coteau du Lac would be about elevation 139.0. The computed water levels using the above data and the actual maximum water levels reached during the winters of 1942 and 1943 are shown in Fig. 9. The formation of the ice cover from Ile Juillet up to Coteau du Lac extended over a period of about four days each year. During that four-day period frazil packed under the surface in the section from gauge N12B to gauge N11, with the result that the water surface profile in this portion of the river is steeper than it would be with a smooth ice cover.

There are many variable factors from winter to winter, these being flow, temperature, wind, snow, and load con-

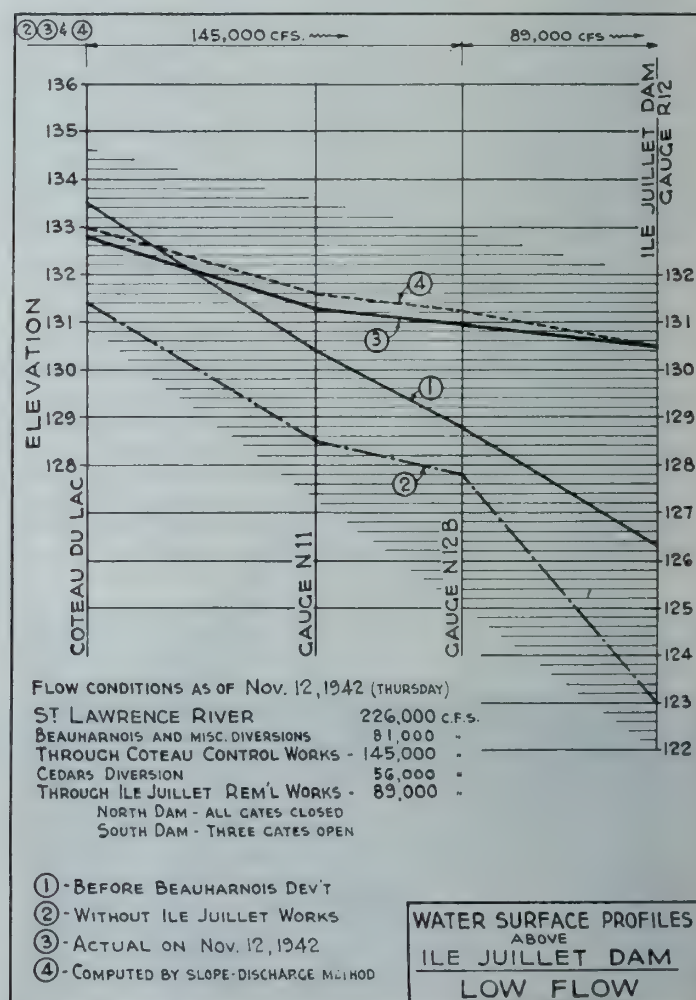



**Fig. 7a and 7b—Water surface profiles from Ile Juillet upstream**

ditions, and evidently it is not possible to apply a definite formula to the resultant rise in water levels. Mr. McLachlan's conclusions, however, when used with judgment provide the best means available to-day for arriving at a practical result.

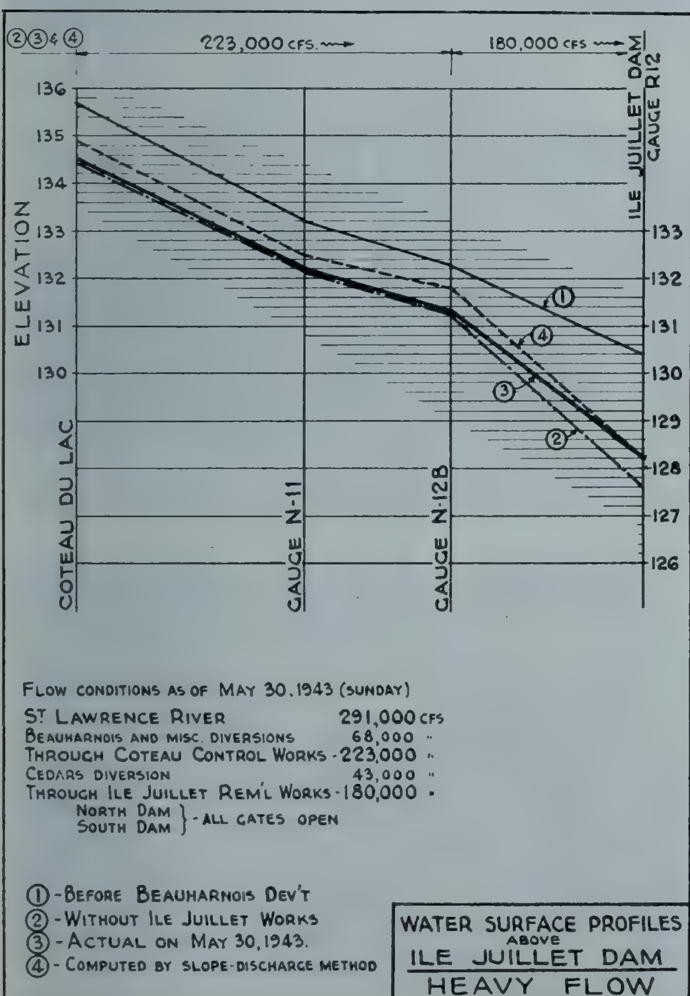
### Features of Construction

The construction features of the various dams making up this whole programme of remedial and control works have provided some interesting problems, of which by far the most important were those of the cofferdams. In most dam construction work the cofferdams for unwatering the river bottom present many and diverse difficulties. This is particularly true for the St. Lawrence river where the ordinary minimum flows are greater than even the flood flows of most other rivers. As the concrete structures are not of great height and are essentially confined to the existing river channels, it is obvious that the cost of cofferdams must represent a higher percentage of the total costs of the structures than is usually the case. In the remedial and control works here discussed the amount expended on cofferdams has been about 25 per cent of the total construction cost.

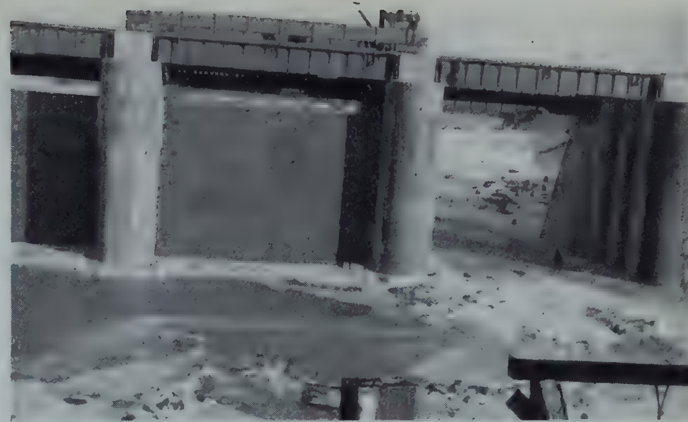
The other features of the construction work comprising excavation in the river bed, concrete, approach embankments, and erection of the gates and operating equipment, did not present any new or unusual problems, and further notes on construction will therefore deal mainly with the cofferdams.

### Cofferdams for Coteau Dam No. 1

The average maximum flow of the river during the year when Dam No. 1 was built was approximately 240,000 cu. ft. per sec., and after allowing for the diversions to the power plants, the net flow through the Coteau rapids was




to Coteau du Lac for low flow and heavy flow respectively.



**Piers and gates of South dam at Ile Juillet.**

then 220,000 cu. ft. per sec. Channel No. 1 carried about 40 per cent of the flow, or almost 90,000 cu. ft. per sec. The channel was 2,000 ft. wide with a maximum depth of 22 ft. The cofferdams were built entirely of timber cribs using 8 by 8 in. B.C. fir. The job was constructed in two stages with about three-quarters of the area enclosed in the first cofferdam. After the first five piers and the south abutment had been completed, the upstream and downstream cofferdams were connected to pier 5, and the sluices 1 to 5 opened up to carry a part of the flow. The cofferdams were then completed to Thorn island and the balance of the permanent structure built inside them.

The design of the timber cribs for the cofferdam was based on the following assumptions:

1. Full hydrostatic pressure against the upstream face.
2. Rock fill assumed to be 80 per cent of gross volume.
3. Weight of rock assumed at 100 lb. per cu. ft.
4. Weight of timber neglected.
5. Coefficient of friction of crib on river bottom assumed at 0.40.

Cribs were built on shore with the lower course scribed to fit the river bottom. The cribs were handled to position and placed by a locomotive crane, and held in place during sinking by lines from a scow anchored to the previously constructed portion of the cofferdam. The maximum head against the cribs during construction was 5 ft. and two 1-in. steel wire ropes were adequate to hold them. The velocity around the end of the cofferdam reached a maximum of about 12 ft. per sec. The maximum load on the holding cables was measured at 50,000 lb. The upstream and downstream cofferdams were built parallel to the axis of the dam and spaced to give about 30 ft. of working space above and below the limits of the concrete structure. The cofferdams were removed by strutting the cribs to the sluice structure and unloading them in the dry.

### Cofferdams for Ile Juillet

The cofferdams for the south and north channels at Ile Juillet as shown on Fig. 4 were the most difficult of all the structures because of the depth and high velocities encountered. Their construction was begun in July, 1940, for the purpose of restoring and improving the head conditions at the Cedars plant as quickly as possible, and necessitated a schedule of about 18 months for completion of both dams.

It was calculated that with the south channel closed and with a flow of 150,000 cu. ft. per sec. all confined to the north channel, there would be a head of nearly 10 ft. across the cofferdam. This presented a difficult construction job for closing the channel in one cofferdam. After a study of various methods and layouts of cofferdams, it was decided that rockfilled structural steel cribs would be the most satisfactory. The basic advantage of the steel cribs is that all the cribs can be placed across the channel with only sufficient rockfill to anchor them in place, allowing the water to flow through the structure and avoiding the formation of a

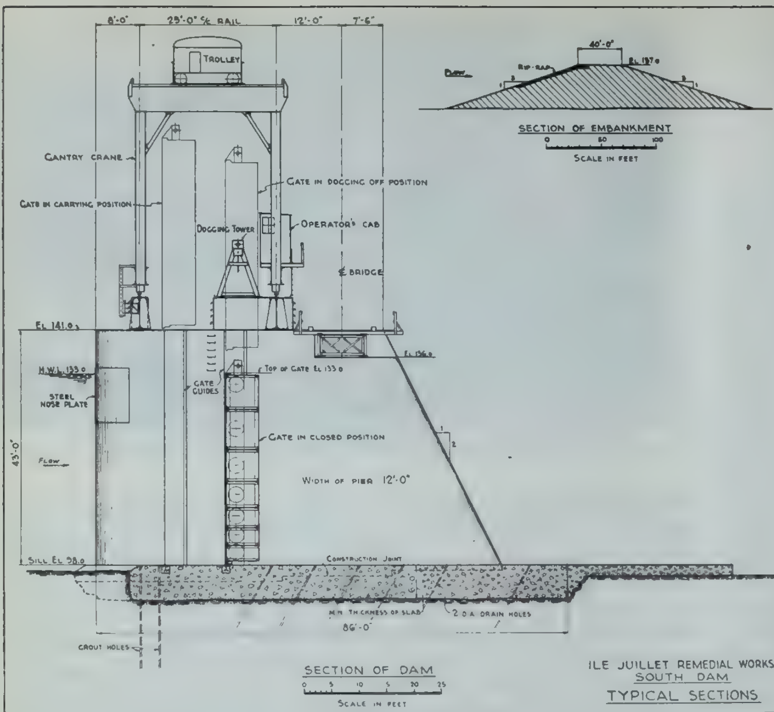



**Fig. 8—Typical dam sections (with gates and gantry at Ile Juillet).**

head sufficient to scour the river bottom ahead of the work. While the upstream cofferdam was being built, work followed gradually on the downstream one, and the south channel was successfully closed in one jump, which permitted the uninterrupted construction of the permanent works. This cofferdam was constructed during the summer of 1940, in a period of two months, and the permanent works were completed ready for the removal of cofferdams by the middle of January, 1941. The South dam was entirely opened up by April, and the north cofferdam work started in March. On account of starting the North dam early in the spring and since the maximum water in the river was not likely to occur before June, it was decided to do the work in two stages, enclosing two of the sluices in the first part of the cofferdam. The first stage cofferdam was built entirely of timber cribs and, as soon as it had been completed, work was pushed on the excavation and concrete inside it. Meanwhile the cofferdams for the second stage were extended using the steel cribs removed from the south channel for the upstream portion. The work progressed favorably, and from observations and study of the rate of river discharge, it was determined that the cofferdam could be completed across the channel without waiting to open up the sluices being built in stage 1. The balance of the permanent structure was therefore tied into the initital work in one large cofferdam closing the whole north channel. Complete records of head and discharge distribution were made during the progress of the work, so that flooding damage due to the progressive closing off of the channel could be avoided. The cribs were erected on a platform at the south shore, and a 30-ton derrick boat, *Foundation Mersey*, handled them to position. The boat was anchored to a small island about 2,000 ft. upstream by a 2-in. wire rope, with tackle at the boat end consisting of nine parts of ⅞ in. wire rope. The tackle permitted a variation of about 40 ft. in the length of the holding line, so that the boat swinging on the arc of a circle could place the cribs in a straight line. 1½ in. holding lines led from the boat to the crib. After the cribs were filled they were sealed with steel sheet piling.

### Cofferdams for Coteau Dam No. 3

The placing of timber cribs in deep fast water has always been a major construction feature of cofferdam work, and many methods have been developed, all of which require substantial rigging for making the soundings for each crib and for holding the crib itself while it is being filled. For the construction of the Coteau cofferdams a deflector scheme was developed which proved to be effective.

The "deflector," a substantially constructed timber crib somewhat tapered in shape (as shown in Fig. 10), sheeted on its inshore and upstream faces, and anchored to a suitable deadman on shore or to an adequate anchor crib, was arranged to be moved along the upstream face of the cofferdam as construction proceeded. The rigging was designed for the maximum pressure encountered, and after being once installed was simple to handle and use. With the deflector at the outer end of the work, the flow of water was diverted away from the end of the completed section of the dam thus providing a quiet area for sounding and placing the next crib. Three advantages were gained by this area of quiet water, namely:

1. The soundings for the next crib were accurately and quickly made by a small crew of men, working from a raft of the same size as the crib. No heavy sounding rod or elaborate rigging was necessary even in 25 to 30 ft. of water.
2. There was very little pressure against the crib as it was being placed, and the holding lines were simple.
3. As the water level in this area was that of the downstream side of the cofferdam there was 5 to 6 ft. of crib-work above water, so that relatively little additional weight was required to put the crib on bottom.

**Construction of Dam No. 1 at Coteau (1933), with piers of first stage completed and five sluices in operation. Second stage upstream cofferdam almost completed.**

**Construction of Dam No. 3 at Coteau (1943), showing first stage completed and opened, the second cofferdam unwatered, and the third section of the channel still flowing free.**

The work on Coteau Dam No. 3, (see Fig. 3), was started in the fall of 1941 with the object of constructing sufficient of the upstream cofferdam to be able to hold Lake St. Francis up to its normal elevation during minimum winter flow conditions and with the full Beauharnois diversion of 83,000 cu. ft. per sec. Approximately half of the channel was closed at this time, and as this timber crib cofferdam would have to withstand the winter ice pressures and particularly the mass spring run-off of ice from Lake St. Francis, it was necessary to make proper provisions to meet these conditions. Fortunately the middle of the river channel had a bare rock bottom, and there was no danger of scouring from under the outer crib. The depth at the outer end of this first cofferdam was 30 ft., and the last crib was made 40 ft. wide with the upstream face sloped (two horizontal to one vertical) from a point 4 ft. below the water level at the upstream edge. This sloped upstream face was solidly sheeted with 8 by 8 in. timbers and then covered with 3/8 in. steel plates. Great quantities of ice went down the channel during the winter and spring, but no serious damage was done to the cofferdam, as the ice was able to slide easily over the sloped outer cribs.

If the total flow of the river had been less than 220,000 cu. ft. per sec. during the construction period, the whole channel could probably have been closed in a single stage cofferdam. In an ordinary year, this might have been practicable, but it so happened that the completion of the dam in 1943 came at a time of very high water in the St. Lawrence river, with the peak outflow from Lake St. Francis in May reaching almost 340,000 cu. ft. per sec., so that what had been laid out in 1941 as a two-year, two-stage job became a three-stage job.

Figure 11 shows the estimated levels of Lake St. Francis corresponding to closures in one, two, and three stages of cofferdam construction, and it will be noted that for the heavy river discharge encountered in the season of 1943, a single or two-stage arrangement for closing channel No. 3 would have raised the water above its natural regimen.

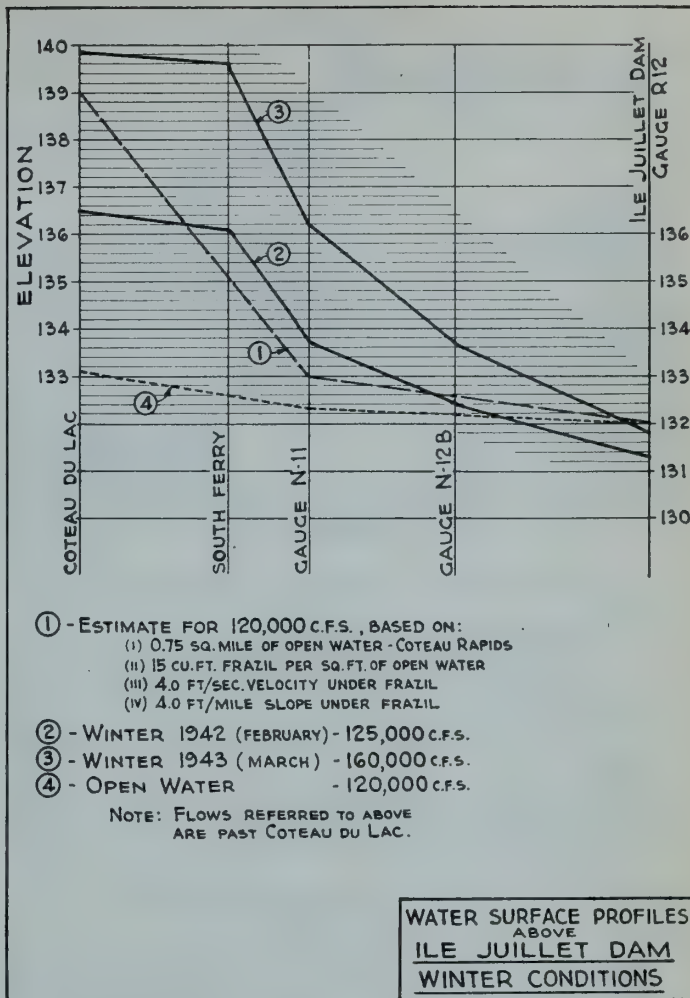



**Fig. 9—Computed and actual water surface profiles above Ile Juillet (winter conditions).**

**Closing the gap in the final stage of Coteau Dam No. 3 cofferdam.**

**Ile Juillet South Dam completed (typical of all structures in both works).**

## Steel Crib Cofferdams

It was found that the use of open steel cribs on the Ile Juillet cofferdams presented several advantages over the ordinary timber type, some of which are as follows:

1. The large openings in the steel work permitted the placing of all cribs across the channel and created a maximum head of only 3.2 ft. across the dam (south).
2. That head was insufficient to seriously scour the river bottom ahead of the work, so that successive cribs could be accurately fitted to the soundings.
3. The steelwork presented little obstruction to the flow and consequently the pull on the holding lines was moderate.
4. There was no buoyancy to be overcome, hence sinking the cribs to place was a simple operation.
5. The large pockets made unloading easier (by means of clam-shell buckets).
6. The same cribs could be used for both channels with little changing except for re-scribing the timber bottom.
7. After all cribs had been placed across the river, closure was simply completed by building the rockfill up in successive horizontal layers.

The design of the steel crib cofferdam covered two conditions, first the construction stages, and secondly the final rockfilled cofferdam. For construction conditions the design was based on the following assumptions:

1. Differential head during placing and first stage of rock fill—5 ft.
2. Full hydrostatic pressure against the rockfilled portion of the cribs, and against 50 per cent of the gross area of the unfilled portions of the cribs.

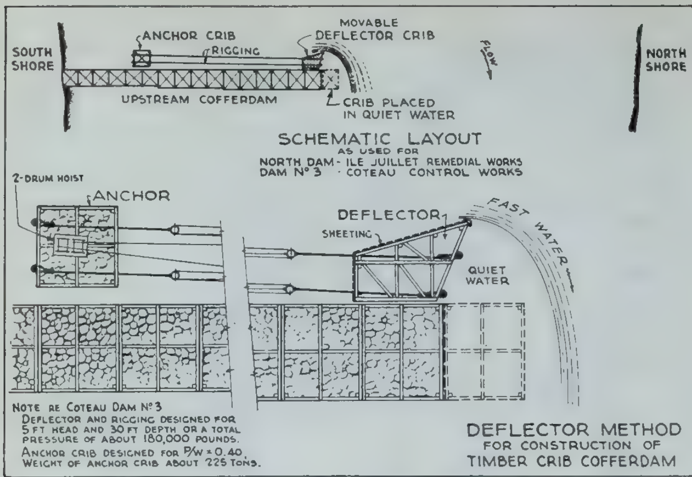



**Fig. 10—Deflector method for construction of timber crib cofferdams.**

3. Weight of submerged rockfill assumed at 50 lb. per cu. ft.
4. Sliding factor of not over 0.40.
5. Factor of safety against overturning—1.50.
6. Diagonal bracing in the cribs designed for 10 ft. differential head.
7. Subsequent filling of the cribs in 5-ft. horizontal layers.

For the stability of the completed cofferdam after it had been unwatered, the following factors were set for the design:
1. Weight of rockfill—90 lb. per cu. ft.
2. Sliding factor—0.40.
3. Factor of safety against overturning—3.0.

### Removing Cofferdams

In all of the structures the sills of the sluices are at roughly the same elevation as the natural river bottom. It was therefore necessary to provide for completely removing the cofferdam cribs in front of and below the sluices. At Coteau Dams Nos. 1 and 2 the cofferdams were located close to and parallel with the structures. After the gates had been placed in the finished sluiceways, the cofferdam cribs were braced to the piers and gates with struts of sufficient strength to permit complete unloading of the cribs in the dry. Rock was loaded into skips and handled by derricks to cars on the bridge. At Ile Juillet, part of the cofferdams were unloaded by sheeting and sealing the back faces of the cribs and pumping out inside the cribs. The unloading was again done with skip boxes. The balance of Ile Juillet and Coteau Dam No. 3 cofferdams were removed by clamming out the rock under water, using several crawler cranes equipped with clams. This last method has proved to be the most satisfactory, with an average rate of excavation of 6 cu. yd. per clam per hour being obtained.

### Progressive Construction

The first dam (Coteau Dam No. 1) was built in the year 1933, and the others followed as the load on the Beauharnois plant and consequent diversion of water increased:

Coteau Dam No. 2 was built in 1934.
Ile Juillet South Dam in 1940.
Ile Juillet North Dam in 1941.
Coteau Dam No. 3 in 1942 and 1943.

In all cases the construction of the upstream cofferdam governed the rate of progress of the dam work.

### Personnel

The author, who had charge of the design and construction of the control and remedial works, was ably assisted by L. H. Burpee, M.E.I.C., who also had a large part in the preparation of this paper.

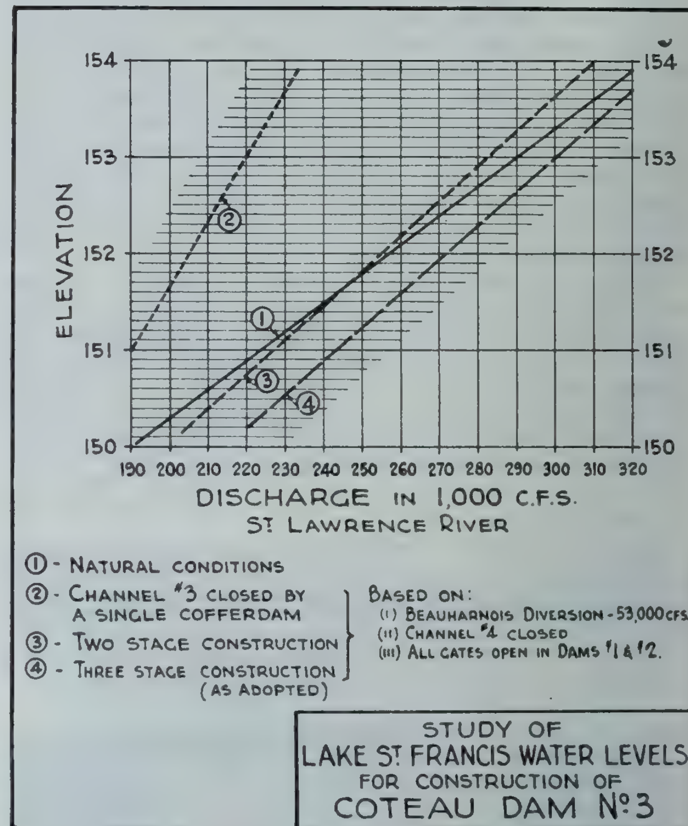



**Fig. 11—Study of probable Lake St. Francis water levels resulting from various methods of closing Coteau channel No. 3.**

At the time of the construction of Coteau Dam No. 1, F. H. Cothran, M.E.I.C., was in complete charge of all the Beauharnois work.

The actual construction of the Coteau Dams Nos. 2 and 3 was carried out by the Beauharnois Company's construction staff, under the general supervision of B. K. Boulton, M.E.I.C., with C. G. Kingsmill, M.E.I.C., as construction engineer, and C. O. Whitman, M.E.I.C., as resident engineer.

The construction of the Ile Juillet dams was carried out by the Foundation Company of Canada Limited, W. U. Smick, general superintendent, in co-operation with the Beauharnois Company engineers.

All of the gates and control equipment were manufactured by the Dominion Bridge Company and their successful operation under severe winter conditions is a tribute to the soundness of their design and workmanship.

# TRENDS IN INDUSTRIAL RELATIONS

J. C. CAMERON

*Professor of Commerce and Head of the Industrial Relations Section, Queen's University, Kingston, Ont.*

**A luncheon address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on October 2nd, 1943**

In taking this opportunity to address an audience of varied experience in handling industrial problems, my object is not to make a pronouncement but rather to provide a basis for discussion.

Examination of the literature which deals with labour in industry shows that the terms "labour relations" and "industrial relations" were not in common use in Canada until comparatively recently. Employers have hired, fired and trained labour; and there have been various manifestations of industrial unrest,—indeed all the phenomena that we include under the terms "labour relations" and "industrial relations." Why, then, were these terms not used earlier ? The explanation, I think, is to be found in the different concept of the relationship of employers to employees that prevailed prior to the development of modern personnel management.

We used to think and speak of The Labour Problem. We used to speak about "capital" and "labour"; and the relations between the two were conceived as presenting a more or less mechanical problem of removing friction between two opposing forces. The problem then was to find a single solution that would remove the differences between capital and labour, and thus put an end to all forms of conflict.

Later, the idea of a single labour problem gave way to the conception of a number of problems or evils, for each of which separate, practical remedies were to be devised. Further experience, however, revealed that what were evils from one point of view appeared as remedies from another. Thus strikes, boycotts, and picket lines might be regarded as evils by the employer, but to the employees they are remedies—means of improving labour conditions—while to the community they might appear both as evils and as means by which employees help themselves instead of looking to the government to improve conditions for them.

### Modern Concept of Personnel Management

The breaking up of the labour problem into separate problems for specialized study represented an important scientific advance. It was not however until industrial managers began to look on labour problems, not as social evils or abuses, but rather as problems in human engineering, that the present conception of labour relationships began to emerge. No longer do modern personnel managers look upon labour problems as distinct social evils for each of which a specific remedy is to be found.

Modern personnel management is concerned with contractual human relationships which tend to get out of adjustment and which need to be constantly managed, controlled, revised, adjusted, adapted. Wage problems, problems of hours of labour, unemployment, strikes, labour turnover, and so forth, appear to personnel managers as difficulties involved in securing a proper adjustment of the relations between production managers, foremen, supervisors, and wage earners:—difficulties for which no general remedies are to be found, but which are likely to require different methods of handling in different plants and industries. From this has grown the larger conception that includes in the labour relationship, not only the management and workers within the employer's establishment, but also the stockholders, the labour movement, the community and the government*.

Modern personnel management, therefore, is concerned not only with employment and welfare management, but also with economic and governmental problems for which democratic forms of organization are necessary. The industrial relations policy of a progressive concern not only integrates under centralized control the movement of the personnel through employment policies and provides proper working conditions through welfare or service policies, but also makes provision for something like a bill of rights, with a legislative organization to represent the employees from all parts of the industrial establishment, and some kind of judicial tribunal for the protection of the rights of both workers and management against encroachment by either party.

These developments promise for the first time to give us the ethics of labour relations. The main difficulty in human relations in industry has been that we have had no common feeling of what is right and wrong. There has been no common standard of justice by which we might be guided. The collective labour agreements between trade unions and employers represent, I suppose, steps towards the development of an ethical code, and employee representation plans also point in the same direction. I am convinced, however, that these steps are not enough and that the time has come when industrial leaders must give positive leadership in developing a code of ethics.

The general line of approach which seems most promising is that each company should formulate its industrial relations policy and make it known to all its supervisors, its employees, and to the community. I shall not attempt to prescribe a general formula that will meet everyone's needs, but I venture to submit for your consideration the following outline of what I consider to be the fundamentals of a sound industrial relations policy for a typical manufacturing enterprise.

### The Industrial Relations Policy of the "X" Manufacturing Company

We, the Board of Directors of the "X" Manufacturing Company, have, through our incorporation under the laws of this country, secured the right to do business here and to demand the protection and the privileges which the law affords. We admit that in return for this protection and for these privileges, this community can exact from us obedience to its laws. However, we believe that our obligations to society are greater than mere obedience of this sort can discharge. The law imposes on us only the minimum requirements of good citizenship. It is designed to exact from the unwilling all they will grudgingly give. We are convinced, therefore, that as conscientious and enlightened participants in the life of this community we must assume obligations far greater than the law requires. .

We are particularly concerned here with setting forth those obligations which arise out of our association with labour. In this way we hope to clarify our position for the benefit of our entire personnel—manual workers, supervisors, managers and operating executives, and for the community at large.

We see the law in this matter clearly. It requires us to pay wages at certain minimum rates, to provide accident protection and compensation for injury, to maintain decent surroundings for our working force. To determine the inadequacies of these minimum requirements it is necessary for us to describe the nature of our relationship with labour as we see it. In so doing, we bear in mind that our view is not a rigid one. We will change it as we

*An excellent discussion of these matters will be found in a lecture on Personnel Management by Wm. M. Leiserson, which is contained in Wertheim Lectures on Industrial Relations 1928, (Harvard University Press, 1929).

come through observation, reflection and discussion to understand the situation more fully. This is a fundamental characteristic of employer-employee relationships as we now see them.

Our approach to this problem must rest primarily on the fact that people, even in this machine age, have a large place in industry, and that, as human beings, they are distinctly different, in kind, from the machines with which they are necessarily associated. It is true that the people in industry are not a homogeneous body. They may be classified in various ways—men and women—skilled and unskilled— supervisors and wage earners—management and workers—employers and employees. Regardless of the scheme of classification, their interests point in the same direction, the success of the undertaking. The idea that there is a necessary and a deep-rooted antagonism among them is fallacious and untenable. Actually we have to consider the relationships between groups of human beings who are working together in the same enterprise in a democratic system.

It follows that, where satisfactory relationships exist, co-operation dominates the attitudes of the employer and the employee groups to each other. The two groups come together, in good faith, for discussion and consultation, to deal with those problems affecting their welfare and the success of the undertaking.

If employees are to meet employers effectively, they must do so, because of their numbers, through their duly chosen representatives. Thus some form of employee organization, democratically constituted, law-abiding and co-operative, is essential to successful relationships.

Harmonious relationships between employers and employees cannot last unless both groups receive remunerations which are just and equitable in the light of the situation in which they operate. The ideal basis of reward is payment in proportion to the contribution to the undertaking.

Both employer and employee will expect to get more out of the undertaking than large profits and high wages. They will expect to enjoy the satisfaction that comes with work well done; the sense of comradeship that comes with participation with others in common tasks; the protection that the group can give its members against economic distress arising from injury, illness and old age.

Good industrial relationships will not develop spontaneously in a plant. Some group must assume the leadership and undertake to direct and to educate both employer and employee in these matters. It is proper that the Board of Directors assume this responsibility, bearing in mind that it guides and directs a body of opinion and that it has no place as a dictator in a situation where democratic principles hold sway.

In this situation we are led to adopt a definite policy that will govern our participation in employer-employee relationships, a policy which we will carry out in such a way that every supervisor, every manager, and every operating executive will feel that he has a part to play in establishing and maintaining proper industrial relations, and to which we will insist that each adhere scrupulously.

A.

1. It will be our practice to provide our employees with "fair" wages, promptly and regularly paid for "reasonable" hours of work. We will provide "good" working conditions, careful supervision, as stable employment as business will permit and every opportunity for advancement on merit.

2. We will allow no discrimination against an employee on account of race, nationality, religious or political affiliations or membership or non-membership in a lawful labour organization.

3. We will encourage our employees to take an interest in the business and in management problems by offering rewards for constructive suggestions.

4. We will deal and negotiate in good faith with the lawful organization that represents our employees.

5. In co-operation with our employees we will institute such plans for employee security as the prosperity of the business permits.

B.

We cannot fulfil our obligations to our employees unless they, for their part, recognize and fulfil certain obligations to us.

1. We will expect them to demonstrate their loyalty to the business by supporting the management in its efforts to maintain, improve and expand the business.

2. We expect them to co-operate with fellow workers and with the management, through the regular channels, for discussion and solution of the problems that arise in the course of our operations.

3. They ought to treat as confidential all information regarding our business and ought to carefully avoid passing on to competitors anything that might be injurious to us.

4. They ought to give good workmanship and careful attention to the job in hand.

5. They must obey promptly all reasonable rules and orders, including those regarding punctual and regular attendance, sobriety, restriction of smoking, safety practices, good housekeeping and personal cleanliness.

C.

We will bargain collectively with our employees, if they desire it, through the lawful agency which represents them. We will negotiate with them in good faith, doing our utmost to arrive at a collective labour agreement—an agreement which will set out as clearly as possible the duties, responsibilities, rights, privileges, and immunities of both parties.

We believe that the agreement, to be effective, should cover certain important questions.

1. It should explicitly indicate the bargaining agency and it should define the extent of its recognition.

2. It should guarantee the rights of management to operate the business safely and efficiently and to direct and discipline the working force.

3. It should give the employees the right to appeal to management if they believe that the rights of management have been unjustly exercised.

4. It should provide machinery for the discussion and the solution of problems and for the settlement of grievances arising out of the agreement.

5. It should make provision that, if the parties fail to arrive at a mutually satisfactory decision on any matter arising out of the agreement, it should be referred to a board of arbitration whose decisions should be final and binding on both parties.

6. Both parties should agree to accept the existing scale of wages direct and indirect, subject to such modifications or changes as are allowed or ordered by the national or regional war labour board.

7. The regular hours of work and the rates of pay for overtime on regular working days as well as on Sundays and legal holidays should be set out.

8. There should be a provision for vacations with pay for hourly workers, but the granting of such vacations should be dependent upon regular attendance.

9. It should be agreed that in case of lay-offs, transfers, rehirings or promotions, competence shall be the governing factor, but that seniority shall be given due consideration. It should be clearly understood that the management is the sole judge of the competence of the employees. The seniority of all employees who have gone into the armed forces should be preserved and protected.

10. There should be a guarantee that members of the bargaining agency shall be free to discharge their duties to that agency without fear that their relations with the company will be affected in any way. (It should be understood, however, that the bargaining agency's business must be done in working hours or on the company's premises only to the extent specifically allowed in the agreement).

11. There should be a provision under which the company guarantees to protect, by every reasonable means, the safety and health of its employees during the hours of their employment. The extent to which the company provides personal necessities, such as hard hats, hard-toed shoes, gloves, overalls, rubber aprons, rubber boots, etc., should be clearly defined.

12. It should be agreed that so long as the agreement remains in force and the parties are living up to their promises, there shall be no lockout by the company, nor shall there be any strike, slow-down, sit-down, or suspension of work, either complete of partial, by employees.

13. The agreement should be for a reasonably long period of time, for its object is to maintain as well as to establish industrial peace.

D.

It will be our policy to protect the interests of all lawful bargaining agencies and to oppose the efforts of any group which, by subterfuge, misrepresentation, coercion or other objectionable methods is seeking to strengthen itself at the expense of any other lawful bargaining agency or group of employees.

However, we do not consider it in the best interests of the business to deal with more than one collective bargaining agency in a single establishment, unless the interests of others are so divergent as to require separate treatment.

When we have bargained in good faith and have entered into an agreement with a collective bargaining agency, and when there is no question about our willingness to live up to the terms, we think it is highly improper that we should be punished for the alleged sins of some other employer by means of a sympathetic strike of our employees. We therefore favour legislation under which a collective bargaining agency will be deprived of its bargaining rights for a period of at least one year when an appropriate judicial body has convicted it of authorizing, promoting or encouraging a sympathetic strike.

CONCLUSION

In conclusion, I suggest that in handling industrial problems it is part of your job to study trends in social thinking, noting both the direction and rate of growth, so that you may apprise your directors of the significance of the trends and suggest what steps should be taken in matters of industrial leadership. It was only recently that many of you began to interest yourselves in industrial relations.

Many of you have recently negotiated your first collective labour agreement. Some of you emerged from the negotiations with weak hearts, others with ulcerated stomachs, and others with a richer experience and a highly developed sense of humour. I think it is fair to say that your condition depended on your state of preparedness.

In the years that lie ahead will you pioneer a new order of human relationships or will you be content to make your policy from day to day as necessity demands ? I hope that you will adopt the former course and, as a first step, I suggest that you write out for your own guidance, if for no other reason, the code of ethics which you think should be adopted.

# STEAM GENERATION FOR MARINE AND STATIONARY SERVICE IN THE UNITED STATES, 1939-1943

E. G. BAILEY

*Vice-President, Babcock & Wilcox Company, New York, N.Y.,*

**Paper delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on September 30th, 1943**

Steam generating plants, on both land and sea, are furnishing power satisfactorily for the production of munitions, equipment, and supplies as well as for their transportation —and also for the movement of fighting ships themselves —without the need for any new special designs or major changes in existing types of boiler units. This does not mean that we are using old out-of-date equipment; new and advanced designs of all types of boilers now being used have been largely developed since the early thirties. Fortunately, they were developed far enough in advance of the present emergency to have been thoroughly tested and proved.

The shortage of steel and other critical material has greatly restricted the extension of many electric utility systems and many industrial plants have been forced to continue with what they had or bring back into use many boilers built fifteen to thirty years ago. This has required that practically all steam-generating units be operated at higher load and use factors than ever before.

This high-duty service is furnishing an opportunity to determine any shortcomings or limitations that might exist as well as the features of reliability, all of which are valuable guides in evaluating the best designs for the future, when new plants will be built after the war.

Some points of pre-war development that have proved to be of important significance, and which apply to both stationary and marine use are summarized as follows:

*Welded Drums.* As far back as 1930 the United States Navy approved the use of fusion-welded boiler drums. The A.S.M.E. Code approved fusion-welded drums for stationary boilers in 1931. This technique has been developed and proved to be satisfactory. The use of welded boiler drums has been a very important factor in connection with higher steam pressures and in the saving of steel.

*Steam Separation.* Wet steam has always been a problem in boiler design and operation. When superheaters were first put into general use, they usually evaporated the moisture which came over from the boiler, with the result that dry dust from the solids in the moisture, which we now speak of as "carry over," were left in the steam. These solids or carry over remaining in the superheated steam in some forms and in some cases cause deposits on turbine blading. Great improvements in the methods of separation of water from steam are now widely used in stationary and marine boilers with good results which are little short of absolute perfection.

*Water Walls for Furnaces.* While many types of boilers such as the Scotch marine, the locomotive, and even many of the early water-tube boilers had water-cooled furnaces, there was a period during which the furnaces were largely of refractory-wall construction. For better combustion, furnaces were enlarged until refractory trouble brought about a change toward water-cooled furnaces. During the last twenty years, there has been a steady and permanent increase in the amount and suitability of water-cooling construction for furnaces burning all kinds of fuel. Water walls are extensively and satisfactorily used in stationary and marine service; in this latter, they have resulted in marked savings in weight and space for a given steam output.

*Feedwater Treatment.* Continued high rating has been made possible by many factors, among which is the important problem of keeping boilers free, or more nearly free, from scale and dirt through chemical treatment of feedwater. Better condensers and deaeration of feedwater should also be mentioned.

*Chemical Cleaning.* In both stationary and marine plants, many boilers, economizers, and water walls are now cleaned entirely or in part by acid. An inhibitor, which does not reduce the effectiveness of the acid in removing scale and sludge, is used to prevent action on the metal.

*Fuel Burning.* Important progress has been made in equipment and methods for burning oil in stationary and marine boiler furnaces, with special emphasis placed on the leadership of the United States Navy.

Coal burning made great strides in the decade preceding the war, especially in pulverized fuel in the larger industrial and central-station units. The spreader type of stoker has won a position of importance in smaller land boilers and also in coal-burning marine boilers.

*Meters and Automatic Combustion Control.* Boilers are being operated at higher rates and with better efficiency than they could possibly have been without the almost universal use of meters and automatic control of feedwater and combustion conditions. Superheat control might also be included here. Boiler and furnace designs have been developed to bring about uniform steam temperatures by hand control or automatic means.

## Stationary Boilers

In the stationary field, many of the new boilers supplied since this war began have been exact duplicates of, or similar to, units already designed and in operation. This is in contrast to the changes and developments that have been the general practice, especially in the utility field, during the past twenty years.

Under war conditions it has been necessary to obtain delivery as quickly as possible. By duplication of units, drawings and bills of material from other jobs were ready to permit the immediate placing of orders for steel.

The principal exception to this has been in connection with the synthetic-rubber programme which became active in April, 1942. At first the programme was for 15,000,000 to 20,000,000 pounds of steam per hour, with steam pressures from 350 up to 900 lb. per sq. in. for different jobs, and steam temperatures not over 700 to 750 deg. F., using as high as 90 per cent make-up water. Plants were to be located throughout the country with varying conditions of feedwater and fuel; the latter ranging from low-grade coal to oil or gas.

The critical situation of steel supply was becoming apparent to those in charge of this programme, and it was suggested that boilers of the forced-circulation type be used as a means of saving steel. After a thorough discussion of the problem, it was found that the saving in weight of steel was about 11 per cent of the boiler unit itself. The actual experience with forced-circulation boilers abroad were known to have been under different conditions than those to be faced here, so it was considered best to install practically all boilers for this programme of proven types of natural-circulation design, with special consideration being given to the adverse water conditions. The equipment actually purchased has a total capacity of 13,080,000 pounds of steam per hour and includes only one boiler of the forced-circulation type, and this has a capacity of 350,000 pounds per hour.

There were three other developments in connection with steel supply that might be mentioned. First, on June 19, 1942, the A.S.M.E. Boiler Code Committee sanctioned the use of a somewhat lower factor of safety for welded-steel boiler drums and seamless-steel tubes, but with improvements in design. Although many of the boilers on order had to be built before it was possible to take advantage of this weight saving, later jobs were built to comply with this easement. While the saving in steel was not large on the entire rubber programme, it amounted to a considerable saving in all boilers installed for all purposes because practically all stationary water-tube boilers built since that date have been constructed to comply with this easement.

The second development was the almost universal use of large two-drum boilers instead of the three-drum and four-drum type which previously had been generally used for medium- and low-pressure service and in plants using relatively poor feedwater. The two-drum boiler came into general use for smaller sizes in the industrial field during the thirties. It was only necessary to extend this general type of design to the larger capacities, and boilers of this design were supplied for many of the synthetic-rubber plants. These designs were only possible because of the recent developments in steam and water separation in boiler drums, previously mentioned.

The third factor was the design of low-head bottom-supported boilers of large capacities, in many cases for outdoor installation, which were adopted primarily in the interest of saving structural and building steel.

In some processes for the manufacture of butadiene, steam at about 25 lb. per sq. in. is heated to 1,400 deg. F. Several different designs of superheaters have been developed, some using 6-inch O.D. tubes with about ½-inch wall, subjected to direct radiant heat of moderately low-temperature gas burners, and others using 2-inch O.D. tubes about 0.2-inch thick and subjected only to gas having a temperature of less than 2,000 deg. F. Most, if not all, of these superheaters used tubes and headers of 18-8 chrome-nickel alloy. These units are only now being placed into service and results from their operation will be an interesting contribution to our engineering knowledge.

The shortage of certain critical materials has, in some cases, led to changed designs of superheaters and superheater supports to minimize the content of chrome or nickel in alloys used.

Many heating plants have been built throughout the country at cantonments and ordnance plants. In the beginning of the defense programme, some of these plants were over-engineered as to number, size, and type of equipment, and many of them that should have been suitable for burning coal were designed for oil fuel.

Many industrial plants have converted from oil to coal. Engineers who were foresighted enough to have selected boiler units suitable for burning either oil or pulverized coal had little difficulty in making the change promptly and effectively.

Engineers who had made no provision for coal when their boiler units were originally installed encountered considerable extra expense for conversion and often had to be satisfied with a reduced steam output with coal firing.

In making conversions from oil to coal, many plants installed small stokers, and some hand-fired equipment. For the larger units, pulverized coal was usually adopted as fuel. To adapt pulverized coal to small furnaces, either under steam boilers or metallurgical furnaces, a circulating system has been developed in which a single direct-fired pulverizer supplies several furnaces, each taking its fuel supply from a fuel and air pipe much the same as gas is taken from a header.

## Marine Boilers

This war has definitely proved the wisdom and foresight of the officers of the United States Navy who were in charge of the Bureau of Engineering later the Bureau of Ships, over the last ten or twelve years.

We are fighting this war with a Navy powered with water-tube boilers and geared steam turbines operating at 600 lb. per sq. in. and 850 deg. F., having ample power for high speeds, great manoeuverability, lighter weight, greater steaming radius, and a fuel consumption appreciably less for the same class of service than in any other Navy in the world, or our own pre-1935 standard.

At the same time our Navy is doing further experimental work on forced-circulation boilers using steam at still higher pressures temperatures. One such ship is in service.

In the Merchant Marine, all boilers recently built for the Maritime Commission have water-tube boilers, usually built for steam conditions of 450 lbs. per sq. in. and 750 deg. F. These boilers have been moderately rated for the purpose of obtaining great reliability and high thermal efficiency.

An illustration of the trend that may take place in propulsion plants afloat, as increased emphasis is placed on fuel economy, is the 1,200 lb. per sq. in. reheat steam cycle installed in the S.S. *Examiner*, which went into service about 18 months ago. As it was not desired to use alloy steam piping and fittings, the temperature of both the primary and reheat steam was limited to 750 deg. F. The results to date with this installation have been highly satisfactory; the oil consumption averaging 10.3 per cent less than that of a sister ship fitted with a 425 lb. per sq. in., 750 deg. F., steam-turbine installation without reheat. No more difficulty has been experienced with the practical operation of the reheat-cycle installation than with lower-pressure installations.

Boilers of the Navy and the ocean-going Merchant Marine of the United States have all been oil-burning. Continued development and tests of oil burners have been carried on toward the goal of smokeless combustion and high efficiency.

Another important fleet of steamships in war service is carrying coal, iron ore, and other commodities on the Great Lakes. Here again the foresightedness of ship owners resulted in advanced and reliable designs of steam plants before the war, so that they have been able to carry record tonnages per season with great reliability and economy.

Practically all new turbine-driven lake tonnage is coal-burning, and uses water-tube boilers generating steam at 400 lb. per sq. in. and 750 deg. F. temperature. Coal is usually burned with stokers, mostly of the spreader type. Because of the difficulty of obtaining turbines for some of the newest tonnage being built on the lakes, a large percentage of these ships is being fitted with reciprocating steam engines using steam at 200 to 250 lb. per sq. in. and approximately 450 deg. F. total temperature (approximately 50 deg. F. superheat).

The war has not disclosed any inherent weakness in any of the marine steam plants that has necessitated any appreciable change or improvement in the equipment which was supplied or is currently available.

Some ten years ago, the floating power plant *Jacona* was built by installing a 20,000-kw. steam turbine in one of the old Shipping Board hulls. It was not self-propelled, but was intended to be towed to any location where local or emergency power requirements justified its use. The results obtained with it have been so satisfactory and the flexibility of its location such an asset that four new floating power plants are now under construction for the United States Government for use on inland waterways or the Gulf Coast. New barges have been built to hold the 30,000-kw. plants of these four units, these being limited in their dimensions and draft so that they may readily pass through the locks of the inland waterways and shallow rivers. The steam conditions on the *Jacona* were 400 lb. per sq. in. and 700 deg. F. total temperature, whereas the four new units will use steam at 900 lb. per sq. in. and 910 deg. F.

### Fuel

This war has brought into bold relief the true situation of the reservoirs of our basic fuel supplies.

For years many companies have blissfully developed power and heating equipment which required the use of high-grade fuel without giving too much consideration to the long-range welfare of their customers and the nation, regarding the reliability of the supply and the probable price of the necessary fuel. The petroleum industry balanced its production in the most advantageous way as long as it could find a market for residual oil at a price competitive with coal.

I believe Harold L. Ickes[2] has presented this picture more convincingly than anyone else has done to date. For a long time it has been evident to many engineers that fuel-burning equipment should be installed in certain geographical areas to use either coal or oil. Many of those who provided only for oil are now burning a fuel which is, at present, partially subsidized by our federal government.

The petroleum industry is now requesting a substantial increase in the price of crude in order to stimulate discovery of new oil fields. Unless substantial discoveries are made, we may shortly be forced to import oil from abroad, and probably also make it from coal and oil shale. Any source of additional oil supply will probably result in a sufficient increase in the price of petroleum products to cause a long-time readjustment of the relative economies of oil and coal for many uses in some parts of the country.

### Future

In steam-power equipment we have already passed through a period of striving for the highest thermal efficiency, and more recently we have balanced off on an overall economy, considering investment, thermal efficiency, reliability, and operating and maintenance costs. At least, that is what we have striven for, but some of these cost factors do not average out in their true proportions until the plant has been operated for several years. Sometimes the cost statistics and operating care have not been truly comparable, so that concrete and accurate conclusions are not always available.

If the price of fuel and the price of equipment are to change materially, future designs will still have to be made on a basis of estimates and judgment.

It seems safe to say that we shall probably burn a larger proportion of coal, and that of a lower quality than we used in the past.

Steam pressure will depend upon many factors for each individual case. Many power-boiler units installed in the past five years have been for generation at 900 lb. per sq. in. and higher. Satisfactory operation of natural-circulation boilers up to 2,500 lb. per sq. in. has been established.

As to steam temperature, it also depends upon conditions, one of which is the steam pressure. Many plants have been operating satisfactorily at 850 to 950 deg. F., and it is likely that steam temperatures will be further increased as the most effective means for obtaining efficiency at a reasonable increase in cost.

[2] "Coal's New Horizons," *Coal Age*, April, 1943. "Fightin' Oil," Alfred A. Knopf, 1943.

# INTERNATIONAL ASPECTS OF POST-WAR PROBLEMS

W. A. MACKINTOSH

*Special Assistant to the Deputy Minister of Finance, Ottawa; Canadian Chairman, Joint Economic Committees (Canada-United States); Vice-Chairman, Advisory Committee on Economic Policy*

**An address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada, in Toronto, Ont., on October 2nd, 1943**

It should not be inappropriate in this distinguished international gathering, in which engineers of both Canada and the United States have come together, to direct attention to the international side of post-war reconstruction. I am not competent to speak of the political and strategic problems whose effective solution is basic to all post-war plans. It is rather of the international side of *economic* problems that I am thinking.

### Canada's Dependence on Exports

By force of circumstances, nearly all our Canadian problems have an international side. The pattern of our economic life was from the first set in a functioning world economy; if the world economy does not function, the pattern is destroyed. A clear demonstration of this is found in our exports. Though small in population, we had become fifth among the world's trading nations. Before the war, rather more than one-fifth of our total national output of goods and services was sold outside the country. The market for these was the greatest single factor in determining the level of our national income. Canada has great resources but they are relatively specialized resources. They could not have been used so effectively; they could not have supported so high a standard of living apart from the great basic export trades in wheat and wheat flour, newsprint and wood pulp, gold bullion, base metals, lumber and fish. In the sale of these products, the export market was overwhelmingly predominant and in a surprising number of cases, we were the world's largest exporter. Whole regions of the country have been directly dependent on one or more of these basic exports, while the dependence of other regions has been indirect. Through these basic exports, virtually all our other industries had a vital *indirect* interest in world markets. Many of these other industries, moreover, had, in proportion to their size, a surprisingly large direct interest in outside markets. In such typically United States products as automobiles, industrial, office, and household machinery, farm implements, and rubber footwear and tires, Canadian exports *per worker employed* were in pre-war years two to four times those of the United States.

There is another fact which has been, and will continue to be important. Our two great markets have been the United Kingdom and the United States. It is of great importance that two-thirds to four-fifths of all our exports went to these two markets. But it is also of great significance, and less generally understood, that one-fifth to one-third of our exports went elsewhere, to other parts of the British Commonwealth, to Continental Europe and to the Orient. Without these other markets, we should be in narrow straits.

I shall not attempt to describe what has taken place during the war except to suggest a few things which are relevant. Our total national output has about doubled. In peace, we sent rather more than one-fifth abroad; now we send nearly one-third.

The war has increased rather than lessened our international position. It has given us a greater, not a smaller, stake in the outside world. Within this great expansion, there have been great shifts; meats and dairy products have expanded at the expense of cereals, aluminum has outstripped the other nonferrous metals, labour has been drawn away from gold, newsprint and even lumber, the output of manufactured goods, particularly highly fabricated metal products, has increased enormously.

### Post-war Trade Stability Vital to Canada

Without discussing government policy or party programmes, one can point to certain conditions which any Canadian government must take into account. In the first place, our economic life depends on the establishment of stability and prosperity in the outside world. Without these, it will be difficult indeed to effect the re-adjustment of the Canadian economy which will be required at the end of the war. This is not to suggest that there is no room for expansion in the domestic market nor that the export market will necessarily be more important after than before the war. It is simply to point out that in a world restricted and divided as was the pre-war world, Canada will find the problems of re-adjustment difficult indeed.

In the second place, it is world and not regional prosperity, which must concern us. There have been recent periods in which it has been the fashion to propose dividing the world neatly into regions or blocs or even continents. Such thinking may have some validity in strategy and power politics. I do not know. I do know that when in the nineteenth century the steam railway opened up the great land masses of the world and the fast steamship lines linked the continents together, the world economically achieved a high degree of unity. I should have thought that air transport, the motor truck and the faster ship had made an integrated world even more necessary. However this may be, it is very clear that a world organized in economic regions would be a world into which Canada would find it hard to fit. If you ask whether we choose a dollar bloc or a sterling area, we can reply only that we prefer sterling which can be changed into dollars and dollars which can be changed into sterling. To ask whether we prefer to trade with the United States or with the United Kingdom is to ask us on which side we wish to be paralyzed. Not even unrestricted trade with both is sufficient. Since we think in terms of peace and mutual advantage and not in those of subjugation and geopolitics, we can claim a share in the whole world as our living space. We must be free to sell the products of our specialized resources in many other countries beside the United Kingdom and the United States if we are to maintain active employment and a high standard of living.

This is very plain in the case of Canada and a number of other countries. It is less obvious but probably not much less true of the United States. It was this consideration which led an economist from another small country to advance to me the other day the proposition that it was very difficult for a large country to develop an international point of view, but that it was a daily necessity in a small country such as his own and Canada. Without pushing the proposition too far, it is true that we cannot escape awareness to the impact of the outside world on us.

### Trade Policies in the Past Fifty Years

No country was more affected by the economic dilemma of the thirties than was Canada. There have always been two objects which economic policy has sought: (1) the *full* use of resources both human and material, and (2) the most *effective* use of resources. As the revolutionary technical changes of the nineteenth century unfolded, the *full* use of resources seemed to pose few problems and policy was directed mainly to their most effective use in the light of Adam Smith's dictum that the division of labour is limited by the extent of the market. Economic policy was concerned mainly with freedom of trade. Brushing aside some exceptional cases, the arguments for freedom of trade are unanswerable in a world where there is reasonably full use of resources and in which the risk of war is not considerable. But even Adam Smith urged that defence is more important than opulence and the lowering of trade barriers in the face of unemployment is politically difficult even when it is economically desirable.

In the great depression of the thirties, when so many economic and social growths bore bitter fruit, two related facts produced a conflict in our economic objectives. First, the threat of war and civil strife hung over the world, and, second, the degree of division among countries was such that concerted policies were impossible of attainment. Those countries which sought effectively the *full* use of their resources did so by reducing their trade with other countries or by preparation for war or by both. Those who were reluctant to adopt restrictive, beggar-my-neighbour policies, found themselves exposed to the full fury of the blizzard. In the result, we had, through the world, an incredibly irrational and impoverishing mixture of increased and discriminatory tariffs, quotas, export subsidies, depreciated exchanges, and discriminatory clearings agreements coupled with unemployment relief, employment-creating expenditures and credit expansion policies. Only where the preparation for war was a paramount consideration, was unemployment reduced to low levels.

### No Simple Formula for Organization of International Trade

Here is the central problem to be solved post-war. Like all economic problems, it is not a single problem to be met by a simple formula. It is to be met by co-ordinating and harmonizing the solutions to a whole series of problems. Foreign exchange, commercial policy, international investment, trade in raw materials, and the harmonizing of national measures for promoting a high level of employment and incomes are all parts of this series. I suggest that if we can keep our eye on the problem and use the means and experience at our disposal many of the controversies over methods and institutions will sink into the background. I am less concerned over the intervention of governments in business direction, regulation or ownership than I am over the fact that in the vast majority of cases the object of intervention has been to maintain an uneconomic position, a vested interest in an obsolete way of doing things. I am less interested in the question, when was the gold standard a gold standard than in the attempt to provide convenient, reliable and confidence-inspiring means of exchanging the world's products. I am less concerned about maintaining private enterprise than in setting conditions in which it will be enterprising.

### Post-war Monetary Organization

It is because of the central importance of these problems that active consideration, as indicated in announcements from time to time from Washington and London, is being given to them. Aside from the many urgent problems of relief and rehabilitation of liberated countries, discussions have advanced further on post-war monetary organization than in the other fields. This is not because the other problems are less important but because lack of agreement on post-war monetary organization may completely frustrate the attempt to reach other desirable agreements and because agreement in this field should not be difficult.

Originally, two tentative plans were put forward, one by the British Treasury officials and one by experts of the U.S. Treasury. To these, after discussions with both groups, Canadian officials added a third plan, embodying some of the features of each and adding some new provisions. I should add that no government is committed to any of these proposals. I am not going to discuss these plans in any detail since their provisions are necessarily technical and the techniques are not engineering techniques. The objects sought and some of the principles involved, however, should be of interest as revealing the direction of thinking on these international problems.

Among the plans, there are differences, some of them important, but all less important than the points of agreement. The proposals do not attempt to deal with problems of relief, rehabilitation, or long-term investment. They represent only one part of a complete structure. They attempt to accomplish a number of highly important things.

### Credits Needed to Pay for Imports

First, it is proposed that countries which at the end of the war are short of foreign means of payment shall be given limited moderate access to a fund or credit which will enable them to purchase necessary imports wherever the products are available. Such means would be provided under agreed conditions out of a central fund or account, not by individual countries competitively as was done after the last war. In effect, each country on a reciprocal basis would put into the account or fund the means of payment which other countries required in order to purchase from it. We must make it possible to re-establish multilateral trade and avoid a mad rush into the bilateral deals which marked the thirties and which were a means of spreading penury among nations and of turning independent countries into vassal states. There is, I am sure, no need to elaborate on the disorganizing and impoverishing effects of putting trade into the manacles of bilateralism. In Lord Keynes' lucid words, these proposals would enable us to "apply fully what we do earn from our exports wherever we may be selling them, to pay for whatever we buy wherever we may buy it."

### Stability in Rates of Exchange

Second, in accomplishing the first, we must make it possible not merely to convert the currency of any member country into that of any other but to do so at reasonably stable rates of exchange. Such rates need not be unchangeable, but substantial changes should be made only after some measure of agreement has been obtained that the change is the best method of re-adjusting an unbalanced position. Competitive depreciation has at times held advantages for some countries but all countries have now become too expert at it for any to make any gains. Readjustments will be necessary, but there must be stability and the confidence in stability which business decisions require.

Third, even in the most fortunate circumstances, we may expect that countries will be beset by many of the vicissitudes that have affected them in the past. Crop failures, new products discovered by their competitors, changes in productive efficiency—these and other things will temporarily affect their ability to buy abroad. It is desirable to provide a cushion so that such changes may not have the effect of forcing them to restrict trade and thus spread depression to other countries. No country can fight depression effectively if other countries are thrusting depression on it.

### Countries Must Buy as Well as Sell

Finally, it is important that what we gain from foreign countries by selling our products to them should be used to buy the products of foreign countries or to repay debts to them, or to invest in their development. Only by so doing can any country as a whole get usable value for what it has sold.

### An International Fund is Needed

In providing resources to such an institution, no country would be performing an act of generosity or charity toward other countries. It would be recognizing its stake in a functioning international economic system and recognizing the cost to it of trade disorganization and stagnation.

Further, such an institution would be international not supernational. Member countries would act in agreed ways for common purposes and advantages, realizing that without such agreement the common purposes could not be achieved. It would relieve countries of many serious limitations they have been under in pursuing sound national policies for the welfare of their people. There is no salvation in setting up world authorities to solve the hitherto insoluble problems. The only salvation is in countries solving them together as we have met war problems.

### Important Lessons from Past Experience

Programmes for meeting post-war problems should be evolved out of the experiences of the years before the war and of the war itself. Much of the pre-war experience was bad, and should teach us what to avoid. Some of the war experience relates to purely war problems which will not recur in peace, but much of it is very revealing. We have come to think of imports, not as the disturbing results of foreign machinations, but as needed products which we try to expedite, make representations to combined boards in order to get, and divide with our friends and allies like water rations in the desert. We have found anew how interrelated the economic world is and how much our own prosperity depends on that of other countries. We have found that when, under the stress of war, we gave priority to the *problem* and brushed aside the one-eyed adherents of this or that doctrine, nations could in concert accomplish tremendous tasks for their own and the common good.

Surely it is not too much to hope that by similar methods and in the face of no greater difficulties we can pursue with increasing knowledge and understanding the twin objects of full productive use of the world's resources and co-operation in their more effective use through world trade. These problems are not to be approached dogmatically, not sentimentally, nor timorously, but with willingness to learn from experience, with hard-headed assessment of mutual interests and with the boldness of conception which is now bearing fruit in the conduct of the war.

---

# MANPOWER UTILIZATION IN THE UNITED STATES

LAWRENCE A. APPLEY
*Deputy Chairman and Executive Director, War Manpower Commission, Washington, D.C.*

**An address delivered at a joint meeting of The American Society of Mechanical Engineers and The Engineering Institute of Canada at Toronto, Ont., on October 1st, 1943**

Manpower utilization in the United States is at this time in the stage of definition, identification, and programming. Outstanding leadership in this field is being supplied by the Bureau of Manpower Utilization of the War Manpower Commission.

While the Bureau of Manpower Utilization furnishes leadership in this field, by far the greatest amount of actual utilization work is done within industry itself by management and labour. Other Government agencies closely identified with production facilities render varying types of assistance.

At this point in the manpower utilization programme we are in the consulting rather than the inspection stage. The ever increasing stringency of the labour market as well as the speed with which industrial management increases its own activities along this line will determine whether we have to enter the inspection approach to this question.

### Manpower Utilization Defined

Utilization can be defined as follows: Utilization means the most productive use of the minimum amount of labour necessary for production under working conditions that will maintain worker effectiveness and morale.

When this conception and definition of responsibility are thought through, the extent of the obligation will plot an area of large size. It includes the best use of industrial, agricultural and government personnel. It means that each person, male or female, who is physically able to render personal service, shall be given the opportunity to serve in an essential capacity; exert his particular abilities in a sustained and unrestricted way on a schedule of hours and under working conditions consistent with good health and morale. Actually no worker is left out of this total war enterprise. Obviously, utilization involves all the factors that affect workers in the performance of their productive effort. It is immediately apparent what some of these factors are —Plant conditions, production procedures, personnel policies and out-plant conditions. In fact, a list of the various elements of these major categories affecting manpower utilization needs to be set down. We shall include such a basic factor list in connection with the programme plan of action.

Lest we become casual in considering utilization, we should recognize that we are now seriously under-utilized all along the manpower front. This is the consensus of opinion of management, labour, and of independent observers.

When in an airplane factory over 30,000 employees have been added to the payroll in one year, and yet at the end of the year there are 400 less employees than at the beginning, we can understand the enormous utilization wastage of turnover.

As to absenteeism—In one large company, it was found that the rate of absenteeism was such that 1,500 additional workers had to be kept on the payroll in order to meet the production schedule.

On the other hand, when a shipyard in a period of nine months can cut the manhours on a Liberty ship from 900,000 to 250,000, we get some idea of the contrast between-under-utilization and utilization. We gain an insight on what manpower utilization means.

When a plant, by improved production procedures, can turn out thirty-five per cent more work with twenty-five per cent less workers, we get an idea of what proper utilization can do and is called upon to do.

From these illustrations it is clear that the utilization job has got to be done at the local level, where the plants, factories, and industries are located, and, it is the combined job of government, labour, and management.

### General Description of Utilization Job

The utilization job requires a plan of procedure to acquaint management, not only with the manpower utilization services of the War Manpower Commission, but a plan of publicized information on utilization that will enlist the co-operation of management and labour in undertaking utilization improvements.

Let us now translate this general job statement into a utilization programme at the local level.

### I. Determination of Utilization Needs in the Area

Effective utilization of manpower is so big a job, with so many sides to it that we must organize our attention on the larger issues first. That being so, we can pick out what are the primary indicators of inadequate utilization. They are such things as unplanned Selective Service withdrawals, production lag, and low production rate per man-hour, excessive turnover, absenteeism, and unusual labour recruitment problems.

Notice that these primary indicators are not the causes, but the effects of under-utilization. They are the signals of need. There are other signs, too, such as frequent complaints of workers at the employment center. Also, threatened strikes and serious accidents are evidences of need, but these latter are dramatic items that are headline news and could not fail to provoke attention. But in the ordinary day-by day treadmill of war effort we can expect to find need for a utilization job wherever military withdrawals are irregular, where production is behind schedule, where turnover and absenteeism are excessive, or where there are serious labour recruiting problems.

It would seem to be a matter of common sense that on account of the hurried pace of war production, we have to think in terms of greatest needs first. Of course, we have to do an overall educational job, too, and do it concurrently, but we shall deal with that a little further along.

Our situation is somewhat analogous to an epidemic of influenza. It may be that the general health of the populace is below par, and that this contributes to the rapid spread of the disease. The medical job is, of course, a dual one. It must treat the sick, and it must conduct a health campaign in the press to get as many as possible to help themselves and keep well. The physicians, however, will be giving their skilled attention to those in greatest need. In like manner, our consultants are out there in the area dealing with the most pressing cases of need. The training and placement personnel is an indispensable auxiliary force. At the same time a general health campaign is under way. We shall presently make suggestions for the health campaign. The epidemic we have to deal with is under-utilization, and the utilization programme is the health programme to meet that condition. The whole enterprise is under the operational direction of the area director.

### 1. SELECTIVE SERVICE WITHDRAWALS AND MANNING TABLES

One of the very first recognized needs for manpower utilization arose in connection with Selective Service withdrawals from industry. A technique was needed that would prevent undue dislocations of worker personnel while at the same time providing for military manpower. That technique is now well known to everyone as the manning table and Replacement Schedule procedure. Its usefulness as an instrument in connection with other phases of utilization is significant. However, it should be mentioned here that the Selective Service phase of the utilization job is not at all finished. The work along this line must continue. It is well to add here this further comment: that the assistance rendered and being rendered to management in the preparation of manning tables by Bureau of Manpower Utilization consultants, has been one of the outstanding parts of the civilian war effort. As of June, 1943, manning tables for more than 6,000 factories, shipyards, etc., have been prepared or are in process of preparation.

We may expect to find in connection with this work that after the Replacement Schedule is made out, some employers will say that they cannot meet its replacement demands. This condition is becoming quite common. Responsibility for additional utilization service is thus called for. We may regard this as a further extension of the manning table project.

Though the manning table plan has of necessity occupied a predominant place hitherto, we are all aware that the utilization programme branches out in several directions. As we shall see, the manning table will continue to be a useful part of utilization.

### 2. PRODUCTION LAG AND PRODUCTION RATE PER MAN-HOUR

#### A. PRODUCTION LAG

In the case of production lag, we know that factors outside of our responsibility may be operating, such as lack of material and equipment, but nonetheless production lag is a danger signal and should not be ignored.

How do we know what constitutes production lag? The answer to this question would be very easy if all war production plants had a production schedule. All the major shipyards, aircraft, and auto factories have, but many companies have no such schedule, and this is especially true of the sub-contractors. No doubt as time goes on it will be possible for most businesses to set up production goals. However, we are not without recourse in getting at production lag.

In cases where there are production schedules, production percentages are available from information supplied by the War Manpower Commission's Reports and Analysis Service, and also from procurement agencies of the Government. One caution should be brought out here, and that is, that the one hundred per cent fulfilment of a production schedule is not proof that the best utilization is taking place. Production schedules were set quite arbitrarily as "best guesses." Recently one very large aircraft plant that was up to 100 per cent production made a utilization survey, and found that it could maintain that production with fourteen hundred less men.

In factories without production schedules it will be necessary to depend on estimates derived in various ways, from the plants themselves or from Production Drive Committees and so on.

#### B. PRODUCTION RATE PER MAN-HOUR

We have just talked about production lag in relation to schedules. But in the last analysis, utilization is greatly concerned with the most effective productivity per unit of man-hours. Is every man in this and that plant getting the most production out of the skill and effort expended? This question does not imply that the worker should "speed up" or use up twice as much energy to squeeze out more and more production. The question is, how can we use the same energy most effectively? The key to utilization, as applied to productivity, is the phrase, *Most Effective Effort*, including most effective use of time. Time is frequently lost through delays of various kinds. Competent observers among the workers themselves concur with production men that the most effective use of the same effort now expended could increase production a very appreciable amount.

One problem before us is, how can we obtain the information which will indicate the red signal of need? As in the case of production lag, some plants have carefully worked out production rates per man-hour. Even in these cases, management can do a great deal more in bringing about an improvement by restudying their situation. One of the best approaches to this problem is through the acquisition of comparative production figures per unit of manpower of plants doing the same kind of work.

An effort is being made to investigate the possibility of supplying data on this problem. Contact is being made with various government agencies to discover reliable sources of information that could be obtained in the field, or passed along to the Area Consultants.

### 3. TURNOVER

The turnover situation is extremely serious and it has become a major utilization problem. As an indicator of under utilization or misused manpower it has moved up to front page news.

The utilization consultant has available in the Area Director's office many facts about turnover in the area. The new Form ES-270 for use beginning July, 1943, contains the information. This report gives not only total monthly turnover, but a separate report on turnover among women employees. The ES-270 form, and the Manual of Instruction that goes with it, should bring order and definition to the reporting practice on a monthly basis which has been established for all Government agencies. There is a turnover report available for every war production plant with 200 or more employees. When we speak about turnover, we should mean monthly turnover. The monthly turnover percentage is derived by the following formula:

$$\text{Monthly plant turnover} = \frac{\text{Total separations in month}}{\text{Average of working force}} \times 100$$

(The average working force may be found by adding together the total employees at the beginning of the month and the total employees at the end of the month, and dividing the sum by 2.)

Of course, the same formula can be applied to departments within a plant, by doing the same thing with the department figures. And if desired, the turnover by occupations may be similarly derived by taking occupation figures.

The question may be raised, granted that we know how much turnover there is. How do we know what constitutes excessive turnover? Turnover in peacetime is between two per cent and three per cent and it varies for different industries, and this is usually accepted as a peacetime norm. In wartime it is much more difficult to say what a normal turnover percentage should be because, in the nature of war conditions, there must of necessity be many separations and accessions. Right now the average turnover for the country as a whole is slightly over 7½ per cent. In some places, it is as high as twenty per cent and more. Obviously, the latter is too high, but what shall we call the wartime norm? We simply cannot fix it precisely without being arbitrary, but we can be practical and say that anything over five per cent is dangerous. We do want it as low as possible and we should be on the alert to observe whether there is a trend in one direction or another. In any case, we can arrange our priority list so that a glance will indicate the higher percentages as urgent cases.

#### 4. ABSENTEEISM

The fourth indicator of under-utilization is absenteeism. In spite of wide publicity, it continues to be disturbing.

Let us understand first what absenteeism is because the word has been loosely used.

Absenteeism or job absence is defined as the failure of a worker, who is on the payroll, to appear on the job when he is scheduled to be at work and work is available. This is a standard definition commonly used by government agencies. The definition can be further clarified, however, by noting that an absence means a whole day or "man-day" as it is called.

The percentage rate of absenteeism is computed on a monthly basis according to the following formula:

> Number of Absences during month (man-days lost) divided by Plant Monthly Absentee Rate equals: Total number of employees scheduled for employment during the month, multiplied by 100.

As in the case of the Turnover formula, a department absentee rate may be computed by restricting the numbers to department figures.

In peacetime, absenteeism may go as high as nine per cent in certain industries, but the average is about five or six per cent. In time of war the average is higher and at present it is approaching eight per cent for all industries. In some war industries it is higher still. The practical view is that any absentee situation which goes above five per cent has moved into the red and should be looked into. It should not be too difficult to list the more serious cases which require consultant service.

Facts regarding absenteeism are, as in the case of turnover, obtainable from the new Form ES-270. This report shows total absenteeism and then separately it gives absenteeism for women workers. In addition to this, it shows absenteeism by shifts. This is designed to help locate where the greatest absenteeism occurs which will be of assistance in discovering the causes of absenteeism.

#### 5. UNUSUAL RECRUITMENT PROBLEMS

The United States Employment Service is constantly endeavouring to recruit labour to meet industrial demand. It frequently happens that the Employment Service has some question about the legitimacy of the demand. It sometimes appears that these demands are excessive. Are they really necessary? If the Employment Service were to fill the demand in all cases, it would often be required to carry on intensive and extensive recruitment. It will be glad to do so if the labour demand is justified. Where there is a question regarding these apparently excessive demands, the Employment Service would like to have reassurance that the requests are justified. How shall this reassurance be obtained? Logically, if one ignored existing practice, it would seem that at this point the utilization consultant should take over and carry on whatever investigation or survey is necessary at or in the plant to determine the legitimacy of the employment demand. And no doubt the utilization consultant will frequently be presented with this problem by a United States Employment Service office. If so, he may proceed, for it is part of the overall utilization job.

However, we must take into account existing practice and utilize that practice. Many U.S.E.S. offices have an already established routine for following up on excessive demands. They have registered the further investigation of the employment situation as part of their function and they have used members of their own staffs for that purpose. Where this is so, and very competent personnel is available, there is good reason for disturbing the procedure, and much reason for retaining it. After all, there are so many more employment offices than area offices, that the coverage is much greater. Then again the U.S.E.S. has been in business a long time. It has a well-trained staff and it has many excellent contacts with various business enterprises. These valuable assets are part of the total strength of the War Manpower Commission. The Bureau of Manpower Utilization does not wish to suggest that the U.S.E.S. let up on any of the valuable services it has been rendering. On the contrary, it is regarded as a very important ally. Organizationally a distinction has been made between Placement and Utilization, but the distinction is not a wall. In practice the services merge at many points.

Returning for a moment to the question of special recruitment problems as an indication of utilization need, we call attention to a few more of these problems. There are cases where the demand for new workers is not too great in terms of numbers, but too high in terms of skilled workers asked for. Quite possibly a job breakdown analysis might solve this situation. Then again, the recruiting problem may be one where workmen are unwilling to take employment in certain industries because of known in-plant conditions. Another situation that is now appearing is the number of requests for Statements of Availability and likewise appeals cases. These are all indicators that something is wrong somewhere.

It is very clear that abnormal demand for workers is an indicator of under-utilization of genuine significance, therefore, this item has been featured as one of the primary indicators for which to be on the lookout.

In regard to all these primary indicators of need, it is fortunate that we have ample facilities for getting information on most of these various points. Additional items of information may, as we have said, turn out to be leads, but the usual ones are indicated here. And on account of these indicators, we are able to classify industries in the area according to utilization need.

### II. Plan of Action to Supply Urgent Utilization Needs

#### A. THE MANNING TABLE PROCEDURE

The manning table is an important part of utilization procedure. It is still desirable that industrial establishments should be encouraged to make manning tables, not only as a tool essential to orderly Selective Service withdrawals, but also when it appears to be essential to solving other manpower problems.

The programme of utilization will be recognized as emphasizing the term "utilization survey." We wish to state that the survey is not something utterly new nor is it diversed from the manning table procedure. In order to make a manning table, something in the nature of a survey must be made, yet to make it does not necessarily require all that we are now envisaging in a utilization survey. On the other hand, it is possible to make a utilization survey without making a manning table. But in this latter case, a great deal of the same information will have to be acquired which would be already in hand had the manning table been made.

Aside then from the Selective Service aspect of the manning table, the table remains a useful and available tool of utilization. But it is not a "must" in all utilization plant services. We may do either a survey or a manning table or we may do both, depending upon the local situation and the discretion of the area staff.

B. THE BASIC FACTORS OF UTILIZATION

At this point what do we know? We know that we have a number of more or less serious cases of under-utilization in the industries of the area. We do not yet know the causes of these conditions, except in the case of Selective Service withdrawals. The utilization needs of the area are established for us by our priority list of need.

In order to set up a plan of action to meet the need by locating the causes of under-utilization and removing them, it is of the utmost importance that the consultants have a thorough understanding of just what it is that utilization is concerned with. What are the possible causes or factors that make people quit their jobs or take days off or that slow them down? What are the conditions that retard or bring about a decline in the production rate? The possible reasons are well known to specialists in the fields of production engineering and personnel management. The reasons or causes cover a wide range of possibilities, any one of which, or any combination of which, may be operative in a particular plant. That is to say, if we could have a kind of master list of these causes, or even a list of the most common causes that make for ineffective utilization of manpower, we could survey a factory in terms of this list and locate what it is that is causing the difficulty.

Such a list of basic factors has been prepared as part of the utilization survey list. It contains a breakdown of the elements usually classified under the headings of plant conditions, production procedures, personnel policies and outplant factors. We shall discuss the functions of this list in a moment, but here we wish to say that such a list contains the common recurring characteristics of items that affect manpower utilization. Any industrial organization that could rate itself or be rated "good" on all these items would be a very outstanding business, with a very low percentage of absenteeism and turnover, and a high rate of production per man-power. That company would have a healthy or sound utilization programme as part of its management policy.

We now know two fundamental things; first, the utilization needs in our area, and especially the cases of most immediate need; second, what utilization is. We know from the study of utilization survey list, the factors or constituent elements of utilization. We know now what the pulse rate and the temperature of the business enterprise should be. The next step will be the actual contact at the plant.

C. PROCEDURE FOR MAKING CONTACT WITH MANAGEMENT

Having selected a prospective establishment for interview, a procedure is necessary. It is not the intention to provide the consultant with a stereotyped sales talk in undertaking his contact. It will make some difference regarding the character of the approach whether the consultant was invited or came of his own accord, or whether the factory experience with manning tables was satisfactory or not. Some general considerations, however, regarding approach may hold for most cases. And these suggestions are equally valid, whether the consultant makes his contact in the interest of getting a manning table acceptance, or whether it is a more extensive utilization survey that is in view.

It should be an axiom that contacts must be made with the highest operating official in the company. We should not go in except through the top man. The interviewer should have a good deal of knowledge of the corporation in question. Presumably he knows about its production, turnover and absenteeism. And if there was a manning table prepared, he knows a good deal more.

Let us assume that the object of the interview is agreeably to induce management to allow the interviewer to make a utilization survey. We already know there is need for utilization improvement, and in all probability, management will be more than ready to co-operate with the man who is there to help him supply that need. In such an interview a skillful and tactful consultant will obtain a fairly good idea of what kind of an organization he has to deal with. Without ever displaying a check list, the consultant should learn during the interview a number of things on the survey list that are most essential to know—the personnel policy of the company, the size of the staff, the attitude of management toward labour, hiring practices, attitude toward minority groups, use of women, wage structure, and so on. These first impressions can be confirmed or qualified later, but the initial interview should be on a high level. It should be conducive of mutual respect, laying solid ground for the later interviews in which the recommendations for dealing with the situation are to be presented.

We should not forget at any time the human relation aspect of the interview. Management frequently has a defensive frame of mind toward Government men and understandably so. In the first place, executives have reason to think they know how to run their own businesses. They have pride in their organization and they may resent the implied criticism of our presence. In the second place, they may have had some unpleasant encounters with other Government representatives. They may think they would be in better shape now if it were not for "all this Government interference." We are not concerned with the merits of this attitude. We are concerned to remark that the wise consultant will take it into account and understand it. Perhaps he may dispell it by his own judicious approach. Management needs to be reassured that this is not some government investigation that is about to take place. We are not going to collect information to be placed on file anywhere. We can, however, render a type of service that is not likely to be supplied by anyone else in the present employ of management. These are all important considerations. The whole success of the utilization survey may very well be determined by the way in which the approach is made to management. Consequently, we need for this work men who not only have experience, but men who know how to meet people forcefully, but not officiously.

It is conceivable that management would refuse to co-operate at all, but this extremity is unlikely. We have every reason to approach management with the awareness that it is as much interested in winning the war as we are. And winning the war is helped at the plant level by manpower utilization.

D. MAKING THE UTILIZATION SURVEY

1. Information on Utilization Factors Provided by manning table

a. Total personnel employed.
b. Total hired previous six months.
c. Description of the nature of the business concern.
d. List of jobs in the plant.
e. Extent of use of women and handicapped.
f. Percentage of workers in each job.
g. Number of workers in training in each job.
h. Extent of job re-engineering.
i. Extent of upgrading and transfer.
j. Extent of recruiting outside the plant and estimate of maximum labour needs.
k. Recommendations already made to plant for improving utilization on the basis of manning table findings.

The fact that the manning table discloses so much is an impressive commentary on its usefulness. In fact, in some regions, many of the items in the survey check list are already included as part of the presentation to management of manning table findings.

The ES-270 Form also discloses a great deal about a plant. The following information from Form ES-270 will be available in any case whether there is a manning table or not:

a. Employment trend.
b. Turnover percentage for all employees and women.
c. Absentee percentage for employees and for women.
d. Critical occupational shortages and number needed in these occupations.
e. Anticipated gross labour needs for next four months.
f. Anticipated separations for next four months.
g. Information regarding recruitment methods, in-plant training, up-grading and job breakdown.

2. The Purpose of the Survey List

The survey list serves as a guide in locating the causes of under-utilization. Much of the knowledge required in completing the utilization survey will be in hand before we get much beyond the main office. The items that remain should be covered through a variety of interviews with the personnel manager, chief production engineer, labour-management committee chairman or members, production drive committee people, operating supervisors, foremen, workers, and union representatives. The United States Employment Service and Training people may contribute important items essential to an evaluation. The resident Army or Navy officer or other Government personnel should be consulted. Various people in the community may need to be interviewed. The circumstances will dictate to the alert consultant various avenues which must be locally followed to gather the pertinent information of the survey.

3. The Use of Utilization Work Sheets.

In order to assist the consultant in gathering his facts, work sheets have been prepared together with accompanying instructional material. These tools will be of aid in getting more detailed information regarding the causes of under-utilization disclosed by the preliminary survey. For example, if in the process of making the preliminary survey or check-up it appears that a production flow bottleneck is the problem, then the special work sheet on production and the instructional material therewith, will aid the consultant in getting the pertinent facts about production conditions. In other words, the work sheet will enable the consultant to make a more complete survey analysis of the difficulty. Again, if the preliminary check list discloses that a lack of a constructive personnel programme is the main cause of absenteeism or turnover, then the work sheet for personnel will be of aid to the consultant in getting more complete knowledge of the personnel deficiency. Thus the work sheets are supplementary to the check list and will enable the consultant more competently to make the utilization analysis.

4. Analysis of Utilization at the Plant

The consultant having gathered his data, must now study it carefully. No doubt he has seen many things that might well be improved. But the hurried nature of our task compels us to think in terms of the main factors that need improvement. We should isolate these main causes and have a very clear conception of what they are.

Equally important is the necessity of determining what measures would overcome or greatly minimize the causes. It cannot be emphasized too much that this step calls for a very comprehensive understanding of the whole situation, and for some hard thinking.

#### E. RECOMMENDATIONS TO MANAGEMENT

All that was previously said about the initial interview with management is also applicable now. It is really harder to present the findings and tell management what is wrong. But there are remedies to propose and that is something constructive. Be able to show what these recommendations will do in this plant if they are adopted. We must talk in terms of consequences that are positive and that can be measured.

#### F. AGREEMENT WITH MANAGEMENT ON MEASURES TO BE TAKEN

Action must be taken on the recommendations. As a matter of fact, all that may be necessary in many instances will be the presentation of what the causes of trouble are. Alert management will want to do something about this. That is what we hope for. In other cases it may be necessary to press for action to be taken. The agreed-upon procedure must be a definite programme with specific steps spelled out with a time schedule, and clear delegation of responsibility for carrying out the actions.

### III. Plan of Action to Supply Need for Utilization Education

It was remarked earlier in this descriptive outline that in dealing with an epidemic there are two basic needs that have to be met. First, dealing with the immediate cases of illness, and second, promoting a health campaign to educate the public. The use of the epidemic analogy is not far fetched. The lack of adequate utilization is a menace to our manpower resources just as real and just as effective as an epidemic would be. It removes as many people, probably more, from productive effort. Therefore, it does become necessary as part of utilization to undertake educational measures. It is not management alone, but labour too, both in the ranks and at the helm, that requires a genuine appreciation of the utilization problem. We must convince labour as well as management that the utilization programme does not encroach upon or infringe in any way the real interests of either. There is nothing here that anybody has to be on guard against. False notions about utilization have bobbed up here and there—that utilization is a new kind of regulation of management, that it imposes policies and procedures that management does not like or, from the labour point of view, that utilization means "the speed-up" with all the old-time associations therewith. These misunderstandings are not even close to the facts. Actually, utilization if properly understood is a balanced programme of co-operative effort in the common interest. No real values are subtracted from anybody, and yet the common pool of national effort can be enriched thereby.

Clearly an educational effort is called for. It needs to be dynamic. It needs to inspire as well as to inform.

### IV. Organization to Administer policies and Actions

It is plain that at the area level the organization requirements are very simple to state. The organization of the War Manpower Commission has already been determined and within that organization a place was made for manpower utilization.

At this level the Area Director has, as a member of his staff, one or more Bureau of Manpower Utilization consultants. The Chief Consultant directs the works of the other consultants and at all times is directly responsible to the Area Director.

This programme, as now stated, has defined the meaning and extent of utilization, the determination of need, and the manner in which need is to be supplied. In short, the programme has tried to make clear what the procedures and actions are that can be completed at the area level.

### V. The Accurate Measurement of Results

It has already been mentioned with regard to the educational phase of the utilization programme that results cannot be measured too precisely. But it should be quite different in regard to our specific plant procedures. We should be able to measure the results of our treatment of specific cases. As a matter of fact, in measuring the results of our efforts, we do something very similar to what we did at the outset when we took note of the primary indicators of under-utilization. We look in the same direction where we saw the red signal flags, and we ought to be able to discover something very positive.

1. We should see a smoother flow of Selective Service withdrawals. It happens that we already know positively that this result has taken place. It has measured very definitely, as one sample illustration will show. In one of the country's largest industries, the weekly withdrawals had been scaled to one thousand. Yet, because of the planning in connection with the manning tables, that organization was able to maintain for a long period that rate of withdrawal, and at the same time hold its production schedule at a high level.

2. It should certainly be possible to discover in any given organization that had applied utilization recommendations just what the improvement is per unit of man-hours. If we do not show measureable improvement here, we have not attained one of the most important objectives of the programme.

3. Lower percentages of turnover will give us positive measures of this factor.

4. Lower percentages of absenteeism will give us a positive measure of the extent of improvement here.

5. Lessening of serious recruitment problems at our employment offices will be readily recognized as positive evidence of improved utilization.

* * *

This application of this approach supplies the management involved with an accurate measurement of conditions and with a very definite plan of action for correcting conditions of under-utilization where they exist. As already stated, this effort is too young to report on its effectiveness. That, however, which has already been done gives us very favourable indications. So far we are kept busy answering requests for help. It is reasonable to assume that, since this whole effort pulls together many proven methods of sound production and personnel management and focuses them upon a specific problem, it is assured success.

# Abstracts of Current Literature

**Abstracts of articles appearing in the current technical periodicals**

### AIRCRAFT SALVAGE IN MIDDLE EAST

From *Trade and Engineering* (London, Eng.), October, 1943

It is now possible to give some account of the sterling work carried out in the Middle East by the men of the Repair and Salvage Units of the R.A.F. Their task was to locate crashed aircraft in the wastes of the Western Desert and to bring them back to bases where the least damaged machines were rebuilt and put back into service, and those which would obviously never fly again were taken apart and serviceable parts saved for use in another aircraft.

The task of the salvage units was by no means simple, and it entailed exposure to great discomfort and often to danger. When a crash was reported an engineer of the Repair and Salvage Unit set off on a given compass bearing to locate the aircraft. Having found it, his first task was to decide whether or not the wreck could be repaired on the spot. If the work was such that the aircraft need not be moved he had a mobile repair unit sent out; but if the damage necessitated taking the aircraft back to base the "aircraft carrier" lorries were sent out. The wreck was lashed to them and hauled home to the forward post. There the wrecks were gathered together and a huge convoy made up. Usually a dozen or so aircraft were transported at the same time and the unwieldy procession seldom faced a journey of under 400 or 500 miles. The "aircraft carriers" are strongly built vehicles 60 ft. in length.

Frequently during the recent campaign in Libya and Tripolitania the salvage units had to find their way over the trackless desert for distances of 100 miles with no more than a compass to help them. They had to take with them all the food, water, fuel, and oil which would be required for the return journey, for they invariably travelled as self-contained units. Sometimes the vehicles had to jolt their way over rocky outcrops, which imposed a severe test on springs and tyres, sometimes the way led over soft sand in which the heavy vehicles sank up to their axles and had to be dug out. In the desert the men often experienced unexpected and unpleasant changes in the weather. For days at a time the convoy might be immobilized in a blinding sandstorm, or a sudden rainstorm might churn the surface of the desert into a sea of treacherous mud. There was, too, the ever-present danger of running into an enemy patrol or being attacked by an Axis aircraft.

When the crashed machine, with the others brought in the same convoy, reached the base it was methodically dismantled, the hundreds of component parts carefully examined, then repaired or replaced, and the whole aircraft rebuilt. In a tribute to the men of the Repair and Salvage Units, an R.A.F. officer at Middle East Headquarters said that a large percentage of the machines were able to go back into service and that many a German aircraft had been shot down by a machine which, when it reached the repair base, had appeared to be little better than a crumpled wreck.

### BRITISH MIDGET SUBMARINES IN ACTION

From *Engineering*, (London, Eng.), October 15, 1943

The German reported sometime ago the presence of British midget submarines in the Norwegian fjords where the battleship *Tirpitz* and other enemy surface craft have established a base. The Admiralty have now confirmed these reports and have revealed that a number of midget submarines, three of which appear to have been lost, successfully penetrated on September 22 some 50 miles into the Alten Fjord, in the Arctic Circle, and inflicted considerable damage on the *Tirpitz* with torpedoes. Subsequently it was disclosed by Colonel Knox, the United States Naval Secretary, that the submarines carried two men apiece, and that the United States Navy had been kept informed for nearly a year of the experiments that were proceeding with this type of craft. According to the Admiralty statement, "interrogation of crews of midget submarines which took part in the exploit, and subsequent photographic reconnaissance, now leave no doubt, despite enemy claims to the contrary, that the attack met with success. Air photographs taken after the attack show the *Tirpitz* which has not moved from her anchorage, surrounded by thick oil which covered the fjord where she lay and extended over a distance of more than two miles from her berth. The photographs also show a number of small unidentified craft alongside the battleship, possibly repair ships or ships to provide power and light. Personnel who took part in the operation report that, on September 22, while still in the immediate vicinity of the anchorage, they heard a series of very heavy detonations at the time expected for units to be attacking." Alten Fjord is stated to be 1,000 miles from the nearest British base, from which it may be inferred that the submarines were transported to within a comparatively short distance of the entrance to the fjord. They had to pass through minefields and to evade the enemy's patrol vessels in order to reach their objective, located in a channel less than a mile wide and relatively shallow for submarine operations; and having made their attack, the surviving submarines had to make an even more hazardous passage back to the sea. With good reason (to quote the statement again) "the Admiralty consider that the crew of these midget submarines displayed the highest qualities of courage, enterprise and skill."

## PLANNED MAINTENANCE OF ELECTRICAL EQUIPMENT

From *Production and Engineering Bulletin* (LONDON, ENG.), SEPTEMBER, 1943

The first aim on an efficient maintenance organization is to prevent trouble rather than to put right what may have gone wrong. A preventive service ensures economy in plant and in the materials and labour involved in overhauls, and avoids the serious hindrance to production caused by breakdowns. This can only be achieved by planning the work of the maintenance department on a properly ordered basis. Such a service is economically sound practice at any time, but in present circumstances it is a vital necessity.

Plant maintenance generally is still one of the most neglected aspects of works organisation, and such inspection as is done is mostly confined to boilers and other equipment which usually have a high factor of safety and are not particularly subject to unexpected breakdowns.

Where electrical plant is concerned it is frequently left to the operators to report when anything goes wrong with their machines, and repairs are made after, instead of before, a breakdown. Delays caused by such unforseen breakdowns are apt to be prolonged and may recur if, in order to get production started again, make-shift repairs are effected and the real cause of the trouble is not determined.

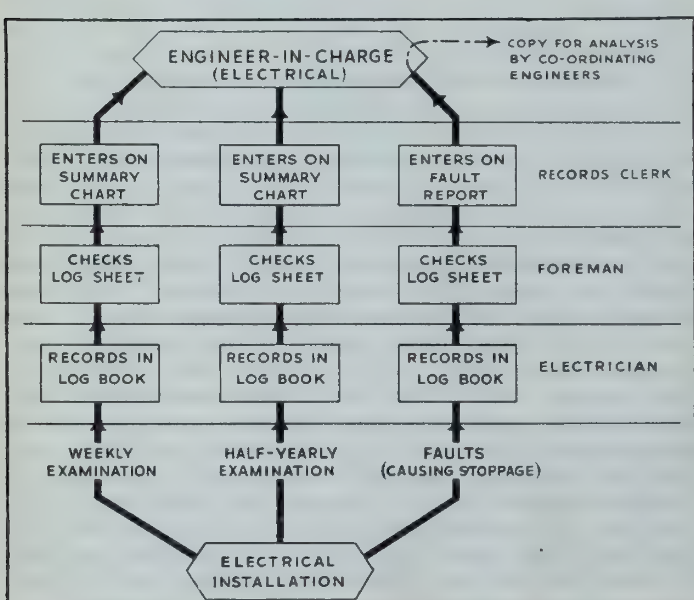
Organizing any planned system takes time and energy at the outset. "Nibbling" at it is no use; but once a good scheme is in operation, the initial effort is soon repaid by fewer breakdowns, lower repair costs, and the saving in time of the supervisory staff.

We are indebted to a correspondent for the broad outlines of a scheme for the planned maintenance of electrical equipment which is operating successfully in a number of works.

The scheme is illustrated by the accompanying chart, the procedure being as follows:

A weekly inspection is made to check for any incipient troubles. Being only visual, this takes but little time and does not entail shutting down any plant. Then at suitable intervals, say quarterly or half-yearly according to the type or use of the equipment, all plant receives a detailed examination and overhaul.

These examinations are briefly recorded by the electrician in a duplicate log-book and the result entered by the records clerk (usually a girl without technical training) on summary charts. The charts are displayed in the engineer-in-charge's office, and so enable him to see, at a glance:




(a) the condition of all plant,
(b) that inspections and overhauls are made at the proper times,
(c) that no part of the installation is being entirely neglected.

All faults causing stoppage of plant are recorded on fault report forms which serve to bring to light any inherent weakness in types of gear or methods of operation which otherwise tend to be overlooked.

Copies of fault reports sent in from a number of different works are analysed together, thereby enabling troubles to be anticipated, cures determined and information gained at any one factory made available for all.

In one large works, when this system was introduced, the daily reports of faults (causing stoppage) covered more than four pages; now, with more electrical plant installed, the average is less than one page.

An analysis of electrical faults at another typical factory, in which planned maintenance was recently started, will be of interest:—

Breakdowns due to lack of maintenance . . . 43 per cent.
Breakdowns due to abuse by operators, and so on . . . 34 per cent.
Breakdowns due to unsuitable plant or faulty manufacture . . . 23 per cent.

Whilst the system of planned maintenance outlined was primarily devised for the larger organizations with their own maintenance departments, the correspondent suggests that it could well be adopted by a number of smaller works operating a "pooled" maintenance scheme, or modified to meet the needs of the smaller manufacturer.

## VERSATILE NYLON

DR. V. E. YARSLEY, F.I.C.

From *Trade and Engineering* (LONDON, ENG.), OCTOBER, 1943

Much public interest was aroused some weeks ago when it was reported that a WACO glider carrying important pharmaceutical chemicals to Russia had been towed across the Atlantic by an aeroplane of the R.A.F. Transport Command, the two rope used being of nylon with steel attachments designed to stand a pull of approximately 10 tons. The interest was mingled with not a little surprise since nylon has hitherto been associated in the public mind with superfine silk stockings or toothbrushes. The latter have been available commercially in this country for some years but the former are still rare luxuries obtainable at present only by the fortunate few.

The fact that the responsibility for a valuable aeroplane and cargo should have been entrusted to a relatively new material at once suggested the confidence which manufacturers have in this new plastic. The new material has in fact been applied experimentally in many directions in which it has already shown remarkable promise. It is frequently spoken of as if it were a single chemical substance, while in actual fact it is a generic term which covers a group of substances which were obtained as the result of the remarkable long-term researches of Wallace Carothers and the Du Pont Company of America. The aim was to produce an entirely new fibre capable of being spun into yarns and having properties equal or, if possible, superior to those of natural silk. The structure of natural silk was examined and was carefully imitated in the laboratory, the result being nylon.

### CHEMICAL PROPERTIES

In chemical language the nylons are produced by condensing aliphatic dicarboxylic acids with aliphatic diamines. Since the Du Pont Company announced the discovery of this new group of synthetic "super polymers" as they were styled at the end of 1938, a substantial amount of development work has been carried out, and although much of this has been preserved as a war-time secret the volume of technical and patent literature which has already been published on this subject is very considerable.

Among the attractive properties of nylon is its high heat resistance. While most thermo-plastics soften in the region of 160 deg. F. and according to one authority the highest softening point previously obtained is about 280 deg. F. tests show that the present plastic does not soften until around 450 deg. F., and it is expected that other nylon plastics having even higher softening points will be produced. As would be anticipated from an examination of its structure, nylon is extremely tough. It is also one of the lightest of plastics, its specific gravity being of the order of 1.06 to 1.19, as compared with 1.3 to 1.5 for cellulose acetate plastics. It shows a remarkably high degree of chemical inertness, and it is inert to metal inserts. A point in its favour as a newcomer in plastics is that it can be worked with existing plant and it can also be easily machined.

### Post-war Possibilities

Although nylon fibres are readily wetted they absorb much less water than do cotton, silk, rayon, or other textile fibres, and, furthermore, they are stated to be just as strong wet as dry. They are not water repellent, but can be easily made so by suitable treatment. By contrast with most textile fabrics which blaze when brought into contact with flame, those of nylon simply melt without catching fire, so that the fire hazard is very considerably reduced. In a brief review recently published the following possible applications have been suggested as among those likely for the post-war development of nylon. It is stated that bearings made of the material were among the first strictly plastic applications investigated, and that experiments on various types are still in progress. These bearings are water lubricated where necessary, but they require no lubricant for a light load at high speed, or for a heavy load at slow speed. The commercial possibilities of these bearings have apparently yet to be explored. The toughness of the new plastic has suggested its use in the form of extruded tubing, and it has the added desirable properties of flexibility and resistance to oils, chemicals, and heat. In the field of electrical insulation moulded nylon units have been employed with success, and the new plastic is also being used in solution form for special insulation work; it is stated that electrical wires are coated with the material by being run through the coating solution at the rate of a mile a minute.

In the more domestic spheres of application, strips of nylon have been used on outdoor furniture, where they have stood up well against weathering and ageing action. This weathering property and ability to resist chemicals has also encouraged the application of this plastic in the experimental production of zip fasteners. It is likely that the application pioneered by the toothbrush will be extended in many spheres, especially where brushes and bristles have to withstand severe treatment and come in contact with chemical reagents. It is stated that tapered nylon paint brushes wear at least three times as long as brushes made of pig bristles.

## INDUSTRIAL ELECTRONICS

From *Mechanical Engineering*, (New York), November, 1943

At a conference on industrial electronics, Schenectady, N.Y., Sept. 14, 1943, which reviewed what electronics has done, is doing, and can do in industry, it was pointed out that hundreds of electronics equipments are now available to industry to help do jobs better and to take over jobs that could not be done otherwise. Welding, heat-treating, positioning, speed-matching, current and voltage control, temperature control, colour matching, motor control, inspection and counting, process control, measurements and testing, power rectification and frequency changing, industrial X rays, precipitation, and decorative lighting are some of the fields falling within the scope of this equipment.

Speakers at the conference were: L. A. Umansky, assistant manager, industrial-engineering division, General Electric Company, who spoke on the broad aspects of industrial electronics; W. C. White, engineer of the electronics laboratory, who told of the variety and types of electron tubes available for industry; L. W. Morton, of the industrial-engineering division, who covered electronics in power conversion and frequency changing; W. C. Hutchins, manager, special-products division, who told of the application of electronic measuring equipments, J. P. Jordan, electronics section, industrial-heating engineering division, who described electronic heating; and E. H. Alexander, engineer, industrial-control division, who discussed electronic controls. W. C. Yates, assistant manager, industrial division presided.

In pointing out how electronics has already come to maturity in industrial operations, Mr. Umansky said that 1943 will see 25 billion kilowatt-hours of electrical energy passing through electronic devices. He told how the application of electronics has brought about changes in many manufacturing industries and gave as an example the contributions of electronic control to bring previously unknown precision, speed, and reliability to resistance-welding operations, thus making possible the mass-production fabrication of many of to-day's implements of war.

"No one familiar with industrial engineering," he said, "considers any longer as a daring or pioneering feat the use of electron tubes for accurately controlling the speed or acceleration of motors, for precision positioning a sheet of paper on a printing press; for colour matching; for controlling wire tension; for smoke detection; or for temperature control—to mention a few of the hundreds of electronic applications that have passed from the laboratory to the factory stage."

Mr. Umansky pointed out that he looked upon electronics as another tool—a very important one, to be sure—added to a well-filled tool chest and to be used side by side with other tools on hand. In the true perspective of things, electronics has taken its place as an equal partner, side by side with other electric equipments, enhancing rather than superseding them.

### Electronic Measurements

Mr. Hutchins described a few of the many electronic instruments available to industry to perform a wide range of testing and measuring. He told about the new electronic winding-insulation tester which is helping to make better motors. By simulating unusual stresses to which the motor may be subjected after installation, such as those caused by lightning or switching, this instrument makes it possible to detect damaged insulation in the motor windings.

The measurement of sound is essential in the manufacture of quiet operating apparatus, whether it be an air-conditioning equipment in a theater or war equipment that must be quiet to prevent giving away the positions of our soldiers to the enemy. A sound-level meter, utilizing a specially designed microphone in combination with an electronic circuit, has made it possible to convert the noise or minute sound pressure waves to an accurate numerical value.

The electronic vibration-velocity meter has made it possible to measure and analyze vibrations in high-speed machines more accurately than was possible without the use of the electron tube.

Heat exchangers, with water flowing through tubes and air passing over the outside, are required for the operation of submarines and battleships. Since a leak in one tube may cause thousands of dollars damage, testing of these brass tubes became important in manufacture. After conducting every conventional test, faulty tubes were still getting into the finished heat exchangers. The replacing tube cost only $1, but the cost to install the tube amounted to $250. A tube flaw detector, a high-frequency electronic equipment was installed. The saving resulting from the rejection of tubes with flaws before the tubes were installed, saved the price of the installation in less than three months, and speeded up production.

"The science of electronics," said Mr. Hutchins, "has enabled the engineer to build equipment that is almost human in that he has practically duplicated four of the human senses. To illustrate, the mercury-vapor detector simulates the sense of smell; the sound-level meter the sense of hearing; the vibration meter the sense of touch; the photoelectric tube the sense of sight, even to the extent of distinguishing colours more accurately than is possible with the human eye."

### SUBMACHINE GUN, M3

From *Army Ordnance*, Sept.-Oct., 1943

Abstracted by *Mechanical Engineering*, November, 1943

In an article by Col. René R. Studler describing briefly the new submachine gun, M3, now the standard submachine weapon of the U.S. Army, considerable space is devoted to the method by which it was brought into being and the tests to which it was subjected before its adoption.

The need for such a weapon as the M3 submachine gun, according to the article by Colonel Studler in the September-October issue of *Army Ordnance*, was first foreseen in July, 1942, when it became evident that production capacity then available for submachine guns of the type required under war conditions was inadequate to meet the growing demand for such weapons. Expansion of existing facilities was out of the question. Machine-tool capacity was even then being diverted to high-priority projects. What was required, in effect, was a gun of improved performance characteristics that used neither the raw materials nor the machine tools normally required in gun manufacture.

Within four months an experimental gun which met these almost impossible requirements was ready for test. After engineering tests indicated that the new gun had extraordinary possibilities, it was tested in rapid succession by the Infantry, Parachute Troops, Amphibious Troops, Armored Force, and the Tank Destroyer Command.

The Infantry reported that in comparison with standard weapons the new submachine gun was more accurate, easier to control, had less recoil, and a slower rate of fire which made each shot more effective. The Parachute Troops preferred it because of its lighter weight and collapsible stock. The Amphibious Troops found that rain, salt spray, or even complete immersion in sea water had little effect on its reliability during landing operations. The Armored Force reported that even under conditions of excessive dust incident to tank operations in the desert it could be depended on to deliver accurate deadly fire. The Tank Destroyer Command found that its sturdy all-metal construction stood all the battering that a high-speed motorized gun mount could give. At the climax to this series of tests the Ordnance Department stated that it was superior in all respects to every comparable foreign weapon.

So overwhelming was the superiority of the new submachine gun that it would not be possible to supply American soldiers with any other submachine gun and maintain a clear conscience. So carefully planned was the design and so well organized was the procurement program that less than ten months after the need for a new submachine gun was first established, the weapon was coming off the assembly line in large quantities and at an ever-increasing rate.

At 10.00 a.m., on April 30, 1943 the first of the U.S. Army's new guns came off the production line. Known officially as the M3 submachine gun, this weapon at first glance resembles the equipment used by "Buck Rogers." The outstanding features are: Reliability of functioning, accuracy, portability, a low rate of fire, and endurance when operating under adverse conditions of mud, dust, and water. When it is field-stripped it can be packed in a box $12\frac{3}{4}$ x $7\frac{1}{2}$ x $3\frac{3}{8}$ inches. No tools are required in taking the gun down or assembling it. This weapon is simplicity itself. When disassembled there are only 25 component parts and 73 pieces made by the manufacturer (less magazine). It is all-metal, fabricated mainly from stamped parts to take advantage of speed and economy of manufacture and assembly. As standardized, the M3 uses the standard caliber 0.45 ball-cartridge ammunition. A magazine feed of 30-shot capacity will fire at the rate of 450 rounds a minute.

The new gun employs the straight-blowback full-automatic principle. Single shots can be made by the quick depression and release of the trigger. This is possible because of the slow motion of the bolt and the low rate of the fire. The bolt has a fixed firing pin and is so designed that the excess energy from its forward motion is expended simultaneously with the explosion of the cartridge. This available energy is to counteract the muzzle rise in recoil of the weapon, thus improving accuracy of fire. This gun has an 8-inch barrel, a sliding removable stock, and weighs eight pounds (less magazine). All working parts are fully enclosed to protect them from dirt, dust, mud, and water. There are no projecting moving parts to endanger the operator. The ejection port cover is also a safety device to insure a closed safe gun when it is not in use. The safety lug on the cover, when it is closed, locks the bolt on an empty chamber when it is forward. In the cocked position, the safety lug holds the bolt back off the sear and makes the sear and trigger both ineffective.

When this new M3 was standardized, former standard submachine guns were classified as limited standard. This action will gradually release facilities making the former weapons for the manufacture of other necessary items. This is possible because the M3 submachine gun can be produced without complicated machine tools, and since most of the components are made by the metal-stamping process, many facilities equipped to do this type of work, which have been previously unable to take part in the war effort, can be utilized.

The savings involved in switching to the exclusive manufacture of the new gun are enormous, whether viewed from the standpoint of money, man-hours, or machine tools. The first submachine gun bought by the army in 1928 cost upward of $200. Fifteen years later, after several hundred thousand had been made, these same guns with comparatively few modifications cost about $40 apiece. Contrast these figures with a unit cost of less than $20, a 50 per cent reduction in man-hours, and a 25 per cent reduction in machine-tool requirements for the new submachine gun and you have a combination which means dollars to the taxpayer, manpower to the Army, machinery to the manufacturer, and trouble to the Axis.

### BEST U.S. FIGHTER, THE MUSTANG

From *Trade and Engineering* (London, Eng.), October, 1943

The best fighter aircraft yet produced in the United States —certainly the best so far delivered to the R.A.F.—is the North American Aviation Company's Mustang. It has already proved its quality with the R.A.F. Army Cooperation Command and has been described as the fastest army co-operation aircraft in the world. It is ideally suited for its specialized work, being a low altitude machine, very fast and manoeuvrable and possessing heavy armament. The makers' name is the N.A. 73 Apache.

The Mustang is in service in this country in two versions, the earlier of which had one Allison V-1710-39F3R 12 cylinder liquid cooled engine, giving 1,150 hp. at 12,000 ft. at 3,000 r.p.m. The later version has a Rolls-Royce Merlin 61 engine made by the Packard Company of America. Standard equipment is a Curtiss three-bladed constant-speed electric airscrew. Maximum speed with the Allison engine is put at 370 m.p.h. at 13,000 ft. and 320 m.p.h. at 1,000 ft., but with the Merlin engine the speed is higher. Armament consists of eight Browning machine-guns, including two of 0.5 calibre.

A low-wing monoplane, the Mustang weighs 7,708 lb. loaded and only 5,990 lb. empty. Principal dimensions are as follows:—Span, 37 ft.; length, 32 ft. 2 in.; height, 8 ft. 8 in.; wing area, 235.75 sq. ft.; aspect ratio, 5.94; and track, 11 ft. 10 in. One unfortunate thing about the Mustang is its close resemblance to the Me. 109. With its square wing tips it has set a problem of identification for many members of the Royal Observer Corps and others.

During the fighting in Sicily the Mustang made an appearance in a new guise. This version, which is known as the A. 36, was fitted with diving brakes and carried out duties very much like those of a dive-bomber. Italian and German prisoners confirmed that it was most successful, causing great destruction by its swift dives and accurate bombing.

# FIFTY-EIGHTH
# ANNUAL GENERAL MEETING
AND
# GENERAL PROFESSIONAL MEETING

## THE ENGINEERING INSTITUTE OF CANADA

**Québec** - *Thursday and Friday... February 10th and 11th, 1944*

All Sessions will be held at the Château Frontenac

## PRELIMINARY PROGRAMME

### *Thursday, February 10th*

A.M. —Annual Business Meeting
President's Retiring Address

Afternoon and Evening—Session on Post-War Planning.—The theme of this session is the belief that the best answer to extremist policies is a clear statement from employers, with supporting evidence, which will assure workers of a reasonable chance of employment and security without resort to exaggerated procedures and unproven policies.

### *Friday, February 11th*

A.M. —"The Design of the Shipshaw Development," by Dr. H. G. Acres

P.M. —"The Steam Plant at Arvida," by M. G. Saunders
A paper on Electronics
A paper on Industrial Relations

Evening —Annual Dinner and Dance

*See the January Journal for full details*

### THE FIFTY-EIGHTH 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 1944 will be convened at Headquarters at eight o'clock p.m. on Thursday, January 27th, 1944, for the transaction of the necessary formal business, including the appointment of scrutineers for the officers' ballot, and will then be adjourned to reconvene at the Chateau Frontenac, Quebec, at ten o'clock a.m., on Thursday, February 10th, 1944.

### THE INSTITUTE MOVES FORWARD

The history of an organization can be traced by the amendments to its by-laws. As the field of usefulness expands, the limitations of by-laws must be extended also. This is progress. The Institute now stands on the threshold of great changes—all of these in line with the established policy of service to the profession. The additions and changes are sponsored by Council itself, after unanimous approval had been given at many Council meetings in many parts of Canada.

The proposals which are printed herewith will be presented by Council at the next annual meeting in Quebec. If approved there they will go to ballot of the membership early in the year. Council asks the support of all members in considering these far-reaching recommendations.

One amendment provides for the appointment to the Council of the Institute of a representative of each provincial professional organization with which the Institute has a co-operative agreement. The purpose of this proposal is to provide a further effective means of bringing about genuine and complete co-operation. It is felt that by thus integrating the administrative groups the usefulness of each can be increased. It is a logical next step in the desired unification of effort on the part of technical and professional societies.

Another proposal calls for a new by-law whereby cooperation can be carried forward with sister societies in Canada, the United States and England. This proposal is more limited in its scope than the one mentioned above, and does not envisage a common membership, which is the principal feature of the agreements with the provincial bodies. Such common membership would be difficult to arrange with a group of societies whose standards of admission vary over such a wide range; nevertheless the proposed by-law makes provision for it, without in any way sacrificing the professional status of membership in the Institute.

This proposal is made by Council in the belief that contractual agreements with sister societies will go a long way towards bringing about a better understanding of the purposes of each organization in its specialized field, and a further discovery of interests common to both that can be best developed by common effort.

The proposals to change the by-laws affecting Student membership is based on recommendations received from branches. Its principal purpose is to place in the hands of each student a copy of *The Engineering Journal,* to the end that a contact will be established, sufficient to hold the young engineer to the society after he leaves college. The records show that those who subscribe to the *Journal* go on to Junior membership in greater number than those who do not. It is hoped that this closer contact will enable the Institute to do more for the student and young engineer.

These changes are the culmination of many years of preliminary work. Council has proceeded slowly so that it might be certain that the changes were in the best interests of the Institute and that the membership would have some desire for them before they were asked to vote. It is believed that all proposals will be well supported.

### AMENDMENTS TO BY-LAWS

In compliance with the requirements of Section 80 of the By-laws, notice is hereby given to all corporate members of the introduction by Council of the following new by-law and amendments to existing by-laws. These proposals will be discussed at the next annual meeting in Quebec City, on February 10th, 1944.

*Proposed New By-Law 82*

Notwithstanding any other by-law of the Institute, the Council may enter into an agreement with any Canadian, British or American society or societies of engineers for the purpose of carrying out all or any of the objects of the Institute in co-operation with any such society or societies, and without limiting the generality of the foregoing, any such agreement may provide for all or any of the following:

(a) The admission of those belonging to any classification of membership of either party to the agreement to the classification of membership of the other to which his qualifications entitle him, or to any privileges, the enjoyment of which it may offer;

(b) The amount and method of collection of entrance fees, if any, and other fees, whether joint or several, payable to the parties to the agreement or either of them;

(c) The appointment of a representative of the one party who is a member of both organizations to the Council or governing body of the other;

(d) The termination of the agreement;

Any such agreement before the execution thereof, shall be published in the Journal of the Institute and shall become effective only upon approval of the same by:

(1) The affirmative votes of at least two thirds of the members of the Council, cast by letter ballot; and

(2) Resolutions of the respective Executive Committees of a majority of the Branches of the Institute; and

(3) A resolution enacted at an Annual General Meeting of the Institute, or at a Special General Meeting, the notice of which, in either case, has stated that such resolution shall be proposed at such meeting.

*Section 29.* Add—"and one councillor from each society or association with which the Institute has a co-operative agreement as described in Sections 78 and 82 of the by-laws, as such councillors are appointed."

*Section 31.* Add—"A vacancy in the office of councillor appointed by a society or an association with which the Institute has a co-operative agreement as described in Sections 78 or 82 of the by-laws, shall be filled by the said society or association."

*Section 78.* Add—"The association shall have the right to appoint a representative to the Council of the Institute who shall enjoy all rights and privileges as described in Section 32 of the by-laws, and who shall be a corporate member of the Institute."

Add at the end of the first paragraph after "regarding"—"all or any of the following"

*Section 22.* Delete—"and Students who shall have the option of subscribing to the Journal at the above rate,"

And include—"and Students who shall pay one dollar per annum."

## SKETCH OF HEADQUARTERS BUILDING

The picture of Headquarters shown on the cover of the October *Journal* has been reprinted in enlarged form suitable for hanging in the home or office. Many members have expressed an interest in having a copy and a small number have been reproduced in sepia on heavy paper measuring 14¾ x 18¾ in.

These are to be sold at fifty cents a copy, which includes mailing cost. It is not necessary to send any remittance—the amount will be charged to your fees account if you so desire.

The original sketch was made by Vernon H. Bailey, of New York, a distinguished American artist, whose drawings are well known in America and Europe. The Institute was extremely fortunate in having him do the work, and is greatly indebted to the friend who made it possible. The original has been presented to the Institute and will be hung on the walls at Headquarters.

Only a small number of prints have been made. If there is any large demand there will have to be an additional printing. Please let us know quickly if you are interested.

## WARTIME BUREAU OF TECHNICAL PERSONNEL

### Female Technical Personnel

When the Technical Personnel Regulations (P.C. 638, 1942) were first put into effect, it required some time for employers of technical persons to become familiar with the requirements of the regulations and with the procedure set up to administer them. Although the order itself was clear enough in referring to "persons", rather than to men or male persons, many queries were received as to whether it covered women whose qualifications brought them in the category of technical personnel.

By publicity, particularly in technical and professional publications, by interview and by many contacts with industries and universities, the full details of the regulations and the details of their administration have become more and more widely known. This is strikingly illustrated in the case of female technical persons. In the seven months—April to October of 1942—permits were issued for the employment of 91 women. The figure for the corresponding period in 1943 is 598. (It is interesting to note that about one in six of these women is married.)

### University Science Students Regulations

With the opening of a new academic session, it has been necessary to put in motion the machinery for allocation of the graduating classes in science and engineering—class of 1944. Complete final nominal rolls are being secured, as well as registration by means of the Bureau's questionnaire. A meeting has been arranged for an early date with the Joint Committee from the three Armed Services to discuss their requirements and to set up a procedure for the early selection of candidates from among those volunteering for the various services.

### Monthly Statistics

During the month of October, 1620 interviews were granted by the Bureau's staff, 162 questionnaires were added to the files, and 354 permits to employ technical personnel were issued.

## REGISTRATION IN ENGINEERING COURSES AT THE UNIVERSITIES

The accompanying tabulation of engineering students registered at the various universities shows a few changes from last year, the principal one being in the total registration. Last year this figure was 4,968, whereas this year it is 4,461. This is a substantial decrease which is difficult to understand in view of the increased demand for engineering graduates.

The difference in total figures is more than accounted for by the reduction in the number taking the general course, which in reality is the first and in some cases the second year group. Last year's figure was 2,206 against this year's figure of 1,573. Mining and metallurgy show slight decreases, whereas electrical, mechanical, physics and forestry show the greatest increases.

The largest registration is now in electrical, although it exceeds mechanical by only one. Chemical is a very close third, being only fifteen less than electrical. These three are by far the largest groups of all.

All universities are giving special courses for the armed services so that in spite of the falling off of students in the regular courses, the attendances are larger than ever.

| University | Year | General Course | Aeronautics | Agriculture | Architectural | Ceramic | Chemical Engrg. and Chemistry | Civil | Electrical | Electro-Mechanics | Forestry | Geology and Mineralogy | Mechanical | Metallurgy | Mining | Physics, Engrg. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nova Scotia Technical College... | 1st | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | 2nd | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | 3rd | .. | .. | .. | .. | .. | .. | 13 | 6 | .. | .. | .. | 11 | .. | 4 | .. | 34 |
| | 4th | .. | .. | .. | .. | .. | .. | 10 | 8 | .. | .. | .. | 12 | .. | 3 | .. | 33* |
| Total... | .... | .. | . | .. | .. | .. | .. | 23 | 14 | . | .. | .. | 23 | .. | 7 | .. | 67 |
| New Brunswick | 1st | .. | .. | . | .. | . | .. | 24 | 25 | .. | 13 | .. | .. | .. | .. | .. | 62 |
| | 2nd | .. | .. | . | .. | . | .. | 12 | 37 | .. | 6 | .. | .. | .. | .. | .. | 55 |
| | 3rd | .. | .. | . | .. | . | .. | 9 | 21 | .. | 2 | .. | .. | .. | .. | .. | 32 |
| | 4th | .. | .. | . | .. | . | .. | 6 | 13 | .. | 9 | .. | .. | .. | .. | .. | 28* |
| Total... | .... | .. | .. | .. | .. | .. | .. | 51 | 96 | .. | 30 | .. | .. | .. | .. | .. | 177 |
| Laval..... | 1st | .. | .. | .. | .. | .. | 10 | 4 | 25 | .. | 11 | .. | 3 | 1 | 2 | 2 | 58 |
| | 2nd | .. | .. | .. | .. | .. | 13 | 4 | 11 | .. | 17 | .. | .. | 1 | 3 | 1 | 50 |
| | 3rd | .. | .. | .. | .. | .. | 2 | .. | 4 | . | 13 | .. | .. | 2 | 3 | .. | 24 |
| | 4th | .. | .. | .. | .. | .. | 11 | .. | 4 | .. | 11 | .. | .. | 1 | 1 | 3 | 31* |
| Total... | .... | .. | .. | .. | .. | .. | 36 | 8 | 44 | .. | 52 | .. | 3 | 5 | 9 | 6 | 163 |
| Ecole Polytechnique de Montreal | 1st | 82 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 82 |
| | 2nd | 85 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 85 |
| | 3rd | 55 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 55 |
| | 4th | 47 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 47 |
| | 5th | .. | 7 | .. | .. | .. | 2 | 15 | .. | 18 | .. | .. | .. | .. | 2 | .. | 44* |
| Total... | .... | 269 | 7 | .. | .. | .. | 2 | 15 | .. | 18 | .. | .. | .. | .. | 2 | .. | 313 |
| McGill.... | 1st | 151 | .. | .. | 13 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 164 |
| | 2nd | 76 | .. | .. | 15 | .. | 25 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 116 |
| | 3rd | .. | .. | .. | 4 | .. | 21 | 12 | 12 | .. | .. | .. | 29 | 2 | .. | .. | 80 |
| | 4th | .. | .. | .. | 8 | .. | 14 | 13 | 21 | .. | .. | .. | 30 | 6 | 5 | .. | 97* |
| | 5th | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1* |
| Total... | .... | 227 | .. | .. | 41 | .. | 60 | 25 | 33 | .. | .. | .. | 59 | 8 | 5 | .. | 458 |
| Queens.... | 1st | 239 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 239 |
| | 2nd | 163 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 163 |
| | 3rd | .. | .. | .. | .. | .. | 25 | 11 | 17 | .. | .. | 3 | 37 | 10 | 11 | 9 | 123 |
| | 4th | .. | .. | .. | .. | .. | 25 | 9 | 18 | .. | .. | 1 | 27 | 10 | 6 | 7 | 103* |
| Total... | .... | 402 | .. | .. | .. | .. | 50 | 20 | 35 | .. | .. | 4 | 64 | 20 | 17 | 16 | 628 |
| Toronto... | 1st | .. | .. | .. | 9 | .. | 100 | 52 | 50 | .. | .. | 2 | 59 | 8 | 7 | 37 | 324 |
| | 2nd | .. | .. | .. | 12 | .. | 76 | 54 | 54 | .. | .. | 1 | 84 | 18 | 1 | 36 | 336 |
| | 3rd | .. | .. | .. | 5 | .. | 47 | 38 | 51 | .. | .. | 2 | 61 | 17 | 6 | 22 | 249 |
| | 4th | .. | .. | .. | 3 | .. | 55 | 33 | 25 | .. | .. | .. | 50 | 11 | 10 | 15 | 202* |
| | 5th | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5* |
| Total... | .... | .. | .. | .. | 34 | .. | 278 | 177 | 180 | .. | .. | 5 | 254 | 54 | 24 | 110 | 1116 |
| Manitoba. | 1st | 119 | .. | .. | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 131 |
| | 2nd | 83 | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 88 |
| | 3rd | .. | .. | .. | 7 | .. | .. | 14 | 27 | .. | .. | .. | .. | .. | .. | .. | 48 |
| | 4th | .. | .. | .. | 9 | .. | .. | 20 | 23 | .. | .. | .. | .. | .. | .. | .. | 52* |
| Total... | .... | 202 | .. | .. | 33 | .. | .. | 34 | 50 | .. | .. | .. | .. | .. | .. | .. | 319 |
| Saskatchewan..... | 1st | 162 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 162 |
| | 2nd | .. | .. | 3 | .. | 4 | 11 | 36 | .. | .. | .. | 10 | 86 | .. | .. | 26 | 176 |
| | 3rd | .. | .. | 5 | .. | .. | 8 | 11 | .. | .. | .. | .. | 42 | .. | .. | 8 | 74 |
| | 4th | .. | .. | 2 | .. | 5 | 15 | 11 | .. | .. | .. | 4 | 33 | .. | .. | 7 | 77* |
| Total... | .... | 162 | .. | 10 | .. | 9 | 34 | 58 | .. | .. | .. | 14 | 161 | .. | .. | 41 | 489* |
| Alberta... | 1st | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| | 2nd | .. | .. | .. | .. | .. | 34 | 20 | 50 | .. | .. | .. | .. | .. | 10 | .. | 114 |
| | 3rd | .. | .. | .. | .. | .. | 13 | 14 | 20 | .. | .. | .. | .. | .. | 6 | 3 | 56 |
| | 4th | .. | .. | .. | .. | .. | 19 | 10 | 12 | .. | .. | .. | .. | .. | 6 | 1 | 48* |
| Total... | .... | .. | .. | .. | .. | .. | 66 | 44 | 82 | .. | .. | .. | .. | .. | 22 | 4 | 218 |
| British Columbia..... | 2nd | 182 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 182 |
| | 3rd | 129 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 129 |
| | 4th | .. | .. | .. | .. | .. | 21 | 19 | 26 | .. | .. | 4 | 31 | 1 | 6 | .. | 108 |
| | 5th | .. | .. | . | .. | .. | 24 | 10 | 19 | .. | 4 | 2 | 27 | 6 | 2 | .. | 94* |
| Total... | .... | 311 | .. | .. | .. | .. | 45 | 29 | 45 | .. | 4 | 6 | 58 | 7 | 8 | .. | 513 |
| Grand Total... | .... | 1573 | 7 | 10 | 108 | 9 | 571 | 484 | 579 | 18 | 86 | 29 | 622 | 94 | 94 | 177 | 4461 |

*Indicates those graduating in the spring of 1944—Total 815.

## SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS

### Semicentennial

On November 12th, 1943, this society celebrated its fiftieth anniversary at a banquet held in New York. On this occasion, greetings and congratulations were conveyed on behalf of the Institute in the form of an illuminated address which read as follows:

To—The Society of Naval Architects and Marine Engineers on the Occasion of Its Fiftieth Anniversary—November, 1943

The Engineering Institute of Canada

Conveys its most cordial greetings and expression of admiration and respect for the splendid accomplishments of the Society in the highly specialized field of its endeavour.

The past fifty years have seen astounding developments in all branches of engineering and doubtless the future holds even more opportunities and responsibilities for all. It is a satisfaction and comfort to know that a Society such as yours with its wealth of accomplishment and experience stands ready to give continued leadership through these portentous times. The Institute looks forward with pleasure to the privilege of further association with the Society and expresses the confident hope that the outstanding attainments of the past are but a prelude to the future.

## SOMETHING FOR YOUR LIBRARY

The Deputy Minister of Transport has informed us that there are copies of the "Report of the Board of Engineers" on the Design and Construction of the Quebec Bridge still available. These two volumes were published in 1918 and give a very complete and interesting account of the Quebec Bridge construction from 1908 to 1918. At the price for which they are being offered the supply should be exhausted shortly.

Volume one gives a very interesting history, including the disaster of the first bridge, and contains many wonderful photographs of the new bridge in the shop and in the field. Any engineer would enjoy reviewing this important and interesting history of development in Canada.

The following letter from the Deputy Minister of Transport, Lieut.-Commander C. P. Edwards, O.B.E., M.E.I.C., tells the story in some detail. The *Journal* is very pleased to bring this to the attention of its members.

Dear Sir:

The Department of Transport has a large number of copies of the "Report of the Board of Engineers" on the Design and Construction of the Quebec Bridge, which was published in 1918.

We are anxious to increase the circulation of this publication and dispose of as many copies as possible, and it occurs to me that the report might be of interest to your members and to engineering libraries. It is proposed to dispose of the reports, consisting of two volumes, for the nominal price of One Dollar, to cover postage and wrapping, although previously they were sold for a sum far in excess of this amount.

You might wish to bring this matter to the attention of your members, either through your column "Book Notes" or "Library Notes" of *The Engineering Journal*, or through any other medium you think advisable. Any publicity given to this matter should include the notice that the publication is also available by application to the Distribution Branch of the Department of Public Printing and Stationery.

I am forwarding under separate cover, for your information, a set of the two volumes of this publication.

Yours very truly,

C. P. Edwards,

Deputy Minister.

## WASHINGTON LETTER

There seems to be little doubt in Washington that the European war is moving into its final stages. The odds on an early collapse are improving on Wall Street. The warnings of hard and bitter fighting yet to come are noted but a speedy time-table is still held to be the best bet. This belief is producing some interesting results. Interest in post-war reconstruction has increased tremendously. The War Production Board is thinking more and more in terms of conversion and readjustment. The President has called a special meeting of a carefully picked group of leading industrialists. British business leaders have returned Mr. Eric Johnson's visit to the U.K. The amazing "Bernie" Baruch has entered the post-war planning lists. The Defence Plant Corporation is hard at work on the problems of converting some nine billion dollars worth of plants. The Committee for Economic Development and the Chamber of Commerce are quickening the tempo of their investigations. In Canada, Mr. Howe speaks optimistically about solving the problems of conversion. In spite of much activity, however, there still seems to be a disturbing lack of concrete plans and actual blueprints. The magnitude of the conversion problem is illustrated by a recent statement regarding the aircraft industry. It is said that the aircraft industry is approximately a twenty billion dollar a year industry, whereas the automobile industry at its best only amounted to about three and three-quarter billions a year. The problem of the cancellation of uncompleted war contracts is causing concern. The U.S. Chamber of Commerce estimates that almost seventy-five billion dollars worth of uncompleted contracts are outstanding and a Post-War Adjustment Commission is being advocated.

* * *

In connection with actual physical plans for reconstruction, the vast and comprehensive plans for the rebuilding of London appear to be taking on concrete form. Much work has been done and a number of reports have been prepared over the last few years. Lord Reith, when minister of works, set in motion the Scot and Uthwatt Committees. Several excellent plans have been presented by the Modern Architectural Research Society and also by the Royal Academy. This last summer saw the publication of the Royal Institute of British Architects and, finally, the official London County Council Plan. The Plan is a long term one and will require about fifty years to implement. Decentralization of population is one of the main parts of the plan with the establishment of outlying suburban districts of about one hundred thousand inhabitants. These suburbs are to be linked by arterial highways and separated by green belts or parkways. The plan leans towards houses rather than apartments and horizontal rather than vertical developments. One of the interesting features is the maintenance and improvement of cultural points of interest. St. Paul's will stand in open park land. The British Museum will be the centre of an "island" closed to all except local traffic. It is also the intention of the plan to re-identify old and historic villages long since absorbed and lost in London's congestion. Local centres, based on the British idea of community precincts, will be as self-contained as possible with their own shopping, amusement and cultural facilities and with their own light industrial areas. Like all other plans, however, it still lacks the necessary legislative action. The Plan has official backing but not official approval. Post-war plans all over the world are waiting for a clear definition of the intentions of central governments.

* * *

The recent reorganization within the Foreign Economic Administration is also indicative of a change in the fortunes of war. Late in October, Mr. Crowley announced what he termed the "most far reaching consolidation of Government agencies of the war"—bringing under one direction all foreign economic operations formerly carried out by some six different agencies. It was a much more sweeping reorganization than had been envisaged in September. Mr. Crowley, who has a banking background, has called in several of his chief aids from outside Washington circles. The streamlined agency will operate through two main branches—Supply, including an Import and an Export subdivision; and Planning, including divisions for Relief, War and Programmes.

Another sign of the times is the establishment of the United Nations Relief Administration. U.N.R.R.A. is at present holding its first big conference at Atlantic City.

Most significant of all, of course, were the announcements made as the result of the Moscow conference and Mr. Hull's assurances that the conference marked the end of power politics and set the world on the way of international collaboration. The establishment of the European Advisory Commission is now under way and it is interesting to note that Britain may accord ambassadorial status to her representative. All people with a soft spot for Austria will have noted with interest that, in some senses, she is to be treated as an occupied country.

An apparent contradiction is to be found in the concern regarding the man-power situation—particularly in the aircraft industry. The explanation, of course, arises from the fact that the optimism has to do with the European war only. The possibilities of a national service act are being discussed but the problem may solve itself.

* * *

Discussing his return to his own company the other day, a friend of mine said, "After Washington, I'll need a several months reconditioning course." This is very true. On the one hand, the sense of urgency and excitement which pervades all activity in Washington may be a stimulant hard to replace. On the other hand, red tape and frustrations may condition an acceptance hard to live down. Washington is one of the important centres of the world and there is a great temptation to associate one's self with events merely because of physical presence or to forget that one is seeing the well-known Mr. X in a capacity and not as an individual.

E. R. Jacobsen, m.e.i.c.

---

# CORRESPONDENCE

### Training Engineers for Public Life

The Editor,
*The Engineering Journal*
Dear Sir:

In the September issue of *The Engineering Journal* you republished an article entitled "The Civic Morals of Science" written by the president of Lehigh University and I would like to congratulate you for publishing this stimulating article. I am not informed as to the statements made in the United States which, according to the first paragraph of the article, are to the effect that "education in science and technology must have an infusion or leavening of the liberal arts in order to be beneficient rather than malevolent influences in civic morals." I am, however, in a position to state that there is, among Canadian engineers, a fairly widespread feeling that a broader education for engineers is advisable. The thought behind this feeling does not in any way resemble the thought expressed in the quotation above.

The article to which I am referring stresses at considerable length that the scientifically trained person, especially one trained in pure science or engineering, has a sounder understanding of moral values than one who has not been so trained. I think that we can agree that persons so trained are probably the best equipped for clear thinking although perhaps even this is going too far and it might be better to say "at least as well equipped" because legal training is also conducive to clear thinking. Perhaps we can go a step farther and agree that persons so trained, who deal with nature and with fundamentals, acquire an inherent honesty of thought. Why then do many engineers in Canada think that engineering curricula should be broadened?

Their opinion is that the clear thinking and honesty of thought of these men should be made available for the purpose of assisting in civic, in provincial and in national affairs. Engineers in public life are just about as rare as engineers in penitentiaries as cited in the article to which I refer. If we accept the premise that engineers and scientists are, in the main, honest and clear thinking the obvious remedy is to have more men with scientific or engineering training enter public life, and the idea of broader training is to better fit them so to do.

The average engineer is not vocal except in regard to technical matters. He is not trained in public speaking and is not used to it. When he leaves university he has little background of history, little facility for public speaking, an antipathy to publicity and little, if any, knowledge of his responsibilities in regard to public affairs.

How many young engineers, or even how many engineers young or old, wish to submit themselves to the publicity of an election campaign be it civic, provincial or state, dominion or federal? It would appear that in order to overcome this inertia a broader training is necessary to the end that more of them will find their way into public life where their honesty of purpose and of thought may be of incalculable value, not only in the administration of public affairs, but also in raising the standards of thought and of honesty in public affairs and in subordinating political expediency to sound administration and leadership.

The appointment of engineers to executive positions is gradually becoming more frequent and a broader education is likely to accelerate this comparatively recent development.

In Canada there are several committees studying the various curricula to determine whether or not changes would be beneficial, whether such changes, if advisable, could be made within the usual four year courses, and if not whether a five year course should be adopted.

Yours truly,

J. B. de Hart, m.e.i.c.,
*Department of Natural Resources,*
*Canadian Pacific Railway Company.*

*Calgary, Nov. 3, 1943.*

The above letter will meet with approval from most readers of the *Journal*. It is quite true that not as many members of the engineering profession submit themselves to nomination for public office, although there are many more members in provincial and federal houses than most people realize. Still, in comparison to the legal profession the number is not great.

There are people who maintain that the engineer will never be an outstanding success in politics due to the fact that his training is all wrong for such a calling. Direct methods based on fundamental facts and sciences without influences from extraneous considerations are not the methods that usually lead to success in politics. Perhaps if the whole house were set up on this basis or if the public demanded more of this type of thinking, the engineer would be more readily accepted for public office.

The correspondent leaves himself open to some criticism when he touches on the engineer's ability to do public speaking. It is doubtful if the members of any other profession do any better, and in that statement should be included the legal and theological groups as well. It is probably a mistake for the engineers to go about telling each other and the public that they are inarticulate or are not trained in public speaking. Who is trained in public speaking? While it is not a part of the engineering curriculum, neither is it a great part of the curriculum for any other profession.

—*Ed.*

**Naval Architecture Course Advocated**

The Editor,

*The Engineering Journal.*

Dear Sir:

Considerable publicity has been given recently to the phenomenal growth, during the past four years, of shipbuilding in Canada. Now a major industry in this country, the tonnage output of new vessels has reached a figure which, before the war, would have appeared highly improbable if not impossible. In the last war, Canadian shipbuilding received a strong impetus, but the post-war slump saw a rapid decline in new construction until most of the shipbuilding yards either closed down or else just managed to struggle along with a mere fraction of their former output. The general opinion now held in shipping circles is that this time the industry has come to stay. After the war, of course, the present rate of construction is not likely to be maintained, but certainly Canada should produce an appreciable proportion of world new tonnage.

Apparently little, if any, thought has been given towards the training of young men for this highly skilled profession. If Canada is to continue to build ships—and doubtless the competitive factor will strongly affect the post-war picture—we must have a constant supply of young men entering the profession of naval architect, thoroughly trained and qualified to *design*, as well as to supervise construction, just as our graduates in every branch of engineering provide the annual additions to the designing staffs of other industrial concerns.

Canadian universities offer courses in civil, chemical, electrical, mechanical and other branches of engineering. Graduates of engineering colleges throughout the Dominion have proved their worth and the high quality of their training, not only at home and in the United States but also in Great Britain, South America and many distant lands. No Canadian university offers a course in which students may proceed to the degree of Bachelor of Science in Naval Architecture. No doubt the introduction of such a course after the war in one of our universities would appeal to a number of young men, either presently serving apprenticeships in the shipbuilding industry or who later will be attracted to it. It is natural that the course should be given by a university situated in a shipbuilding area; Halifax, Montreal, Toronto and Vancouver are the only centres which qualify in this respect.

Without such an opportunity, the future Canadian ship designer must proceed either to the United States where two well known courses are offered—at the University of Michigan, Ann Arbor, and at the Massachusetts Institute of Technology, Boston,—or overseas to one of three universities in Great Britain: Durham, Glasgow or Liverpool. (Training for naval shipbuilding in England is largely undertaken by the Royal Naval College, the products of which usually become naval constructors).

One may ask how, without a large number of trained naval architects available, it has been possible to build such a large tonnage of both naval and mercantile craft during the present war. The answer, of course, is that all these vessels were designed by British shipbuilders and by British naval constructors. This fact does not detract from the vast accomplishment of hundreds of thousands of tons of ships built to date (and more to follow). Due to the perilous situation with which we were confronted at the outbreak of hostilities, it was urgently necessary that construction should commence immediately. Perhaps it was not altogether an accident that detailed drawings were quickly available.

But that Canada should continue to accept designs after the war from shipbuilding yards across the Atlantic is not desirable. Firstly there will be greater national pride in the vessel which is entirely the product of the brains and hands of Canadian workmen, from the moment when ink is first put to paper on the drafting board to the time when a brand new ship goes on her trial trip. For less sentimental reasons the designers should be Canadian: methods of production must be adapted to the peculiarities of our climate; standards and sizes of the constructional materials differ from those used in Great Britain; the relative abundance or scarcity of certain materials here in comparison with those available elsewhere; all these and many other factors affect the design of a ship.

It will not be disputed that Canadians are best able to solve the local problems which will confront future ship designers in this country. But they must be thoroughly trained and qualified for the work.

A. L. C. Atkinson, M.E.I.C., M.I.N.A.,
*Constr. Lt. Cdr., R.C.N.V.R.*

*Ottawa, Nov. 10, 1943.*

**About "Canada Moves North"**

The Editor,

*The Engineering Journal.*

Sir:

For the past year and a half I have been privileged to be closely associated with the Canol Project and the Alaska Highway, travelling extensively in the Mackenzie District, the Yukon and Alaska. Returning the other day from a northern trip, I found the copy of your August issue which you so kindly sent, and I read with some amusement and some irritation Robert F. Legget's attack on *Canada Moves North*. I am taking the trouble to comment on it only because some of his remarks are not only prejudiced, ill-informed and misleading, but even impugn my integrity.

I object to Mr. Legget's charge that *Canada Moves North* is "superficial" and that the author's style is that of a "smart aleck." The book was painstakingly and honestly written, backed by nearly two decades of study of and travel in the Northwest Territories, in the hope that it would help to banish misconceptions regarding that country and foster its further development to the best advantage of Canada.

Having been employed by the Hudson's Bay Company's Mackenzie River transportation department for a short time, Mr. Legget would naturally have a special interest in its activities. But because I have taken issue with its fur-trade policy, he assumes that the Hudson's Bay Company is a pet anathema of mine, and he says that my tributes to any good works of the Company are "grudging." This is not so. He complains that I have given inadequate reference to the Company's transportation department. My best reply to that one is that an article of mine on northern tourist traffic and transportation which appeared in an American magazine and which, augmented and brought up to date, forms a chapter in *Canada Moves North*, was reprinted and distributed in pamphlet form by the Hudson's Bay Company as an advertisement.

He says that "the frequently repeated adulation to Stefansson will be cloying to the average reader; to those who have studied the North, it is a good indicator of the value of many of Mr. Finnie's opinions." I have been a serious student of the North for many years, and one of the things I have learned is that it is fashionable among some Northerners and northern travellers to deride Stefansson. And nearly all of those who deride him know neither him nor his books. Such a man, having scoffed at Stefansson's works, called my attention to an Arctic Manual published by the

U.S. War Department. "Now, there," he exclaimed, "is a really valuable book!" Like many another government publication it was anonymous, but I happened to be aware that its author was Stefansson. I do not always agree with Stefansson and have had some lively arguments with him. I deny that there is any adulation to Stefansson in *Canada Moves North;* it simply gives him, along with others, a measure of fair credit for the part he has played in the exploration and development of the Canadian Far North.

Mr. Legget seems to endorse, with reservations, my chapter on the administration of the Northwest Territories, and even embellishes it. The rest of the book, except the pictures, annoys him. Perhaps if he were to read it more carefully he would cavil less at fancied omissions. He accuses it of being "only a partial picture" of the Northwest Territories, his evidence being that the districts of Keewatin and Franklin are listed but once in the index. Those names do not appear more often because of their obscurity; they are seldom used, and many people who are familiar with the Mackenzie District have never heard of Keewatin and Franklin. But it does not follow that the lands included in those districts are neglected in the text: Mr. Legget could find a great many references to Baffin Island, Ellesmere Island, Victoria Island and other islands comprising the Franklin District, and to parts of the country bordering the west coast of Hudson Bay comprising the Keewatin District. He also complains that the book does not cover northern Quebec, albeit it is avowedly a study of the Northwest Territories exclusively.

My declaration, "I do not recall ever having been seriously inconvenienced there (in the Northwest Territories) by cold weather and I have never been badly frostbitten," evokes a snort from Mr. Legget, who protests: "Such youthful exuberance is interesting, even entertaining, but it is unworthy of any serious consideration." Though Mr. Legget refuses to believe it, my declaration is absolutely true. There is nothing remarkable about it. There is no reason why anyone need suffer from cold weather in the Far North, if he is prepared for it, any more than in southern Canada or parts of the United States where sub-zero temperatures prevail in winter. Thousands of soldiers and civilian construction workers in the North have found this out.

Mr. Legget hints that the popularity of *Canada Moves North* is based on ignorance of the North, especially on the part of reviewers. On the contrary, the book has been favorably reviewed in all publications but this one (excepting the Hudson's Bay Company's *Beaver*—a foregone conclusion), and some of the most gratifying compliments have been paid by men who know the North a lot better than Mr. Legget does. The book has gone into a second printing, and Northerners and northern project workers have been among the best customers. Edmonton booksellers are continually running out of stock. On my northern trips since the publication of the book, mounted policemen, trappers, doctors, project workers, and traders—including those of the Hudson's Bay Company—have told me of their appreciation of it. One of the latter, who has spent more than a score of years in the Mackenzie District, wrote to me: "Have just finished reading *Canada Moves North* from cover to cover. It was a real treat to read plain truths about the country with no coating of veneer, and you have stated nothing but the truth."

*Canada Moves North* was written months prior to and without foreknowledge of the inauguration of the Alaska Highway and the Canol Project. I have since derived considerable satisfaction from the fact that the book presages and advocates such development. Yet Mr. Legget dismisses it in a sentence.

In his concluding paragraph Mr. Legget states: "Certainly Canada is not going to 'move northward', as Mr. Finnie suggests." In spite of Mr. Legget's scepticism, Canada is moving north right now—and I am happy to be a witness.

*Edmonton, Nov. 16, 1943.* RICHARD FINNIE.

The Editor,
*The Engineering Journal,*
Dear Sir,

Thank you for your courtesy in allowing me to see Mr. Richard Finnie's interesting letter of the 16th November before its publication. I hope that it will lead many more to buy copies of "Canada Moves North" and to read the review in question. Readers of the latter will then be able to read my comments in their proper context.

Yours faithfully,
Robert F. Legget.

---

## MEETING OF COUNCIL

A meeting of the Council of the Institute was held at Headquarters on Saturday, November 20th, 1943, at nine-thirty a.m.

*Present:* President K. M. Cameron (Ottawa) in the chair; Past-President H. W. McKiel (Sackville); Vice-Presidents L. F. Grant (Kingston), G. G. Murdoch (Saint John, N.B.), and C. K. McLeod (Montreal); Councillors J. E. Armstrong (Montreal), E. V. Gage (Montreal), E. D. Gray-Donald (Quebec), R. E. Heartz (Montreal), W. G. Hunt (Montreal), J. A. Lalonde (Montreal), N. B. MacRostie (Ottawa), G. M. Pitts (Montreal), and J. W. Ward (Saguenay); Presidential-Nominee deGaspé Beaubien; Secretary-Emeritus R. J. Durley, General Secretary L. Austin Wright, and Assistant General Secretary Louis Trudel.

President Cameron expressed his pleasure at the large number of out-of-town councillors in attendance, and extended a special welcome to Past-President McKiel and Vice-President Murdoch from the Maritimes.

*Committee on Professional Interests:* In accordance with the resolution passed at the October meeting of Council, the general secretary presented a draft of a proposed new by-law which would permit the Council of the Institute to enter into a co-operative agreement with any Canadian, British or American society of engineers. The first draft of the proposed new by-law had been circulated to all councillors some time ago for comment and the final draft, as now submitted, has been approved by the Institute's lawyers.

The general secretary read the revised draft and, after considerable discussion and, with a slight amendment, it was unanimously resolved that the proposed new by-law be approved for submission to the membership in accordance with the provisions of Section 80 of the by-laws. It appears elsewhere in this issue.

*Amendments to the By-Laws:* In accordance with Council's decision to sponsor amendments to the by-laws whereby the governing bodies of provincial professional associations which enter into agreements with the Institute pursuant to by-law 78, shall have the right to appoint one of their members to the Council of the Institute, the general secretary presented proposed amendments to Sections 29, 31 and 78 which would be necessary in order to permit such action.

Following a full discussion of the drafts submitted, it was unanimously resolved that the proposed amendments, appearing elsewhere in this issue, to the by-laws, be submitted to the membership in accordance with Section 80 of the by-laws.

*Co-operative Agreement with A.S.M.E.:* The general secretary pointed out that one of the recommendations in the co-operative agreement between the Institute and the American Society of Mechanical Engineers which had been adopted at the last meeting of Council as a basis for the development of closer relations between the two societies, was the establishment of a joint committee of six members—three from each society—to investigate the situation and consider ways and means for promoting such co-operation.

In order that the work of this committee could be tied in to the work of the Commiteee on Professional Interests, particularly for the next year or two, that committee, at its last meeting, recommended to Council that the Institute's representatives on the proposed joint committee should be two members of the Committee on Professional Interests, one of whom should be Councillor J. E. Armstrong, together with a third member resident in Toronto who is also a member of the A.S.M.E. It was suggested that Mr. John G. Hall would be acceptable as the third member.

The committee's recommendations were unanimously approved, and it was decided that Councillor J. E. Armstrong, Past-President J. B. Challies and Past-Councillor John G. Hall, of Toronto, should be asked to represent the Institute on this joint committee.

In response to an inquiry, the general secretary stated that following the appointment of the members of the joint committee, an announcement regarding the co-operative agreement would be made in the publications of the two societies.

*Proposal from the Dominion Council:* President Cameron reported that under date of November 3rd, he had received a letter from the president of the Dominion Council of Professional Engineers, inviting the Institute to send one or two representatives to a meeting to be held in Montreal on or about December 4th, for the purpose of discussing further the proposal made last spring for the setting up of a body "which would be recognized as spokesman for the engineering and allied professions in Canada." A draft constitution for such a body, to serve as a basis for discussion only, had been drawn up and a copy had been submitted to Mr. Cameron.

In acknowledging the letter, the president had pointed out that a meeting of the Council of the Institute would be held in Montreal on November 20th, at which time the matter would be considered. In the meantime, he had sent a copy of the letter and the proposed constitution to the general secretary, and had suggested that he discuss the matter with officers of the Institute, including members of the Committee on Professional Interests.

As president of the Royal Architectural Institute of Canada, Mr. Pitts was particularly interested in this proposal which, in his opinion, did not go far enough. He suggested that there might be some over-all co-ordinating body which would be representative of all the professions, including not only engineers but doctors and lawyers, etc. The present proposal was not sufficiently inclusive.

The general secretary reported that the proposal of the Dominion Council had been discussed at a recent meeting of the Institute's Committee on Professional Interests, and the president read the minutes of the meeting covering this particular item. It was the opinion of the committee that the proposals of the Institute, as set forth in the proposed new by-law, which were the culmination of years of endeavour to bring about co-operation between engineering groups, offered a more acceptable arrangement for co-ordination than that now being advanced by the Dominion Council.

The general secretary pointed out that the proposal of the Dominion Council was not limited to engineering groups. It went beyond engineers, and yet did not include all other professions. The Institute's by-laws were now leading up to an affiliation of all engineering bodies which was a matter of prime importance to the Institute.

Following considerable discussion, it was unanimously resolved that the Institute accept the invitation of the president of the Dominion Council to be represented at the proposed conference, such representatives to be appointed by the president.

*Amendment to By-Laws re Engineering Journal to Students:* In accordance with Council's previous decision that all Students should subscribe to *The Engineering Journal* at a nominal charge of $1.00 per year, the amendment to Section 22 of the by-laws, appearing elsewhere in this issue, was unanimously approved for submission to the membership in accordance with Section 80 of the by-laws.

*Financial Statement:* It was noted that the financial statement to the end of October had been examined and approved by the Finance Committee.

*Repayment of Loan:* The Finance Committee reported that one of the members to whom a loan had been made in 1932 had recently returned the full amount. This is the last of the loans made during the depression, all of which have been cleared up without loss to the Institute. This was noted with appreciation.

*Aid to Members in the Active Forces:* A letter had been received from Vice-President Grant in which he recommended that members of the Institute be asked to make voluntary contributions towards a fund to be used partly for contributions to local auxiliaries of the Royal Canadian Engineers, and partly to assist engineers during the demobilization period. He also recommended that the Institute make an appropriation now to supply cigarettes to all engineering units of the Royal Canadian Engineers overseas. The Finance Committee did not feel that the Institute would be justified in appropriating money for the supplying of cigarettes which was more in the way of work being done by service clubs; nor did the committee approve of the proposal to ask members of the Institute for contributions to a fund as suggested above.

Colonel Grant stated that after further consultation with members of the Institute, he did not now entirely approve of the suggestion himself.

Considerable discussion followed as to the desirability of the Institute supporting the work of the R.C.E. Women's Auxiliaries. It was also felt that the Institute should do something towards helping its members when they return from overseas. Mr. Durley pointed out that at the present time a number of engineers are being returned to Canada for various reasons, and, by contacting them, the Institute might ascertain just how it can be of assistance to its returning members.

President Cameron drew attention to an organization of engineers' wives in Winnipeg which was doing very effective work along the lines suggested by Colonel Grant. He thought that if the idea were more widely known in the other branches, engineers' wives could have their wartime activities more directly co-ordinated under their own organization.

Before taking any steps towards assisting members returning to Canada from overseas, President Cameron thought that the Institute should get in touch with Mr. W. S. Woods, Associate Deputy Minister of Pensions and National Health and Vice-Chairman of the Advisory Committee on Demobilization and Rehabilitation, Ottawa, who, at the joint meeting with the A.S.M.E. in Toronto, had suggested that there were certain definite problems which the Institute should undertake on behalf of returning engineers.

Following further discussion, it was unanimously resolved that Council instruct the general secretary to communicate with the branch secretaries recommending that the branches give such co-operation as may be possible to the local auxiliaries of the engineering units of the Royal Canadian Engineers overseas.

It was also unanimously resolved that the president, the general secretary and Councillor MacRostie be asked to interview Mr. Woods to ascertain in what way the Institute can be of most assistance to engineers returning from overseas.

*Office of Treasurer:* The general secretary had been asked to bring before Council a suggestion that it might be desirable to amend the by-laws so that the treasurer of the Institute would be a full member of Council with voting privileges. Under the present by-laws, the treasurer is appointed by Council and "shall attend meetings of Council," but is not an elected member and, therefore, does not have a vote.

Following some discussion, it was unanimously resolved that no change be made in the by-laws regarding the treasurer of the Institute.

*Attainments of Engineers in the Armed Forces:* Colonel Grant drew attention to the great number of generals in the Canadian Army who are Members of the Institute and expressed the opinion that the Institute should make some recognition of their outstanding attainments. He referred to the most recent of these cases, namely, Major-General Christopher Vokes, who was awarded the D.S.O. in Sicily and promoted to the rank of Major-General.

Council discussed in detail methods by which the Institute could make appropriate acknowledgment, and consideration was given to granting honorary memberships to such persons, but it was the opinion of the meeting that some more specific honour should be done them. Finally, it was proposed by Councillor Pitts that a special medal might be established which could be awarded to such outstanding members in the active services. This proposal was accepted unanimously, and it was resolved that Mr. Pitts and Mr. McLeod be appointed a committee to investigate the desirability and practicability of establishing a new medal for the purpose.

It was also unanimously resolved that the general secretary be directed to send a cablegram to Major-General Christopher Vokes congratulating him upon his promotion and the honours recently received. (Following is the cable which was transmitted immediately: "By resolution Council sends sincere congratulations on recent appointment and honours received. Canadian engineers greatly pleased at recognition.")

*Committee on Industrial Relations:* The general secretary read a letter from the chairman of the Committee on Industrial Relations which contained the following resolution:

"That this committee is of the opinion that strikes in essential industry in wartime are sabotaging the war effort and recommends that the Council of the Institute urge the Canadian Government to take strong and immediate action to stop this practice."

Several councillors pointed out that this was getting into the political field in which the Institute was probably not sufficiently well grounded to produce the desired results. The resolution was very wide in its wording and recommendations and Council felt that it would be difficult to make much progress unless something more specific were proposed.

It was finally recommended that, in view of the general secretary's close contact with the Department of Labour, he discuss the proposal with the Minister of Labour and endeavour to determine whether or not the Institute should take any further action.

*Society of Naval Architects and Marine Engineers:* It was noted that on November 12, 1943, the Society of Naval Architects and Marine Engineers had celebrated its fiftieth anniversary. The general secretary had represented the Institute at a banquet held in New York and had presented an illuminated address conveying the greetings and congratulations of the Engineering Institute of Canada.

*Admission of Enemy Aliens:* At a meeting of Council held in Saint John in May, 1941, it had been decided that, for the duration, as a protective measure, applications from enemy aliens should not be accepted. This action had been taken in view of the fact that at that time the Federal Government was not granting Canadian citizenship to such persons. Since that time several applications for admission to the Institute from persons in that category have been refused.

The Institute has recently received an application for admission as Student from a young Austrian refugee who has been transferred to this country from the United Kingdom, and who is at present attending a Canadian university. An inquiry has also been received from a citizen of Austria whose application for Canadian citizenship is now pending and who expects to receive his naturalization papers within the next three months, asking that his application for membership in the Institute be re-considered.

In response to a recent inquiry made by the general secretary, the following reply has been received from the Under Secretary of State:

"There has never been any prohibition upon a person of enemy alien origin applying for naturalization but in May, 1940, the then Minister decided that he would not sanction the issue of certificates of naturalization to such persons. In the course of administration this decision has been modified in a few special cases where the Secretary of State has been satisfied that the applicant is a genuine refugee and that his sympathies in the war are altogether in favour of our cause and against the enemy. Each particular case is, of course, decided on its merits and the number of certificates which have been granted to persons of enemy origin has been exceedingly limited."

A letter had also been received from the Under Secretary of State for External Affairs, advising that the regulations covering released refugees in this country are now under review, and it is possible that the government policy will be modified somewhat in the near future. In his opinion, there would be no objection to admitting to the Institute the Student referred to above if he is considered to be a desirable member.

Following some discussion, it was unanimously resolved that the Student whose application is pending, be admitted and that any pending applications from enemy aliens be presented for further consideration at subsequent meetings of Council.

*Conservation and the Engineer:* Following the presentation of a paper by Professor R. F. Legget on "Conservation and the Engineer," which set forth very clearly the importance of this subject, the Hamilton Branch, at a meeting on November 17th, passed the following resolution:

"The Hamilton Branch urges that Headquarters set up a Committee to investigate the whole problem of the conservation of our renewable natural resources throughout the country and that this Committee take into its scope the work presently being done by the Western Water Problems Committee and that the strongest possible representation be made to the Federal and Provincial Governments to the end that adequate planning be undertaken now without delay, as a measure of post-war rehabilitation."

Colonel Grant, as chairman of the Institute's Papers Committee, had been endeavouring to secure for some of the other branches a paper on this subject which he felt was now creating more interest than it had in the past. In his opinion, it was something in which young engineers might well interest themselves.

Following some discussion, it was decided that the resolution should be referred to the Institute's Committee on Post-War Problems for consideration and recommendation to Council as to the action which should be taken.

*Elections and Transfers:* A number of applications were considered, and the following elections and transfers were effected:

*Members*

**Bird,** Viggo Edward, B.S. (Mass. Inst. of Tech.), mgr., power dept., Aluminum Co. of Canada, Ltd., Montreal.

**Campbell,** William Lyman, B.S. (Civil), (Mass. Inst. of Tech.), vice-pres., Brown Co., Berlin, N.H.

**Clarke,** Kenneth Harry John, B.A.Sc. (Univ. of Toronto), chief of allocations and conservation divn., Office of the Metals Controller, Dept. of Munitions and Supply, Ottawa.

***Clemens,** James Nicholas, Warrant Officer, R.C.A.F., aerodrome foreman electrician, No. 2 Training Command, R.C.A.F., Winnipeg, Man.

*Has passed the Institute examinations.

**Coburn,** Frederic G., M.S. (Mass. Inst. of Tech.), pres., Brown Co., Berlin, N.H.

**Ingraham,** Harry Alexander, consltg. engr., Edmonton, Alta.

**Little,** Jack Graham, B.A.Sc. (Chem. Engrg.) (Univ. of Toronto), tech. supt., telephone divn., Northern Electric Co. Ltd., Montreal.

**Petrie,** Louis Adrian, B.Eng. (Mech.) (Nova Scotia Tech. Coll.), asst. engr., Aluminum Co. of Canada, Ltd., Arvida, Que.

**Semmens,** Graham Corkill, B.A., B.Sc. (Engrg.) (Univ. of Alberta), production supt., and engr. i/c production, Trinidad Leaseholds, Ltd., Barrackpore, Trinidad, B.W.I.

**Traver,** Leonard Alton, B.Sc. (Mining), (Queen's Univ.), asst. to production mgr., i/c ships divn., Dominion Bridge Co. Ltd., Lachine Que.

**Wilbur,** Robert Alexander, Chem.Eng. (Lehigh Univ.), gen'l. mgr. and chief engr., Ajax Engineers Ltd., Toronto, Ont.

*Juniors*

**Cholette,** Albert, B.Eng. (McGill Univ.), S.M. (Mass. Inst. of Tech.), asst. prof. of chemical engrg., Faculty of Science, Laval University, Quebec, Que.

*Transferred from the class of Junior to that of Member*

**Holder,** Allan Scott, B.Sc. (Nova Scotia Tech. Coll.), works engr., shell filling plant, Defence Industries, Ltd., Pickering, Ont.

**Lavergne,** Emile Denis, B.Sc. (Univ. of Michigan), mtce. engr., Canadian Industries Ltd., Shawinigan Falls, Que.

**Samis,** George Roy, B.A.Sc. (Univ. of Toronto), estimator and designer, plate and boiler dept., Dominion Bridge Co. Ltd., Lachine, Que.

**Somers,** Claude Judson, B.Sc. (Civil) (Univ. of N.B.), safety engr; Stormont Chemicals, Ltd., Cornwall, Ont.

**Tollington,** Gordon C., B.Sc. (Elec.) (Univ. of Alta.), asst. D.C. engr., Canadian General Electric Co., Peterborough, Ont.

*Transferred from the class of Student to that of Member*

**Davis,** Harold Arthur, B.Sc. (Mech.) (Queen's Univ.), plant engr., Ontario Steel Products Co. Ltd., Oshawa, Ont.

**Papoff,** William Nikitovitch, B.Sc. (Civil) (Univ. of Sask.), engrg. staff, Cons. Mining & Smelting Co. Ltd., Trail, B.C.

**Sutherland,** Donald Henry, Capt., B.Sc. (Civil) (Univ. of N.B.), 2nd in command, 2nd Fortress Coy., R.C.E., Halifax, N.S.

*Transferred from the class of Student to that of Junior*

**Aubry,** Gerard, F/O, B.A.Sc., C.E. (Ecole Polytechnique), air navigation instructor, No. 13 S.F.T.S., R.C.A.F., St. Hubert, Que.

**Bryce,** Ronald Campbell, Sub-Lieut., R.C.N.V.R., B.Sc. (Mech.) (Univ. of Saskatchewan), engr. in training on R.C.N. minesweeper, Halifax, N.S.

**Cameron,** Alastair Duncan, Lieut., B.Sc. (Civil) (Univ. of N.B.), regimental survey officer, 21st Fld. Regt., R.C.A., C.A., Fredericton N.B.

**Kelly,** James Oswald, B.Eng. (McGill Univ.), development chemical engr., Dominion Rubber Co., Montreal.

**Letendre,** Lucien, B.A.Sc., C.E. (Ecole Polytechnique), steel fabrication supervisor, Marine Industries, Ltd., Sorel, Que.

**Near,** James Dailey, Lieut., B.A.Sc. (Univ. of Toronto), 3rd Field Coy., R.C.E. Overseas.

**Simpson,** John Hamilton, B.Eng. (McGill Univ.), junior research engr., National Research Council, Ottawa, Ont.

**Turner,** Leslie Charles, Sub-Lieut. (E), B.Sc. (Mech.) (Univ. of Sask.), engr. officer, H.M.S. Ingonish, F.M.O., Halifax, N.S.

*Transferred from the class of Student to that of Affiliate*

**Peach,** William Herbert, vice-pres., C. D. Howe Co. Ltd., Port Arthur, Ont.

*Admitted as Students*

**Barrett,** Francis James, c/o Canadian Gypsum Co. Ltd., Hillsborough, N.B.

**Bates,** Arthur John Clark (Univ. of Toronto), 4 Evans Ave., Toronto, Ont.

***Bédard,** Claude, 136 Racine St., Chicoutimi, Que.

**Carlstrom,** Edward B., Sub-Lieut. (E), R.C.N.V.R., B.Sc. (Elec.) (Univ. of Manitoba), 279 Portland St., Dartmouth, N.S.

**Lowe,** Stanley Cathcart, Sub-Lieut. (E) R.C.N.V.R., B.Eng. McGill (Univ.) P.O. Box 62, Cochrane, Ont.

**Stokes,** H. A. C. (Univ. of B.C.), 266-4th Ave., New Westminster, B.C.

*Students at Ecole Polytechnique*

**Bellefeuille,** Marcel L.-P., 1430 St. Denis St., Montreal.

**Catafard,** Rémi, 4984 Adam St., Montreal.

**Charest,** René, 675 Stuart Ave., Outremont.

**Chevrette,** Bruno, 3516 Cartier St., Montreal.

**Dansereau,** Gérard, 401 Stuart Ave., Outremont.

**Derome,** Louis-Pothier, 1430 St. Denis St., Montreal.

**Gingras,** Roch-Henri, 1028 St. Denis St., Montreal.

**Gravel,** Charles-Edouard, 77 Levesque Blvd., Abord-à-Plouffe, Que.

**Ouimet,** Pierre, 421 Mount Royal Ave. West, Montreal.

**Thomas,** George Ernest, 5834-3rd Ave., Rosemount, Montreal.

*Students at McGill University*

**Brandt,** René Edmond, 3445 Peel St., Montreal.

**Gibson,** Philip Ernest, 477 Prince Arthur St. West, Montreal.

**Knight,** Curtis, 3507 University St., Montreal.

**Wong,** Pui Huey, 73 Lagauchetière St. West, Montreal.

**Worembrand,** Carl Hyman, 1325 Van Horne Ave. West, Outremont.

*Students at Queen's University*

**Bader,** Alfred Robert, 329 Earl St., Kingston, Ont.

**Bandiera,** Leo Joseph, Queen's University, Kingston, Ont.

**Bourgeois,** Patrick O., B.A. (Laval University), 78 St. Famille St., Kenogami, Que.

**Carter,** Charles Junior, 323 Earl Street, Kingston, Ont.

**Colby,** William David, 318 University Ave., Kingston, Ont.

**Davis,** Merritt M., Queen's University, Kingston, Ont.

**Edwards,** Herbert Martell, 309 Earl St., Kingston, Ont.

**Gaffney,** Oliver Joseph, 84 Clergy St. West, Kingston, Ont.

**Gordon,** Ian Percy, 375 Earl St., Kingston, Ont.

**Gordon,** J. Keith, 315 Johnson St., Kingston, Ont.

**Kirk,** Jack Willsie, 323 University Ave., Kingston, Ont.

**Lillie,** Douglas F., 329 Earl St., Kingston, Ont.

**MacGregor,** William Robert, 320 Earl St., Kingston, Ont.

**McColl,** Bruce John, 64 Lower Union St., Kingston, Ont.

**Perreault,** H. C., 392 Victoria St., Kingston, Ont.

**Sinclair,** Donald Alfred, Queen's University, Kingston, Ont.

**Whelen,** Douglas A., 409 Earl St., Kingston, Ont.

**Wood,** Willard Carnal Everett, Arnprior, Ont.

*Students at University of Alberta*

**Bernard,** Gerald William, 11823-87th St., Edmonton, Alta.

**Brandley,** Reinard W., Stirling, Alta.

**Enarson,** Ottawa Ernest, Wetaskiwin, Alta.

**Ferguson,** David Allan, St. Joseph's College, University of Alberta, Edmonton, Alta.

**Forster,** John William, 11144-87th Ave., Edmonton, Alta.

**Jackson,** William Burley, 8527-112th St., Edmonton, Alta.

**Hole,** Harry, 8112 Jasper Ave., Edmonton, Alta.

**Hole,** Robert Walter, 8112 Jasper Ave., Edmonton, Alta.

**Hutton,** George Alexander, Bellevue, Alta.

**Martin,** William David, 10055-91st Ave., Edmonton, Alta.

**Ripley,** Charles Farrar, 11151-89th Ave., Edmonton, Alta.

**Sinclair,** Stewart Ronald, 11002-88th Ave., Edmonton, Alta.

**Walker,** Lloyd Arthur, Box 4, Mazenod, Sask.

**Webb,** John Arthur, 11002-88th Ave., Edmonton, Alta.

*Students at University of Manitoba*

**Dow,** William Andrew, 117 Cordova St., Winnipeg, Man.

**MacDonald,** William Duncan, 358 Maplewood Ave., Winnipeg, Man.

**Porter,** William Charles, 400 Kennedy St., Winnipeg, Man.

*Students at University of New Brunswick*

**Gerrish,** Arnold H., Lady Beaverbrook Residence, Fredericton, N.B.

**Merzetti,** Herman Joseph, 127 Leinster St., Saint John, N.B.

**MacKenzie,** Roderick Fraser, 241 Saunders St., Fredericton, N.B.

---

By virtue of the co-operative agreements between the Institute and the provincial associations of professional engineers, the following elections and transfers have become effective:

*Member*

**Smith,** H. M., Maritimes Regional Engineer, Canadian Broadcasting Corporation, Sackville, N.B.

*Juniors*

**Allen,** John Craig McMillan (St. Joseph's Univ.), junior engr., Dept. of National Defence, Eastern Air Command, Moncton, N.B.

**Thompson,** Charles Mervin, B.Sc. (Civil) (Univ. of Sask.), engr., Dept. of Transport, Winnipeg, Man. (Member of Saskatchewan Association.)

*Transferred from the class of Junior to that of Member*

**Cuthbertson,** Wellington B., B.Sc. (Elec.) (Univ. of N.B.), instr'man, Dept. of Transport, Moncton, N.B.

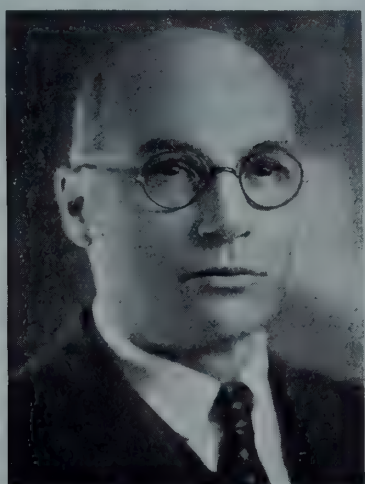
*Has passed the Institute examinations.

# Personals

## News of the Personal Activities of members of the Institute, and visitors to Headquarters

**Relatives and friends of members in the active forces are invited to inform the Institute of news items such as locations, promotions, transfers, etc., which would be of interest to other members of the Institute and which should be entered on the member's personal record kept at Headquarters. These would form the basis of personal items in the *Journal*.**

**W. P. Brereton,** M.E.I.C., a vice-president of the Institute, retires next month from the position of city engineer of Winnipeg after over 38 years of service. Born at Bethany, Ont., he received his primary education at the public and high schools of Port Hope, Ont., and studied engineering at the University of Toronto, where he graduated as a B.A.Sc. in 1903. Upon graduation, he joined the engineering staff of Heyl & Patterson, Pittsburgh, Pa., where he worked until 1904. From 1906 to 1912 he was employed with Smith, Kerry and Chace, consulting engineers, Toronto, as assistant engineer on the construction of a hydro-electric power plant for the Mount Hood Railway and Power Company. Later he became commissioner for the Winnipeg and St. Boniface Harbour Board.



W. P. Brereton, M.E.I.C.

Mr. Brereton joined the engineering staff of the city of Winnipeg in 1914 and was appointed city engineer in 1917, succeeding Lieut.-Col. H. N. Ruttan, a past president of the Institute.

Mention can be made of only a few of the numerous engineering works which have been carried out in Winnipeg by Mr. Brereton during his regime. The first important task was in connection with raising the grade of the Canadian Pacific Railway subway on Main street.

Then followed the construction of a new bridge on Maryland street—a modern concrete structure. The electrification of the high pressure waterworks plant was carried out in 1926. The construction of bridges over the Red river, Assiniboine river and over the C.P.R. tracks at Salter street, was proceeded with in 1930-32. All these bridges were of concrete construction, and of the very latest design.

In 1936, under the direction of Mr. Brereton, work was commenced on the construction of a subway at Portage avenue, west, for the purpose of eliminating the grade crossings of the Midland and Canadian Pacific railways, in order to speed up traffic on this main highway in and out of the city.

For many years, residents living along the banks of the Red and Assiniboine rivers, had complained of the sewage condition of the water brought in by both the Red and Assiniboine rivers.

Mr. Brereton came to the rescue, and in 1935 the City of Winnipeg and the surrounding municipalities combined to form the Greater Winnipeg Sanitary District, for the purpose of eradicating such a nuisance.

In 1936, under the supervision of Mr. Brereton, work was commenced on Winnipeg's modern sewage disposal plant.

This is one of the three major works constructed during the 65 years existence of the city and reflects great credit on Mr. Brereton, who acted as chairman of the board of engineers during the period of construction.

Last February he was elected vice-president of the Institute for the western provinces. All members of the Institute join to wish Mr. Brereton a long and happy period of retirement.

**L. E. Westman,** M.E.I.C., has been appointed Associate Director of National Selective Service in charge of matters relating to war industries.

He entered the Department of Labour in the early days of formation of the Wartime Bureau of Technical Personnel, and was one of those closely connected with the organization of this Bureau and previous activities relating to surveys of engineers, chemists and science workers from the standpoint of wartime needs. He represented the Department of Labour in the development, in conjunction with the Departments of National Defence and Munitions and Supply, of the University Science Students' Regulations, subsequently incorporated in Selective Service man-power regulations and placed under the administration of the Wartime Bureau of Techincal Personnel.

Since its formation, he has acted for the Director of National Selective Service on The Canadian Medical Procurement and Assignment Board.

For the past six months he has directed the employment of Alternative Service Workers.

**N. R. Crump,** M.E.I.C., has been promoted from assistant to the vice-president of the Canadian Pacific Railway Company, Montreal, to the position of general superintendent at Toronto. A graduate of Purdue University, Lafayette, Indiana, Mr. Crump joined the Canadian Pacific Railway Company in 1930 and was employed in Saskatchewan and Manitoba before coming to Montreal.

**George B. Moxon,** M.E.I.C., of the Aluminum Company of Canada Limited, has recently been transferred from Arvida to the Montreal office of the company.

**C. Clark Wales,** M.E.I.C., vice-president and general manager of the Hamilton Bridge Company Limited of Hamilton, Ont., is at present stationed at Pittsburgh, Penn., as engineer on a special assignment with Jones & Laughlin Steel Corporation.

**J. L. Connelly,** M.E.I.C., who returned to Canada a few months ago after having spent three years in British Guiana, has been transferred to Arvida where he is employed with the Aluminum Company of Canada.

**A. C. Fleischmann,** M.E.I.C., has joined the engineering department of the Aluminum Company of Canada at Shawinigan Falls, Que. He was previously engaged in consulting practice, in Montreal.

**J. E. Hanlon,** M.E.I.C., previously of Montreal, is now stationed in Vancouver, B.C., where he is employed with the Naval Service.

**V. J. Melsted,** M.E.I.C., has joined the staff of the Aluminum Company of Canada, at Arvida, Que. He was previously located at Lumby, B.C., where he operated the Harris Creek Placers.

*Canadian Army Photos. Courtesy New World*

**General Montgomery is shown above pinning decorations on members of the Institute who have distinguished themselves in the Sicilian Campaign. Left is Major-General Christopher Vokes, D.S.O., M.E.I.C., of Ottawa, and right is Lieutenant William Kenneth Heron, M.C., S.E.I.C., of Asbestos, Que.**

**Ernest Peden,** M.E.I.C., who had lately been employed with Gore & Storrie, consulting engineers, Toronto, Ont., has now returned to Montreal where he has joined the staff of McColl-Frontenac Oil Company Limited.

**Yvon de Guise,** M.E.I.C., an engineer in the hydraulic division of the Department of Lands and Forests of Quebec, has been appointed lecturer in hydrology and hydraulic structures at the Ecole Polytechnique.

**René A. Robert,** M.E.I.C., a laboratory assistant in the department of physics in the Ecole Polytechnique, has recently been appointed lecturer in mathematics.

**M. S. Saunders,** M.E.I.C., has recently returned to South America where he is employed in the department of geology of the Tropical Oil Company at Bagota. He had returned from South America to Canada earlier this year and for the past few months he had been employed with Imperial Oil Company Limited in western Canada.

**N. Stanley S. Swan,** M.E.I.C., has recently left the staff of German and Milne, naval architects, Montreal, to join Consumers Glass Company.

**F. S. Small,** M.E.I.C., has been transferred from the position of construction engineer with United Shipyards Limited to the same position with Fraser Brace Company Limited, Montreal.

**C. R. Timm,** M.E.I.C., who had been employed for the past three years as electrical engineer with Dominion Rubber Company Limited, Montreal, has accepted a position with Northern Foundry & Machine Company Limited, Sault Ste. Marie, Ont., where he is in charge of engineering.

**G. B. Webster,** M.E.I.C., has left the employ of A. G. McKee, Sault Ste. Marie, Ont., to join the staff of Swansea Construction Company Limited, Toronto.

**N. E. Wideman,** M.E.I.C., previously of Port Arthur, Ont., has been appointed relay engineer for the Burlington district of the Hydro-Electric Power Commission of Ontario, at Burlington, Ont.

**Lieutenant (E) A. Meade Wright,** R.C.N.V.R., Jr.E.I.C., of Montreal, was home on leave in November. He has been assigned to the Royal Navy on combined operations, and was among the first to participate in the Sicily landing. He is the engineer officer in charge of the maintenance of a flotilla of heavy landing craft. Beside Sicily, his travels have taken him to Egypt, Africa, Malta and Gibraltar.

**R. E. Hammond,** Jr.E.I.C. of Northern Electric Company Limited, Montreal, has accepted a position as electrical engineer with British Security Co-ordination, New York.

**J. B. Barrick,** Jr.E.I.C., is at present employed as foreman in the cartridge manufacturing department of Defence Industries Limited, Montreal Works.

**Bernard A. Berger,** Jr.E.I.C., who was previously employed with Electric Tamper and Equipment Company Limited, Montreal, has taken the position of mechanical engineer with Joliette Foundry & Tool Works, Limited, Montreal.

**L. C. Carey,** Jr.E.I.C., has left the employ of the Hydro-Electric Power Commission of Ontario, Toronto, to join the staff of Victory Aircraft at Malton, Ont.

**A. D. Hogg,** Jr.E.I.C., has taken a position in the engineering department of the University of Alberta. He was previously employed with the Hydro-Electric Power Commission of Ontario, at Toronto.

**J. G. Campbell,** S.E.I.C., has left the employ of Canadian Locomotive Works, Kingston, Ont., to join the staff of Aluminum Company of Canada Limited, at Arvida, as a metallurgical engineer.

**Attilio Monti,** S.E.I.C., has been appointed assistant in the laboratory of strength of materials, at the Ecole Polytechnique, Montreal.

**Dan W. Patterson,** S.E.I.C., has joined the R.C.N.V.R. as a sub-lieutenant and is at present stationed at Westville, N.S. He was previously employed as an electrical draughtsman with the Aluminum Company of Canada, Limited, Montreal.

**Raymond Bolduc,** S.E.I.C., is at present doing postgraduate work at the Faculty of Science, Laval University, Quebec. He graduated from Laval University, in 1943, with the degree of B.A.Sc. in mining.

**Marcel Manseau,** S.E.I.C., has been appointed assistant to the professor in engineering drawing at the Ecole Polytechnique, Montreal.

### VISITORS TO HEADQUARTERS

**Captain J. F. Rutherford,** R.C.C.S., M.E.I.C., Montreal, on his way overseas, on October 23.

**Past President J. M. R. Fairbairn,** M.E.I.C., Peterborough, Ont., on October 23.

**Constr. Lt.-Commander A. L. C. Atkinson,** R.C.N.V.R., M.E.I.C., Naval Service Headquarters, Ottawa, Ont., on October 28.

**J. P. Porter,** M.E.I.C., chief engineer, western region, Canadian National Railways, Winnipeg, Man., on October 28.

**Roger Lessard,** S.E.I.C., Marine Industries Limited, Sorel, Que., on November 1.

**C. O. P. Klotz,** M.E.I.C., resident engineer, Aluminum Company of Canada Limited, Kingston, Ont., on November 3.

**T. M. Moran,** M.E.I.C., vice-president, Stevenson & Kellogg, Toronto, Ont., on November 4.

**Lieutenant (E) A. Meade Wright,** R.C.N.V.R., Jr.E.I.C., Montreal, home on leave from service in the Mediterranean, on November 6.

**J. H. Ings,** M.E.I.C., H. G. Acres & Company, Niagara Falls, Ont., secretary-treasurer, Niagara Peninsula Branch of the Institute, on November 10.

**Frederick W. Cowie,** M.E.I.C., consulting engineer, Montreal, Que., on November 19.

**G. G. Murdoch,** M.E.I.C., consulting engineer, Saint John, N.B., vice-president of the Institute, on November 20.

**P. H. Morgan,** M.E.I.C., Foundation Company of Canada Limited, Kenogami, Que., on November 23.

**E. R. Jacobsen,** M.E.I.C., deputy director general, Commonwealth of Australia War Supplies Procurement, Washington, D.C., on November 23.

**W. J. Thomson,** M.E.I.C., Arvida, Que., on November 23.

**D. Hutchison,** M.E.I.C., manager, Mackenzie River Transport, Hudson's Bay Company, Edmonton, Alta., on November 23.

**G. M. Brown,** M.E.I.C., district engineer, Department of Public Works, Saint John, N.B., on November 23.

**W. H. G. Flay,** M.E.I.C., branch manager, Dominion Structural Steel Limited, Ottawa, Ont., on November 25.

# Obituaries

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

**Wilfred Ernest Cornish,** M.E.I.C., acting head of the department of electrical engineering of the University of Alberta, died in the hospital at Edmonton on November 1st, 1943. Born at Broadview, Sask., on February 22nd, 1901, he was educated at Weyburn Collegiate and at the University of Manitoba, where he received the degree of B.Sc. in electrical engineering in 1925. Upon graduation, he joined the Canadian General Electric Company and followed the company's test course until 1927 when he went to the University of Alberta as lecturer in the department of electrical engineering. In 1933, he obtained his degree of Master of Science from the University of Alberta and was appointed assistant professor of electrical engineering.

At his death he was associate professor of electrical engineering and had been acting head of that department since Professor E. G. Cullwick, M.E.I.C., enlisted in the Navy.

Prof. Cornish was secretary of the Edmonton Branch of the Institute for a number of years and in 1938-39 was chairman of the Branch. In 1941-42 he was president of the Association of Professional Engineers of Alberta, and also registrar of the Association until last spring.

During recent summers he had been employed at the Shipshaw power development in Quebec with the Aluminum Company of Canada Limited.

Professor Cornish joined the Institute in 1926 as a Student, transferring to Junior in 1930. He transferred to Associate Member in 1934 and he became a Member in 1940.

**Stanley Farquharson,** M.E.I.C., died in the hospital, at Montreal, on October 19th, 1943. Born at Christchurch, New Zealand, on January 25th, 1899, he was educated at Canterbury University, in New Zealand, where he graduated in 1923. He came to the United States in 1923 and then to Canada in 1924, being first employed by the B. C. Electric Railway Company in Vancouver, B.C. In 1927 he came to Montreal where he worked for a few months with Power Corporation of Canada and in 1928 he joined the staff of Aluminum Company of Canada at Arvida where he was employed on the design and construction of the Chute-à-Caron development.

Stanley Farquharson, M.E.I.C.

Upon completion of the project, Mr. Farquharson was employed on several construction jobs and worked for some time with Consolidated Mining, Steel & Power Company Limited at Trail, B.C. After being employed for some time as manager of Engineering Appraisal Company Limited at Vancouver, B.C., he turned to management engineering and industrial market surveys. In this capacity, he was connected for some time with George S. May Company of Chicago and Montreal and with Stevenson and Kellogg, Montreal. Lately he had worked as field auditor and resident cost accountant on war contracts for the Treasury Branch of the Department of Finance, Ottawa.

He was a veteran of the Great War, having won several medals for conspicuous service in Mesopotamia while a member of the New Zealand expeditionary forces. He was cited in dispatches for gallantry in action.

Mr. Farquharson joined the Institute as an Associate Member in 1928, becoming a Member in 1940. He was one of the founders of the Junior Section of the Montreal Branch of the Institute and was one of its first chairmen.

**Philip Nason Libby,** M.E.I.C., died in the hospital, at New York, on October 29th, 1943, after a long illness. Born at Gray, Me., U.S.A., on July 5th, 1896, he was educated at the University of Maine, where he received the degree of B.S. in 1917. During the First Great War, he served with the U.S. Army in France and Belgium. He came to Canada in 1919 with the Riordon Pulp Company Limited, at Mattawa, Ont. In the following years he was successively employed with Donnacona Paper Company, with the Laurentian Power Company, Beaupré, Que., Wayagamack Pulp and Paper Company, Trois-Rivières, Que. From 1922 to 1924 he was with the Mead Fibre Company of Kingsport, Tenn. He then returned to Canada as chief draughtsman with the Riordon Pulp Company Limited at Temiskaming, Que., later Canadian International Paper Company. In 1931 he joined the staff of E. B. Eddy Company Limited, Hull, Que., and in 1934 he returned to Kingsport, Tenn. For the past ten years Mr. Libby was connected with the engineering department of the Tennessee Eastman Corporation at Kingsport as project engineer, specializing in the design and detailing of chemical equipment.

Shortly after the entry of the United States in the present war, he occupied an important position assisting in the design of chemical process equipment for the manufacture of military explosives and at the time of his death was connected with the Holston Ordnance Works of the Tennessee Eastman Corporation at Kingsport, Tennessee, where this work was carried out to successful completion.

Mr. Libby joined the Institute as a Junior in 1922, transferring to Associate Member in 1927. He became a Member in 1940.

# News of the Branches

**Activities of the Twenty-five Branches of the Institute and abstracts of papers presented**

## EDMONTON BRANCH

F. R. Burfield, M.E.I.C. - *Secretary-Treasurer*
L. Thorssen, M.E.I.C. - - *Branch News Editor*

The first meeting of the Edmonton Branch for the 1943-1944 session was held in the Macdonald Hotel on the evening of Tuesday, October 19th, 1943. The new session was fittingly opened by having as our visitor and speaker of the evening President Cameron. As guests of the branch to hear Mr. Cameron, Premier E. C. Manning, Hon. W. A. Fallow, Mayor Fry, General Foster and Colonel Kirkpatrick sat at the head table. The meeting was well attended by members of the branch together with many of our American engineer-friends still resident in the city.

Mr. Cameron divided his talk into three separate subjects: first he spoke as an alumnus of McGill University bringing greetings to all McGill graduates; he then, in the absence of Dr. L. Austin Wright, spoke for a time on Institute affairs, finally ending with his main topic of the evening **Post-War Planning.** Mr. Cameron's talk on post-war planning, especially as it applied to Government projects, was most interesting.

In concluding the evening, Chairman Carry called upon Mr. Nelson to express the thanks of the Branch to Mr. Cameron.

## HAMILTON BRANCH

W. E. Brown, M.E.I.C. - *Secretary-Treasurer*
L. C. Sentence, M.E.I.C. - *Branch News Editor*

On Thursday, October 28th, one hundred and ten members and guests of the Hamilton Branch of the Institute were privileged to hear Mr. J. A. Palmer of the Dow Chemical Company, who spoke on **Plastics.**

Mr. Palmer introduced his subject by a short historical outline of the development of plastics from the nitrocellulose first used in 1865 as a substitute for ivory in billiard balls, to the present day polyvinyl compounds.

The three main manufacturing processes in use to-day, compression moulding, injection moulding, and hot extrusion, were dealt with in detail. Particular stress was placed on accurate control of mixing and compounding, and of processing temperatures, in the case of both thermosetting and thermoplastic materials.

Moulded parts in general require no finishing, have fair impact strength, good resistance to water and corrosion, and are two to ten times lighter than commonly used metals. Plastics now serve a multitude of purposes from fabric coatings to constructional members. Despite public beliefs, however, the field of plastics is definitely limited, and they are, on the whole, unsatisfactory substitutes for metals.

At the conclusion of an interesting talk, Mr. Palmer answered numerous questions.

On Wednesday, November 17th, a highly appreciative audience gathered to hear Professor R. F. Legget speak on **Conservation and the Engineer.**

Professor Legget, of the Department of Civil Engineering at the University of Toronto, commenced his talk with the avowed intention of awakening his audience to the very real dangers lurking in the present apathetic attitude of governmental and private agencies towards conservation of the rapidly diminishing renewable natural resources of the country.

No credence should be given to glib talk of the "boundless" resources of Canada. Ample evidence exists to indicate that many resources are being rapidly depleted with little or no effort being made towards their conservation.

Serious soil erosion by both wind and water has taken place in the western provinces and indeed in Ontario, where for example, as much as 10 per cent of some areas has been denuded of topsoil.

The forestry situation is tragically critical, and practically nothing is being done about it. Canada is one of the very few countries in the world where it is permissible to cut a tree without planting at least one in its place. Sweden, a prime exponent of reforestation, normally exports more lumber than all of Canada; this has been done for 40 years, yet by following a progressive policy of reforestation, Sweden's forests are now in better condition than ever before. Forest products must be subject to long term-planning, and it is to be hoped that a projected non-political foresty commission will be empowered to institute the necessary changes.

# THE PRESIDENT AT EDMONTON

President K. M. Cameron discusses post-war reconstruction with Hon. E. C. Manning, Premier of Alberta, Hon. W. A. Fallow, Minister of Public Works of Alberta and Colonel Kirkpatrick of the U.S. Army Corps of Engineers.

G. A. Gaherty of Montreal chats with Professor W. E. Cornish of the University of Alberta (deceased November 2nd).

At the Branch Executive luncheon, October 19th. *First row:* President K. M. Cameron, Branch Chairman C. W. Carry, Councillor E. Nelson. *Back row:* I. F. Morrison, G. A. Gaherty, J. W. Judge, H. W. Tye, J. D. A. Macdonald, A. W. Haddow, D. Hutchison, Dean R. S. L. Wilson, Branch Secretary F. R. Burfield.

Colonel Neilson of the U.S. Army is shown at right with members of the Edmonton Branch.

The conservation of wild life was mentioned by the speaker, who commended the accomplishments of "Ducks Unlimited," which organization in co-operation with the P.F.R.A. had substantially increased the western duck census.

The most important resource of the country, and one without which no life could exist, is water. It is unfortunate that as a result of the denuding of originally wooded lands, and of careless farming technique, serious run-off, erosion and flood problems have been created.

Conservation of water on the farm can be aided by maintaining a minimum of five per cent land area in a controlled wood lot with no grazing, and with proper practice of agriculture as exemplified in contour plowing.

The efficacy of Professor Legget's plea for action can best be judged by the unanimous recommendation of those present that Headquarters be urged to take action whereby the profession as a whole might be acquainted with the problems of conservation of renewable natural resources, and that the strongest possible representations be made to both Dominion and provincial governments that much needed action be taken without delay.

## KINGSTON BRANCH

R. A. Low, M.E.I.C. - *Secretary-Treasurer*

The first fall meeting of the Kingston Branch was held at Queen's University on the evening of November 11 under the chairmanship of K. M. Winslow.

Dr. A. L. Clark, HON. M.E.I.C., and former dean of the Faculty of Applied Science at Queen's University, was the guest speaker of the evening. He gave an extremely interesting account of a recent trip down the MacKenzie to the Arctic Ocean, illustrated with slides, and outlined many of the major developments taking place in the MacKenzie Valley. He described the Canol oil project in detail, and questioned the economics of this huge development in view of the relatively limited resources of this oil field. Problems in transportation met with in the far north were discussed and many novel and interesting features of life in this country were included to give a quick word picture of the region.

The speaker was thanked by Professor H. W. Harkness.

Tea was served in the Faculty Players lounge and a short business meeting held for the election of officers for 1943-1944.

## THE PRESIDENT VISITED KELOWNA ON HIS WAY TO VANCOUVER

**The Hon. Grote Stirling, Hon.M.E.I.C., and President K. M. Cameron.**

**Mr. Bowering, Mr. Davis, and S. J. Crocker.**

**J. P. Forde, F. W. Groves, Mr. McNaughton, and Mr. McMynn.**

**Mr. McMynn, Councillor C. E. Webb and A. G. Pearson.**

### LAKEHEAD BRANCH

W. C. Byers, Jr.E.I.C. - *Secretary-Treasurer*
R. B. Chandler, M.E.I.C. - *Branch News Editor*

On Monday, October 25th, the Lakehead Branch of the Institute were hosts to President K. M. Cameron and Mrs. Cameron. Mr. Louis Trudel, assistant general secretary of the Institute, accompanied the president.

Arriving early Sunday morning, the president's party was met in Fort William and motored to their hotel in Port Arthur. Sunday afternoon they were taken on a sight-seeing drive around the twin cities and on a motor trip via the Trans-Canada highway to Amethyst Harbour, an attractive summer resort east of the Lakehead on Thunder Bay.

Sunday evening the presidential party was entertained at the home of Mr. and Mrs. J. M. Fleming where they met the Branch Executive Committee and their wives.

On Monday noon Mr. Cameron and Mr. Trudel were guests at an executive luncheon in the Prince Arthur Hotel while Mrs. Cameron was entertained on a shopping and sight-seeing tour followed by a luncheon in Fort William.

Monday afternoon the presidential party visited the Port Arthur Shipbuilding Company plant and after inspecting various shop units went aboard one of the escort naval craft under construction.

On Monday evening the president addressed a dinner meeting in the Royal Edward Hotel, Fort William, at which the presidents and executives of local Chambers of Commerce, also chairman of Civic Rehabilitation Committees were invited guests.

Mr. Cameron delivered a masterly address on **Some Aspects of the Post-War Problems.**

He stressed the importance of planning for the conversion of industry to peace-time uses so that employment would be available for war workers and soldiers following the cessation of hostilities. Some individuals are asking, "Why talk of Post-War Reconstruction when the war is still being fought ?" "These persons are mistaken," he said. "After all, what are we fighting for ? This war is being fought so that everyone will have the opportunity to hold a job and earn a fair and honest living." It is a tremendous picture puzzle but it should be assembled so that it will be a better picture than ever before, he declared.

"At present, it is estimated that 51 per cent of the population of Canada, over 14 years of age, now are gainfully employed," Mr. Cameron said. "The figure quoted is 5,200,000. Until June of this year manufactured goods to the value of $4,500,000,000 were produced for war purposes. In 1933 when the country was not in a too happy position $1,500,000,000 in goods was produced and in 1938 more than two billions. You can readily vizualize what skills these people, now employed, possess. After the war they will not be satisfied with jobs that do not suit their own skilled trades.

"With the idea that private interests is the best way to meet the situation I would advocate that as soon as possible actual physical plans be drawn up and filed away for the day when they are needed," the speaker said.

"After the war there is going to be a distinctly accelerated evolution due to scientific developments brought about by the war. Seemingly it takes a war to shake us out of our lethargy. After the war these new developments will be used for economic civilian use," he pointed out.

"It is stated that the government will have to act aggressively and intelligently. However, the policy required will be stimulation. What can be accomplished depends on private individuals with government stimulation. The amount

# PRESIDENTIAL VISIT TO THE LAKEHEAD BRANCH

Chairman R. B. Chandler introduces the president.

*Below:* Mrs. Cameron (seated in front) was entertained by Mrs. J. M. Fleming, H. G. O'Leary, R. B. Chandler, S. T. McCavour and W. H. Small.

T. G. McAuliffe, J. M. Fleming, S. T. McCavour.

H. G. O'Leary, F. C. Graham, W. H. Peach, W. C. Byers (end of table), and W. H. Small (right foreground).

G. H. Burbidge, T. G. McAuliffe and J. M. Fleming.

of government control depends on how industry governs itself. If there is too much individualism the government has to step in."

R. B. Chandler, chairman of the branch, presided over the meeting. He welcomed Mr. Cameron and Louis Trudel of Montreal.

The speaker was introduced by S. T. McCavour, vice-chairman of the Lakehead Branch. A vote of thanks to Mr. Cameron was proposed by H. G. O'Leary and J. M. Fleming.

Among the invited guests in attendance were M. J. McDonald, president of the Port Arthur Chamber of Commerce; R. J. Ward, president of the Fort William Chamber of Commerce; T. J. McAuliffe, chairman of the Post-War Rehabilitation Committee for Port Arthur, and J. E. Fryer, chairman of the Post-War Rehabilitation Committee for Fort William.

Mrs. R. B. Chandler, wife of the branch chairman, entertained Mrs. Cameron and the wives of the branch executives to a dinner in the Prince Arthur Hotel, Monday evening.

## MONTREAL BRANCH

L. Duchastel, M.E.I.C. - *Secretary-Treasurer*
H. H. Schwartz, S.E.I.C. - *Branch News Editor*

**Ignitron Rectifiers** was the subject of a talk delivered on Thursday, October 8th, by J. T. Thwaites to the Montreal Branch of the E.I.C. Immediately preceding the talk, a film outlining the various functions of electron tubes was shown. These primary functions are six in number: rectification, amplification, generation, control, light-to-electricity transducer, and electricity-to-light transducer. An electron tube designed specifically for rectification is the ignitron rectifier.

The ignitron rectifier is a tube with a large pool of mercury in its base, and a graphite plate in its upper portion. If an alternating potential is applied between the plate and the mercury pool, an arc will strike between the two, under certain conditions. This arc is unidirectional and carries current only one way, when the mercury pool is negative (cathode) and the carbon plate is positive (anode). Thus this tube functions as a rectifier and converts the alternating current to a pulsating direct current. In order to ensure the arc starting each time the plate goes positive, a small starter rod, the igniter, is placed close to the mercury pool. This igniter starts an auxiliary arc, which immediately flashes over to the plate and forms the main current-carrying arc. The timing of this auxiliary arc can be varied by an external circuit, and thus the current passed per cycle through the tube can be controlled. The ignitron thus provides a smooth controllable d.c. power from an a.c. source. The recent installation of a bank of ignitrons for the Aluminum Company of Canada was discussed.

McNeely Du Bose was chairman of the meeting and Mr. McDonald proposed the vote of thanks.

* * *

On October 21st Mr. J. J. Van Horn delivered a talk to the Montreal Branch on the **Signalling and Interlock-**

**ing of Montreal Terminal—C.N.R.** Mr. Van Horn discussed the history of electric signalling. He emphasized the fact that it was only the utilization of the most modern methods that has permitted the railroads to carry the extremely heavy war loads that exist to-day with speed and safety. The principle of railroad signalling is that the axle of a locomotive connects two rails together, and acts as a shunt of approximately 0.06 ohm. The complete circuit runs from the battery along one rail to the signalling device and back along the other rail. Thus either a short across the rails or a broken rail will operate the signal. Each signal controls a block which may be approximately one or two miles in length, and so allows adequate distance for a train to stop.

The speaker then went on to discuss the installation at the new C.N.R. terminal in Montreal.

Following the lecture several questions were raised as to the vulnerability of this system to enemy sabotage. Mr. Van Horn explained that the interlocking and signalling was so arranged that two separate faults were required to render the system inoperative. Thus, a thorough knowledge of the layout would be required before any deliberate damage could be done.

R. G. Gage was chairman at the meeting and C. C. Lindsay thanked the speaker.

* * *

**Plastics in Engineering** stated Dr. W. Gallay to the Montreal Branch on November 4th is a subject that must be thoroughly differentiated from plastics as a salesman's dream. There are many things that still cannot be done with plastics, notwithstanding all advertisements to the contrary. But plastics as a material with definitely known qualities has come to stay and will grow in importance, provided proper attention is paid to its properties.

There are four basic types of plastics:

1. Moulding.
2. Laminating.
3. Coating.
4. Adhesives.

Moulding plastics are widely used for small objects such as cups, knobs, etc., where the relative fragility of the plastic is no hindrance. Laminated plastics, such as canvas backed, or fiber backed bakelite have high strengths and rigidities. Some experimental results have indicated that fiber-glass bakelite may be as strong as high tensile steel on a strength-to-weight ratio basis. Coating plastics will really come into its own only after the war, and in this field Dr. Gallay was certain that all ordinary paints would be completely superseded.

Dr. Gallay then discussed a new development in the field of wood adhesives. A new type of resin glue has been found to be superior to any glue on the market. This glue requires a curing temperature of 250 deg. F. This is done by placing the glued wood joint in a heated press and raising both the wood and the glue to the correct temperature but the process is slow. Dr. Gallay discovered that the addition of acetylene black to the resin glue rendered the mixture electrically conductive. Thus by passing a current through the glue mixture only the glue is heated and cured. This development cuts the gluing time of laminated propeller blocks from eight days to 2½ minutes.

M. F. Anderson was chairman and A. P. Benoit thanked the speaker.

## PETERBOROUGH BRANCH

A. J. Girdwood, Jr.E.I.C. - *Secretary-Treasurer*
J. F. Osborn, M.E.I.C. - *Branch News Editor*

On October 18th, Mr. C. Neal of the Canadian General Electric Company, Toronto, addressed the Peterborough Branch, having as his topic **Cemented Carbide, The Magic Metal.**

Like so many useful discoveries, cemented carbide resulted from an accident—in this case the formation of a mass of metal containing a large proportion of tungsten. When this material was found to resist grinding by an abrasive wheel, its potential value was realized. In fact the discovery enable the Germans to largely overcome the diamond shortage during the last war. Krupps carried on research that later yielded a group of cemented carbides tough enough for cutting tools. The General Electric Company worked on the problem in America and after years of development produced a useful range of cemented carbides.

Carboloy is the General Electric Company's trade name for a group of cemented carbides consisting principally of a base metal, tungsten with the addition of tantalum or titanium carbide, carbon or a combination of these. While in the powdered condition, by the addition of one or more ingredients, such as nickel or cobalt (generally cobalt) and then applying a heat treating or sintering process, the carbide emerges in its final form. It might be observed that this is one of the applications of powdered metallurgy. As a rule, steel cutting grades contain titanium, tantalum or combinations of both whereas straight tungsten carbide is used for cast iron or non-ferrous metal.

Cemented carbides are extremely hard—next to the diamond in hardness and therefore a great deal harder than high speed steel; but they are not as tough as the latter, which characteristic must be taken into account in their use. They are exceptionally dense and fine grained.

The material from which carboloy is made is reduced to a very fine powder, closely controlled as to constituents and grain size, and is then pressed into blanks. The blanks are subjected to a pre-sintering treatment in an electric furnace, at a rather low temperature to bond the powder together. At this stage the blank is shaped to such a size that the reduction in volume during sintering will bring it approximately to the correct final dimensions. Sintering is done in an electric furnace at a temperature in the order of that necessary to melt steel. In both bonding and sintering, a reducing atmosphere is maintained in the furnace. Final finishing of the tool is accomplished by grinding with silicon carbide wheels, diamond grinding and lapping. Cemented carbide tools are usually brazed to a substantial steel shank for strength and economy.

Cemented carbide must not be considered a cure all for tool problems; but for a wide variety of applications the use of it will permit operating speeds of machines to be increased by several times. There are many die applications on which astounding increase in die life is possible by use of Carboloy. The speaker warned the audience present that expert advice was essential on unusual applications and that the advice of the cemented carbide manufacturer should be sought.

It is a known fact that one reason Germany was able to produce such vast quantities of munitions early in the war was because of a general compulsory use of cemented carbides. At the time the war broke out the use of this remarkable material was on a scale that seemed almost incredible to industrial leaders in England and the United States. However, we are rapidly catching up in this deficiency and cemented carbides are an important contributing factor in present high production.

## SASKATCHEWAN BRANCH

### Saskatoon Section

Stewart Young, M.E.I.C. - *Secretary-Treasurer*
G. W. Parkinson, M.E.I.C. - *Branch News Editor*

A joint dinner meeting of the Saskatoon Section of The Engineering Institute and the Saskatchewan Association of Professional Engineers was held in the Bessborough Hotel on Wednesday, October 20th, to welcome President K. M. Cameron.

Mr. A. M. Macgillivray, chairman of the Saskatchewan

# THE PRESIDENT AT SASKATOON

Prof. A. R. Greig, Prof. I. M. Fraser and President K. M. Cameron.

*Below:* Councillor A. M. Macgillivray, Acting Dean R. A. Spencer, and A. L. Cole.

Acting Dean Spencer introduces President Cameron to the students at the University of Saskatchewan.

The students enjoyed listening to the president.

The president shakes hands with the students after addressing them.

Members of the Undergraduates Engineering Society at the University of Saskatchewan, left to right: D. D. Munroe, treasurer; E. J. Bobyn, N. L. Iverson, B. D. Kenney, vice-president; R. F. Gibson, president and M. W. Chomyn.

Branch, presided. President Cameron was introduced to the gathering by Acting Dean R. A. Spencer of the University of Saskatchewan.

President Cameron reviewed briefly the activities of the Institute during the past year, stressing the progress made during recent years, in the negotiating of agreements with the provincial associations of professional engineers. He then went on to deal with the problems of **Post-War Reconstruction,** reviewing previous attempts to relieve unemployment by publicly financed construction projects, outlining the deficiencies and difficulties encountered in these programmes. President Cameron emphasized the importance of proper planning and advocated that many groups should be engaged in planning, with each group working on some specific phase of reconstruction.

President Cameron visited the University of Saskatchewan on Thursday morning and addressed a meeting of the third and fourth year engineering students. He described the organization and functions of the Institute and also stressed the importance of forming an early affiliation with some professional organization. The sudden increase in requests for student application forms is concrete evidence of how well the president stimulated the interest of the students. At the conclusion of this meeting, he presented to Mr. J. A. Wheat, the certificate given annually to the winner of the third year prize provided by the Institute.

Mrs. Cameron, who accompanied Mr. Cameron, was entertained by the wives of the local members during their visit here.

*Left to right:* **Mrs. H. L. Sherwood, Colonel H. L. Sherwood, Mrs. Kenneth Reid, President Cameron, Branch Chairman Kenneth Reid.**

*Below:* **Kenneth Moodie, Branch Secretary Reginald Bowering, a reporter and A. L. Carruthers dine in private owing to overflow.**

**Victoria City Engineer G. M. Irwin thanks President Cameron. On his right, R. E. Wilson, R.C.E., and J. H. Blake.**

## SAULT STE. MARIE BRANCH

A. O. Evans, M.E.I.C. - *Secretary-Treasurer*

On Wednesday, October 27th, 1943, the Sault Branch of the Institute had the pleasure of entertaining their president, K. M. Cameron, and Assistant Secretary Louis Trudel at a dinner held in the Windsor Hotel, which was attended by thirty-one members and guests.

After the dinner the guests were honoured by having A. Y. Broughton sing two songs, which were, "We're Proud of Canada," and "Now that I've seen Marie." A. H. Meldrum was the accompanist.

The chairman called upon R. S. McCormick to introduce the president. Mr. McCormick spoke of his long association with the president and told the meeting of the fine type of public servants that Canada has, noting that Mr. Cameron heads a Department at Ottawa.

Mr. Cameron had for his topic **Post-War Problems.** There were many facets to this problem such as agriculture, construction, reforestration. He cited that it was the country's desire to give a job to everyone able and willing to work. However, he felt that construction alone could not solve the problem.

To prove his theory he said that there were 722,000 people in the armed forces at the present time, with 1,036,000 employed in direct war production. Last year Canada spent a sum of $640,000,000 on construction, the greatest in the nation's history. However, only 200,000 were directly employed in these projects with some 300,000 producing materials or a total of 500,000 employed.

At present there are now 4,462,000 people employed in Canada. The war production of Canada was valued at four and one-half billions last year.

One of the main reasons for failure of the Government's effort in the depression to relieve conditions was the lack of co-ordination between governing bodies. He felt that the skilled people would not be content with dirt removing jobs.

In closing he said that we must all pull together and make Canada a finer country to live in.

Mr. J. L. Lang first thanked the president for his inspiring talk and then introduced the assistant secretary, Mr. Louis Trudel to the meeting.

Mr. Trudel brought greetings from Headquarters and then spoke briefly on Institute activities, which have greatly increased since the outbreak of war. The Institute interested itself in the status of engineers in the armed forces and in the civil service.

The Institute had printed and distributed a booklet on Structural Defence against Bombing. At present a co-operative agreement with the Manitoba Professional Association was under consideration. He said that Headquarters was fighting for the welfare of engineer

Chairman N. C. Cowie extended the thanks of the Branch to the speakers and expressed the hope that their stay in the city had been a happy one.

A. E. Pickering moved the adjournment.

## VANCOUVER BRANCH

P. B. Stroyan, M.E.I.C. - *Secretary-Treasurer*
A. Peebles, M.E.I.C. - - *Branch News Editor*

The October meeting of the Branch was addressed by Mr. Norman R. Olding, Supervisor of Technical Staff, Western Canada, for the Canadian Broadcasting Corporation, the subject being **Technical Aspects of Broadcasting and Future Trends.**

Members from the Branch and guests from The American Institute of Electrical Engineers (Vancouver Section) numbering about forty-five altogether, heard Mr. Olding deliver a most comprehensive and extremely interesting talk on the different phases of broadcasting.

The various requirements necessary to insulate the studio against vibration in the building were detailed, with a description of the different methods of constructing walls, floors and ceilings to obtain the best results. The speaker explained the necessity of ensuring proper accoustics in the studio, and noted the different materials used in the absorption of sound to ensure the best accoustical conditions.

The use of wire lines in the transmission of network programmes, and some of the technical and physical difficulties encountered were explained, as well as the necessity of recording programmes for later release over different stations on the network to take care of the time differences across the country.

Three of the newer developments in radio, frequency modulation, facsimile, and television were explained at some length. It was noted that frequency modulation, as distinct from amplitude modulation in vogue at the present time,

## THE PRESIDENT'S VISIT TO WINNIPEG

Vice-President W. P. Brereton, Branch Secretary T. E. Storey, Branch Chairman J. T. Dyment, Councillor C. E. Webb, of Vancouver, Branch Vice-Chairman T. H. Kirby and Past Branch Chairman D. M. Stephens.

*Below:* H. S. Rimmington, president of the Association of Professional Engineers of Manitoba, Councillor A. M. Macgillivray, of Saskatoon, Dean E. P. Fetherstonhaugh of the University of Manitoba, T. H. Kirby and Councillor E. Nelson, of Edmonton.

T. E. Storey, M. A. Lyons, H. W. McLeod, D. L. McLean and D. M. Stephens.

*Right:* President Cameron presents the Institute prize to Douglas J. Roy, of the University of Manitoba.

will eliminate static, but whereas the radio band at present accommodates over one hundred different wave lengths, the same band would only accommodate seven or eight channels under frequency modulation, and it will therefore be necessary to use very high frequencies to overcome this difficulty. The practical range, using frequency modulation, is limited to about one hundred and twenty miles, so that in all probability its usefulness will be limited to urban localities, and the rural population will still be served by amplitude modulation as at present.

The new development, facsimile, was explained in detail as well as some of the uses which may be made of this new phase. The same basic ideas developed to a further degree give us television, and the speaker gave a detailed picture of the various principles involved and of some of the difficulties which must be overcome before television will become a commercial possibility.

After the meeting those present were privileged to make a tour of inspection of CBR, the regional station of the Canadian Broadcasting Corporation, where Mr. Olding conducted the members through the various studios and control rooms, explaining the functions and uses of the different types of equipment. The members had the privilege of speaking into a microphone, and within a minute or two the record was played back, so that each in turn heard his own voice rebroadcast.

Mr. Kelly, chairman of the Branch, introduced the speaker, and a vote of thanks, expressing appreciation to Mr. Olding for his very instructive address, was proposed by Mr. Buchan.

### VICTORIA BRANCH

R. Bowering, M.E.I.C. - *Secretary-Treasurer*

A joint dinner of the Victoria Branch of the Institute and the Victoria Section of the McGill Graduates Society was held in the Empress Hotel, Victoria, on Friday, October 15th, 1943. Some sixty members, their wives, and McGill graduates sat down to dinner. In his address to the meeting, President Cameron stressed the part to be played by the engineer and the Institute in **Post-War Reconstruction** He welcomed the opportunity to meet both Institute members and his fellow graduates of McGill University and his remarks were heartily received by all present.

The chairman, Kenneth Reid, and Dr. Hermann Robertson, president of the McGill Graduates Society, both welcomed President Cameron to Victoria and to this meeting of Institute and McGill members.

On Saturday, while Mrs. Cameron was entertained by the ladies of the branch, the president was conducted on a personal tour of the local Pacific Coast defences, the dockyard, drydock, and to Yarrows Ltd. shipbuilding plant at Esquimalt.

President and Mrs. Cameron left Victoria by boat for Vancouver on Saturday night, October 16th.

# Library Notes

**Book notes, Additions to the Library of the Engineering Institute, Reviews of New Books and Publications**

## ADDITIONS TO THE LIBRARY

TECHNICAL BOOKS

**Lubricants and Cutting Oils for Machine Tools:**
*William Gordon Forbes. N.Y., John Wiley & Sons, Inc., c. 1943. 5½ x 8½ in. $1.50.*

**Heat Treatment of Aluminum Alloys:**
*Aluminum Company of Canada, Limited. 5½ x 8¼ in. 31 pp.*

**Short Wave Wireless Communication, including Ultra-Short Waves:**
*4th ed. A. W. Ladner and C. R. Stoner. N.Y., John Wiley & Sons, Inc., 1942. 5¾ x 8½ in. $6.00.*

**Fundamentals of Radio:**
*L. O. Gorder and Carl H. Dunlap. Chicago, American Technical Society, 1943. 5½ x 8½ in. $2.75 (Canadian price).*

**Lubrication of Industrial and Marine Machinery:**
*William Gordon Forbes. N.Y., John Wiley & Sons, Inc., c. 1943. 5½ x 8½ in. $3.50.*

**Industrial Safety:**
*Edited by Roland P. Blake. N.Y., Prentice-Hall, Inc., 1943. 6 x 9¼ in. $5.00.*

**Plastics:**
*Revised edition. J. H. DuBois. Chicago, American Technical Society, 1943. 5½ x 8½ in. $5.50 (Canadian price).*

**Principles of Physical Metallurgy:**
*Frederick L. Coonan. N.Y., Harper and Bros., c. 1943. 6¼ x 9½ in. $3.25.*

**Modern Timber Design:**
*Howard J. Hansen. N.Y., John Wiley & Sons, Inc., 1943. 5½ x 8½ in. $3.00.*

**Voluntary and Selective Programme to Aid Water Utilities in a Co-operative Stop Water Waste Campaign:**
*American Water Works Association, 1943. 8½ x 10½ in. 100pp. $2.00.*

**Slide Rule Simplified with Genuine Dietzgen Slide Rule:**
*C. O. Harris. Chicago, American Technical Society, 1943. 5½ x 8½ in. $3.75 (Canadian price)—with Slide Rule $5.00 (Canadian price).*

**Fundamental Radio Experiments:**
*Robert C. Higgy. N.Y., John Wiley & Sons, Inc., 1943. 5¾ x 8½ in. $1.50.*

TRANSACTIONS, PROCEEDINGS

**The Institution of Mechanical Engineers:**
*Proceedings volume 148, July-December, 1942. London, The Institution, 1943.*

REPORTS

**New York State—Division of Commerce—Executive Department:**
*The expanding mineral industry of the Adirondacks, by Herman F. Otte. 102 pp.*

**Cornell University—Engineering Experiment Station—Bulletin:**
*No. 31; The solution of simultaneous linear equations by an approximation method. No. 32; Radiant heating and cooling; part 1—Angle factors for calculations on radiant heating and cooling.*

**Ohio State University—Engineering Experiment Station—Bulletin:**
*No. 116; The drying of rayon.*

**U.S. National Research Council—Highway Research Board:**
*Wartime Road Problems—No. 7; Use of soil-cement mixtures for base courses.*

**U.S. Bureau of Mines—Technical Paper:**
*No. 654; Hydrogenation and liquefaction of coal, part 4—Effect of temperature catalyst and rank of coal on rates of coal-hydrogenation reactions.*

**National Safety Council—Street and Highway Traffic Section:**
*Summary report of the 32nd National Safety Congress and Exposition, October 5-7, 1943.*

**The Electrochemical Society—Preprints:**
*No. 84-12; The electrogalvanizing of strip steel. No. 84-13; The plating from the potassium stannate bath. No. 84-14; The electric characteristics of the ozonator discharge. No. 84-15; Electrodeposition of cobalt-tungsten alloys from an acid plating bath. No. 84-16; Acetylene polymer produced in electric discharge. No. 84-17; Distribution of galvanic corrosion.*

## BOOK NOTES

**The following notes on new books appear here through the courtesy of the Engineering Societies Library of New York. As yet the books are not in the Institute Library, but inquiries will be welcomed at headquarters, or may be sent direct to the publishers.**

**A.S.T.N. SPECIFICATIONS FOR STEEL PIPING MATERIALS**
*American Society for Testing Materials, Philadelphia, Pa. 255 pp., illus., diagrs., tables, 9 x 6 in., paper, $1.75 (to members, $1.25).*

These specifications cover pipe and tubes for conveying liquids, vapor and gases at normal and elevated atmospheres, as well as those for the castings, bolts, nuts and fittings, used in piping installations. The specifications are the latest adopted by the Society.

**A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS**
*Prepared by A.S.T.M. Committee D-2 on Petroleum Products and Lubricants; Methods of Testing, Specifications, Definitions, Charts and Tables; American Society for Testing Materials, 260 S. Broad St., Phila., Sept., 1943. 442 pp., illus., diagrs., charts, tables, 9 x 6 in., paper, $2.25.*

This pamphlet brings together in convenient form the 1943 report of the committee on petroleum products and lubricants, the various A.S.T.M. standard and tentative methods of test and specifications pertaining to petroleum. The 1943 edition of this annual compilation includes 75 test methods, 14 specifications and two lists of definitions of terms relating to petroleum and to materials for roads and pavements.

**AERIAL PHOTOGRAPHS AND THEIR APPLICATIONS**
*By H. T. U. Smith. D. Appleton-Century Company, New York and London, 1943. 372 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth, $3.75.*

The major part of this book is devoted to the interpretation of aerial photographs and to map-making procedure, with particular regard to wartime requirements. The topographic and geologic aspects of interpretation receive special consideration, and practical, working procedures are emphasized. The viewpoint assumed is that of the user of aerial photographs, so the technique of taking them is not itself presented.

**AEROPLANE PRODUCTION YEAR BOOK AND MANUAL (1)**
*Edited by G. W. Williamson, foreword by Sir C. Bruce-Gardner. Paul Elek (Publishers) Ltd., Africa House, Kingsway, London, W.C.2, May, 1943. 564 pp., illus., diagrs., charts, tables, 8½ x 5½ in., linen, 40s. 6d. (41s. 6d. abroad).*

The purpose of this volume is to provide information in regard to production methods in a compact and accessible form. The use and treatment of aircraft materials are described, general and specialized manufacturing processes are explained, and the construction and characteristics of the varied types of airplane equipment are discussed. There is a large bibliography which includes numerous abstracts.

**AMBASSADOR TO INDUSTRY, The Idea and Life of Herman Schneider**
*By C. W. Park, with a foreword by C. F. Kettering. Bobbs-Merrill Co., Indianapolis and New York, 1943. 324 pp., illus., charts, tables, 9 x 6 in., cloth, $3.50.*

In order to bridge the gap between academic college training and actual working practice, Herman Schneider introduced, at the University of Cincinnati in 1906, the "co-operative plan of education," in which the students went to school part time and worked at actual jobs in their field part time. This end similar activities are emphasized in this biography of an outstanding educator, presented against a background of fact and anecdote which brings out the character of the man.

**(The) AMERICAN PATENT SYSTEM, an Economic Interpretation.**
*By W. B. Bennett. Louisiana State University Press, Baton Rouge, La., 1943. 259 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $3.00.*

Written from an economic viewpoint, this book describes our patent system and discusses its uses and abuses. Many questions involving the patentee, the corporate concern and the public are answered explicitly, with reference to court decisions and the opinions of research workers and business men. The book is intended to be of use to students, inventors, corporations and interested laymen.

**ELECTRO-PLATING, a Survey of Modern Practice, including the Analysis of Solutions**
*By S. Field and A. D. Weill. 4th ed. rev. & enlarged. Sir Isaac Pitman & Sons, London; Pitman Publishing Corp., New York, 1943. 437 pp., illus., diagrs., charts, tables, 7½ x 5 in., cloth, $5.00; 15s.*

The major part of this text is devoted to description of the practical processes by which metals are deposited on a surface. Fundamental principles are briefly discussed; the electro-plating plant is described; mechanical and chemical cleaning of metals is covered; and chapters are included on the testing of electrodeposits and on metal coloring.

**ELECTRONIC INTERPRETATIONS OF ORGANIC CHEMISTRY**
*By A. E. Remick. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 474 pp., diagrs., charts, tables, 9 x 5½ in., cloth, $4.50.*

The main purpose of this book is to show how electronic theories of organic chemistry may be combined with such modern developments in physical chemistry as the quantum-mechanical concept of resonance and the transition-state theory of reaction rates. The work is intended as a review and an advanced textbook, in which those developments in the field of physical and theoretical chemistry that seem to offer new and useful methods of attacking the problems of preparative organic chemistry are presented.

**ENCYCLOPEDIA OF SUBSTITUTES AND SYNTHETICS**

*Edited by M. D. Schoengold. Philosophical Library, 15 East 40th St., New York, 1943. 382 pp., tables, 9½ x 6 in., cloth, $10.00.*

This encyclopedia covers products that have been recently developed in order to replace critical materials that have become difficult or impossible to obtain. The properties and uses of these replacement materials are given, the materials needing to be conserved are listed with their practical substitutes, and a separate index of trade names is provided. All branches of industry, manufacture and pharmaceutics are represented.

**ERUPTIVE ROCKS, their Genesis, Composition and Classification, with a chapter on Meteorites**

*By S. J. Shand. 2 ed. rev. & enl. John Wiley & Sons, New York; Thomas Murby & Co., London, 1943. 444 pp., illus., diagrs., maps, charts, tables, 8½ x 5½ in., cloth, $5.00.*

The early chapters discuss the composition of eruptive rocks and the formation of natural rock-magmas. Later chapters present a classification of eruptive rocks, a system of petrography, and quantitative descriptions of illustrative examples of the main types of eruptive rocks, together with their occurrence and genesis. A considerable amount of detailed information about meteorites forms the final chapter.

**FUNDAMENTALS OF RADIO for Those Preparing for War Service**

*By L. O. Gorder, K. A. Hathaway and C. H. Dunlap. American Technical Society, Chicago, 1943. 373 pp., illus., diagrs., charts, tables, 8½ x 5½ in., cloth, $2.00*

This textbook is intended for a first-level course following the War Department's recommended outline. It covers general electrical and radio theory, the principles and use of basic radio equipment, acoustics and acoustical apparatus, and the construction of transmitters and receivers. A glossary of terms is included.

**HYPER AND ULTRAHIGH FREQUENCY ENGINEERING**

*By R. I. Sarbacher and W. A. Edson. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 644 pp., illus., diagrs., charts, tables, 9 x 5½ in., cloth, $5.50.*

All phases of hyper-frequency engineering are discussed in considerable detail, including the generation, transmission and reception of quasi-optical waves. Following the basic electromagnetic theory are chapters on wave guides, transmission line theory, cavity resonators, horns and reflectors, vacuum-tube behavior and applications of tubes. A large bibliography is included.

**(An) INTRODUCTION TO HEAT ENGINES**

*By A. E. Allcut. University of Toronto Press, Toronto, Canada, 1943. Paged in sections, illus., diagrs., charts, tables, 9½ x 6 in., cloth, $2.75.*

This book provides a concise, interesting introduction to the field of heat engines in which the existence of the same general scientific principles in all types is indicated. Each chapter is illustrated by applications to steam engines, turbines, air compressors and internal-combustion engines, their similarities as well as their differences being pointed out. Chapter four is an excellent brief historical survey.

**THE J. & P. SWITCHGEAR BOOK, being an Outline of Modern Switchgear Practice for the Non-Specialist User, Vol. 2**

*By R. T. Lythall. 1st ed. Johnson & Phillips Ltd., Charlton, London, S.E.7, 1943. 227 pp., illus., diagrs., charts, tables, 9 x 6 in., cloth, 15s. plus postage.*

The new volume of this well-known work on switchgear is planned, like the first to supply practical information for the needs of non-specialists. Volume 2 supplements volume 1 by covering some items omitted in it and by giving information on later developments.

**MANUAL OF INSTRUCTIONS ON PROPER FIRING METHODS in the interest of Fuel Combustion and Conservation, Air Pollution, Smoke Elimination**

*Smoke Prevention Association of America, 139 North Clark St., Chicago, 1943. 58 pp., illus., diagrs., charts, tables, 11 x 8 in., paper, free upon application (send $0.25 for mailing cost).*

The following eight papers by various authors are contained in this manual: Preventing spontaneous combustion in stored coal; How to reduce smoke from hand-fired furnaces; The service engineer; Underfeed stokers; Practical application of statistical methods for controlling coal quality; Overfire air performance applied to stationary plants; The modern spreader stoker; Chain grate stokers.

**METALLOGRAHPY OF ALUMINUM ALLOYS**

*By L. F. Mondolfo. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 351 pp., illus., charts, tables, 9 x 5½ in., cloth, $4.50.*

Four main sections cover respectively: the equilibrium diagram of aluminum alloys; the technique of macro- and micro-examination; the normal structure of the commercial alloys of aluminum; the effect of fabricating on the microstructure, with references to macrostructure and actual practices. Since the book is intended for the plant metallurgist rather than the student, no details are given on general metallurgy and metallography. There is a large, classified bibliography.

**ORGANIZATION FOR METROPOLITAN PLANNING, Four Proposals for Regional Councils**

*American Society of Planning Officials, Chicago 37, Ill., 1943. 73 pp., charts, 10 x 7 in., paper, $1.00.*

This pamphlet contains the four prize-winning essays in a national competition for the best proposal for the organization and operation of a regional council in a metropolitan area. They are presented to stimulate thinking upon a problem that is becoming increasingly acute as the tax base moves out from our cities, while these are called upon to provide social services upon an increasing scale.

**PATENT LAW for Chemists, Engineers and Students**

*By C. H. Biesterfeld. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 225 pp., 8½ x 5½ in., cloth, $2.75.*

The basic principles of our patent law are presented and illustrated by citation of and quotation from court decisions. The book is intended for persons without legal training who, in their daily work, are confronted at times with questions of patent law and practice.

**PHYSICAL CONSTANTS OF THE PRINCIPAL HYDROCARBONS**

*Compiled by M. P. Doss. 4th ed. Texas Company, New York, 1943. 215 pp., tables, 9 x 11 in., cloth, $3.75.*

The data contained in this volume are presented in tabular form, which simplifies their use and provides space for filling in values not now given but which may subsequently become available. Most of the aliphatic hydrocarbons so far isolated or synthesized are included; this holds true to a lesser degree for the other hydrocarbons, except that only the principal members of the polycyclic series are considered. Literature references are given for all values.

**PLANNING and POST-WAR PLANNING —STATE ORGANIZATIONS, Membership Directory, September, 1943**

*American Society of Planning Officials, Chicago 37, Ill. 34 pp., manifold copy, 11 x 8½ in., paper, $1.00.*

A directory of these organizations, giving the names of officials and members, and office addresses.

**PRACTICAL RADIO COMMUNICATION, Principles, Systems, Equipment, Operation**

*By A. R. Nilson and J. L. Hornung. 2 ed. McGraw-Hill Book Co., New York and London, 1943. 927 pp., illus., diagrs., charts, tables, 9 x 5½ in., fabrikoid, $6.00.*

Basic radio principles are concentrated in the first eight chapters of this comprehensive work. The practical application of these principles to aviation radio, broadcasting, and marine radio follow in the order given. Important additions in this edition include material on amplifiers, the cathode-ray oscilloscope, antenna arrays, ultra-high-frequency theory and practice, frequency modulation and direction finders.

**PROTECTIVE AND DECORATIVE COATINGS, Vol. 3**

*Prepared by a Staff of Specialists under the Editorship of J. J. Mattiello. John Wiley & Sons, New York; Chapman & Hall, London, 1943. 830 pp., illus., diagrs., charts, tables, 9½ x 6 in., cloth, $7.50.*

The third volume of this comprehensive work deals with the manufacture and uses of these coatings: Colloids in the paint and varnish industry, Oleoresinous vehicles, Oleoresinous paints, Water and emulsion paints, Lacquers, Printing inks, Luminescent coatings, Paint manufacturing processes, and Stains. The book is the joint effort of a number of specialists. It organizes the facts and theories of paint technology into a coherent, inclusive account, in which basic principles are stressed.

**SHIP OUTFITTER'S HANDBOOK**

*By E. M. Hansen. Cornell Maritime Press, New York, 1943. 291 pp., diagrs., charts, tables, 9½ x 6 in., cloth, $3.00, with Special Supplement of 17 Folding Plates.*

Intended for the beginner, this handbook covers the various jobs the outfitter is called upon to install. It gives full details of procedures and discusses shop work, ordering, preparing materials and the use of templates. Introductory chapters cover ship layout and blueprint reading and, in addition to the large number of explanatory drawings in the text, seventeen special plates are included in a supplement.

**TUNGSTEN, its History, Geology, Ore-Dressing, Metallurgy, Chemistry, Analysis, Applications and Economics. (American Chemical Society Monograph No. 94.)**

*By K. C. Li and C. Y. Wang. Reinhold Publishing Corp., New York, 1943. 325 pp., illus., diagrs., charts, tables, maps, 9½ x 6 in., cloth $7.00.*

This volume, by the leading authority on tungsten, covers its subject thoroughly. The geology of the ore deposits, ore dressing, metallurgy and chemistry are discussed. A chapter is devoted to analysis. Further chapters consider the industrial uses of tungsten, substitutes for tungsten in steel alloys and the economics of the tungsten industry. The chapters have useful bibliographies.

# PRELIMINARY NOTICE

**of Applications for Admission and for Transfer**

November 30th, 1943

The By-laws provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and selection of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

**Communications relating to applicants are considered by the Council as strictly confidential.**

The Council will consider the applications herein described at the January meeting.

L. Austin Wright, General Secretary.

*The professional requirements are as follows:—

**A Member** shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the Council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

**A Junior** shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year at the discretion of the Council if the candidate for election has graduated from a school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

**A Student** shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years, unless in the opinion of Council special circumstances warrant the extension of this age limit.

**An Affiliate** shall be one who is not an engineer by profession but whose pursuits, scientific attainment or practical experience qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

**FOR ADMISSION**

BLAYLOCK—PETER WOODBURN, of Shawinigan Falls, Que. Born at Maidenhead, England, Aug. 7th, 1912; Educ.: B.Sc., McGill Univ., 1934; grad. Member, Institution of Chem. Engineers, London; Member, Amer. Inst of Chem. Engineers; With the Shawinigan Chemicals, Ltd., as follows: 1934-36, chem. engr., plant research dept., design and operation of pilot plant equipm't. for the synthesis of organic chemicals from acetylene gas; 1936-39, chem. engr., operation dept., i/c operation and mtce. of acetic anhydride unit; 1939 to date, development engr., engrg. dept., i/c process design and development work.

References: M. Eaton, A. H. Heatley, H. J. Ward, H. K. Wyman, A. F. G. Cadenhead.

CARRICK—STANLEY MIRUS, of 365 Selkirk Ave., Winnipeg, Man. Born at Winnipeg, Man., Dec. 5th, 1911; Educ.: At present, in 4th year Civil Engineering, Univ. of Manitoba; 1926-28, rodman, C.N.R.; 1930, asphalt inspr., city engr.'s dept., Winnipeg; 1935 (summer), sprinkler system designer, Winnipeg; 1935-36, concrete and steel inspr., Winnipeg Sewage Disposal Plant; 1936-38, instru'mn., res. engr., etc., on Trans-Canada Highway; 1939, sales engr., Vulcan Iron Wks., Winnipeg; 1940-41, instru'mn., Dept. of Transport; 1941 (summer), group engr., Carter-Halls-Aldinger; 1941-43, junior engr., works and bldgs. branch, R.C.A.F., Winnipeg.

References: A. E. Macdonald, G. H. Heriot, N. H. Hall, W. F. Riddell, A. V. Taunton.

CZERWINSKI—WACLAW, of 3 Claxton Blvd., Toronto. Born at Czortkow, Poland, Nov. 16th, 1900; Educ.: Mech. Engr., Univ. of Lwow (Politechnika Lwowska), 1931; 1927-30, asst. prof. of statics and aerodynamics, Univ. of Lwow, Poland; 1930-33, tech. mgr. and owner of glider factory, Lwow; 1933-35, chief engr., tech. glider institute, Lwow; 1935-36, chief engr., military glider factory, Krakow; 1936-39, chief designer, national aeroplane factory, Biala Podlaska, Poland; 1940, designer, Devoitine Aeroplane Factory, Toulouse, France; 1940-41, designer, Polish Tech. group, Polish General Staff, London, England; 1941-42, project engr., De Havilland Aircraft Ltd., Toronto; 1942 to date, chief engr., Canadian Wooden Aircraft, Toronto.

References: C. R. Young, W. S. Wilson, C. F. Morrison, R. F. Legget, M. W. Huggins.

ELLIOTT—ROBERT BARRY of Brownsburg, Que. Born at Montreal, Que., Oct.4th, 1916; Educ.: B.Eng., McGill Univ., 1939; With the Northern Electric Co. as follows: 1936 (summer), elec. mtce. work, 1937 (summer), telephone relay inspection work; 1938 (summer), elec. mtce., install'n. and production work, Angus Shops, C.P.R.; With the English Electric Co., St. Catharines, Ont., as follows: 1939-40, production and test work on industrial elec. equipm't., 1940 (July to Dec.), preliminary design and estimating work, sales dept.; With Defence Industres Ltd., Brownsburg, as follows: 1941 (Jan.-May), inspect'n. foreman on metallic operations, 1941 (May to Aug), metal lab. engr., 1941-42, asst. production supervisor of metallic operations, 1942 to date, inspection supervisor, all operations.

References: J. W. Houlden, E. L. Johnson, G. W. Lawson.

GOLDWAG—DAVID, of 1290 Bernard Ave., Montreal. Born at Warsaw, Poland, Aug. 24th, 1903; Educ.: Diploma engr., Tech. Univ. of the Free City of Danzig, 1928; 1929-31, tech. mgr., automobile assembly plant and repair shops, "Iwa" Co. Ltd., Danzig; 1931-33, service inspr., truck and bus assembly and repairs, "Morris Commercial in Poland" Co. Ltd., Warsaw; 1933-38, tech. mgr., auto. assembly plant and repair shops, "Hudsexway" Automobile Co. Ltd., Danzig; 1938-39, tech. mgr., Polish-British Automobile Co. Ltd., Warsaw; 1940, tech. mgr., auto. repair shops, G. Bakas Automobiles, Kaunas, Lithuania; 1941-42, tool designer, Canadian Vickers Ltd.; at present, tool designer, propeller division, engrg. dept., Canadian Car & Foundry Co. Ltd., Montreal.

References: R. C. Flitton, P. G. Gauthier, W. H. Cook, L. Galler, W. Yack.

HAND—CARL EVERETT, of 238-21st St., Arvida, Que. Born at Blackfalds, Alta., Sept. 8th, 1914; Educ.: B.A.Sc., Univ. of B.C., 1939; 1937 (summer), student asst., topographical survey, Dept. of Mines & Resources; 1938 (summer), engr., R. W. Large Memorial Hospital, Bella Bella, B.C.; refinery operator on foreign contract with Bahrein Petroleum Co., Persian Gulf., as follows: 1939-40, shift operator, 1940-41 (Mar.), water tender, steam plant, 1941 (Mar.-Sept.), shift operator, 1941-42, water tender, power plant; 1942 to date, shift engr., Arvida Sub-Station, Aluminum Co. of Canada.

References: J. N. Finlayson, H. J. MacLeod, C. Miller, P. E. Radley, R. M. Fullerton.

LAMOUNTAIN—GEORGE WILLIAM, of Arvida, Que. Born at Champlain, N.Y., June 10th, 1888; Educ.: B.Sc., U.S. Naval Academy, 1912; 1908-12 (summers), practical cruises on board battleships of the U.S. Navy; 1912-24, gen. asst. engr. to chief engr., various types of ships in the U.S. Navy; retired from U.S. Navy Oct., 1926; 1927-32, with Duke Price Power Co., and 1932-39, supt. of properties, Duke Price Power Co. (now Saguenay Power Co. Ltd.); with the Aluminum Co. of Canada, Ltd. as follows: 1939-42, personnel mgr., 1942 to date, supt. of properties, Arvida, Que.

References: A. W. Whitaker, McN. DuBose, C. Miller, A. C. Johnston, M. G. Saunders, J. L. E. Price.

LIMOGES—JACQUES, of Beauportville, Que. Born at Ste. Anne des Plaines, Que., June 17th, 1908; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1932; R.P.E. Que.; 1928-30 (summers), articled pupil to topographical survey branch, Dept. of Interior, Ottawa; 1931 (summer), instru'mn., Dept. of Highways, Que.; 1932-33, sales engr., Wallace & Tiernan, Ltd., Montreal; with the Dept. of Highways, Quebec, as follows: 1933-34, res. engr., 1934-36, asst. divnl. engr., 1936-40, divnl. engr., Amos, 1940 to date, principal engr., District No. 1, Quebec.

References: Ernest Gohier, A. Larivière, H. Cimon, René Dupuis, Paul Vincent.

LITTLE—ELLIOTT MENZIES, of 81 Gilmour Hill, Quebec, Que. Born at Beachburg, Ont., Oct. 7th, 1899; Educ.: B.A.Sc. (Elec.), Univ. of Toronto, 1925; With the Abitibi Power & Paper Co., Iroquois Falls, Ont., as follows: 1925-28, plant elec. engr., 1928-32, asst. hydraulic engr.; With the Anglo-Canadian Pulp & Paper Mills, Ltd., Quebec, as follows: 1932-40, gen. supt., 1940 to date, gen. mgr. and 1941 to date, president and gen. mgr., Gaspesia Sulphite Co. Ltd.

References: E. D. Gray-Donald, L. E. Westman H. W. Lea, C. R. Young, P. S. Gregory.

McKEOWN—LEWIS AUSTIN, of 1535 Bernard Ave., Outremont, Que. Born at Quebec City, Dec. 29th, 1916; Educ.: B.A., Loyola College, 1937; L.Sc. Univ. of Montreal, 1940; With the Aluminate Chemicals, Ltd., Toronto, as follows: 1941 (June-Dec.), asst. in service work with chem. products for industrial water treatment, 1941 to date, service representative for eastern district extending from Kingston to Halifax; also install'ns., plant survey, recommendations for type and quantity of chemicals, feeding devices and equipm't.

References: G. R. Connor, C. B. Jackson, H. M. Esdaile, G. F. Layne, H. C. Karn, C. R. Bown.

McLEAN—GLEN ROLAND, of 11932 Valmont St., Bordeaux, Que. Born at Edmonton, Alta., June 3rd, 1916; Educ.: B.Sc. (Chem. Engrg.), Univ. of Alberta, 1940; 1937-38, timekeeper, H. G. Macdonald & Co., General Contractors; 1940, lab. asst., Powell River Pulp & Paper Co.; 1940-41, chemical inspection, (Military Explosives Div'n.), United Kingdom Technical Mission; 1941-42, chemical and ballistic inspection, British Supply Board, Chickasaw Ordnance Works, Memphis, Tenn.; 1942-43, asst. to Inspector in charge, New Jersey Powder Co., Belvedere, N.J.; 1943 to date, tech. service engr., plastics div'n. (specialty resins), Monsanto (Canada) Ltd., Montreal, Que.

References: C. A. Robb, A. W. Haddow, R. S. L. Wilson, R. M. Hardy, I. F. Morrison.

ROSS—JOHN HENRY, of 4 Jackson Avenue, Toronto, Ont. Born at Orillia, Ont., June 11th, 1908; Educ.: B.Sc. (Mech.), Queen's Univ., 1935; R.P.E. Ont.; 1935-36, dftsmn., Canadian Kodak Co. Ltd., Toronto; 1936-37, junior engr., Can. Nat. Carbon Co. Ltd., at Toronto, Ont., and at Cleveland, Ohio; 1937-38, works engr., Eveready S.A., Buenos Aires, Argentina; 1938-39, plant engr., ordnance div'n., John Inglis Co.,

# Employment Service Bureau

**The 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. Notices appearing in the Situations Wanted column will be discontinued after three insertions, and will be re-inserted upon request after a lapse of one month. All correspondence should be addressed to THE EMPLOYMENT SERVICE BUREAU, THE ENGINEERING INSTITUTE OF CANADA, 2050 Mansfield Street, Montreal.**

## SITUATIONS VACANT

MECHANICAL ENGINEER, graduate of about one year's standing required by stable industry essential to war work, for draughting, design and study work on mechanical and other maintenance problems. Location south-western Ontario. Apply to Box No. 2682-V.

MECHANICAL ENGINEER for a large pulp and paper company in the province of Quebec. Mill located near Ottawa. Applicant should have good knowledge of paper mill design and layout. Do not apply if a technical person within the meaning of P.C. 246, Part III (Jan. 19-43) unless your services are available under the regulations administered by the Wartime Bureau of Technical Personnel. Reply stating age, experience, and salary expected to Box No. 2687-V.

WANTED—We have an opening in our filtration department for a mechanical, metallurgical or chemical engineer or a man with equivalent technical training or qualifications. This job requires the services of a man to handle test work, sales and servicing of Oliver paper mill filters, deckers, bleach washers, savealls, etc. Knowledge of and experience in the pulp and paper industry along with an engineering background enabling applicants to solve filtration problems is required. This is a permanent position. Do not apply unless your services are available under regulations P.C. 246 Part III (Jan. 19-43) administered by the Wartime Bureau of Technical Personnel. Apply to E. LONG LIMITED, Orillia, Canada.

CITY ENGINEER—The City of St. John's, Newfoundland, requires the services of a fully qualified city engineer. Applications for the position, addressed to the undersigned, will be received up to January 1st, 1944. Applicants are required to state age, qualifications, experience and references. J. J. Mahony, City Clerk.

## SITUATIONS WANTED

GRADUATE CIVIL ENGINEER, age 55, over thirty years' experience as engineer and construction executive in charge railway, highway, bridge and foundations and general heavy construction projects. Capable of taking charge organization and management. Wishes to make permanent connection with view to immediate and post-war developments. Apply to Box No. 279-W.

GRADUATE ELECTRICAL ENGINEER, B.Sc.E.E., 1933, University of Manitoba. Experience in design, layout, installation, supervision of industrial electrical power, distribution systems; high tension overhead and underground transmission systems; outdoor and indoor substations. Design and layout of commercial and industrial lighting systems covering incandescent, fluorescent and cold cathode installations. Available on short notice. Apply to Box 2099-W.

GRADUATE B.Sc., Jr.E.I.C., age 27, executive and administrative ability, keenly interested in fields of industrial engineering and chemistry. Engineering office and laboratory experience, all around technical training. Bilingual. Presently employed, but war conditions necessitate change. Apply to Box No. 2445-W.

ELECTRICAL ENGINEER, B.Sc. '37, M.E.I.C. Age 33, married. Six years' experience covering power station and paper mill operation and maintenance, includes main dam reconstruction, highway, railway, water canal and snow surveys, construction design and layout for paper mill buildings, machinery, piping, high and low voltage, power distribution, assistant superintendent. Previous to graduation, five years experience as electrician's mate, departmental records, time and cost studies. Wants opportunity where knowledge and experience can be used to better advancement. Apply to Box No. 2457-W.

CIVIL ENGINEER, 45 years old, married, experienced in all types of industrial and heavy construction, railways bridges, water supply, etc., desired permanent position. Available December first. Apply to Box No. 2458-W.

CIVIL ENGINEER, M.E.I.C., age 28, married. Experienced in highway and airdrome construction, sewer and waterwork, construction of buildings, steam and hot air heating. Desires position with consulting engineer, municipal engineer or general contractor in prairie provinces or western Ontario. Available January 1st, 1944. Apply to Box No. 2459-W.

## Mechanical and Electrical Engineer Wanted

**For the position of assistant superintendent of the Department of Buildings and Grounds, with the ultimate view of assuming the office of superintendent, for a large educational institution in the province of Quebec. Preferred age, 30 to 35 years. The duties involve, among other things, the inspection of buildings and attached services so that an annual budget can be prepared for the operation and maintenance of two light, heat and power plants and some fifty buildings and their adjacent campuses; the consultation with deans of faculties, wardens of dormitories and heads of departments for the provision of such information as they may require. Applicants must give age, nationality, education, training experience and references, indicate availability, include recent photo, and mail before February 28th, 1944, to Box No. 2688-V.**

---

Toronto, Ont.; 1939-40, asst. mech. engr., Hydro-Elec. Power Comm. of Ont.; 1940 (Feb. to Sept.), project engr. (Nobel), D.I.L.; 1940 (Sept. to date), works engr. and security officer, Small Arms, Ltd., Long Branch, Ont.

References: D. S. Ellis, A. Jackson, L. M. Arkley, L. T. Rutledge.

SIMSON—FRED THOMAS, of Toronto, Ont. Born at Galt, Ont., March 19th, 1898; Educ.: B.A.Sc., Univ. of Toronto, 1923; R.P.E. of Ontario; With the hydraulic dept., Hydro-Elec. Power Comm. of Ont., as follows: 1923-24, dftsmn., 1924-26, asst. test engr.; 1927, mtce. engr., U.S.L. Battery Corp'n., Niagara Falls, N.Y., responsible for all plant mtce. and install'n. of new equipm't.; 1928-37, asst. mech. engr., Canadian & General Finance Co., Toronto, Ont., superv'n., design of hydraulic and mech. equipm't. for power house and constrn. mach.; 1938, acting chief mech. engr., San Paulo Tramway, Light & Power Co., Brazil; 1939 to date, hydraulic engr. and asst. mech engr., Canadian & General Finance Co., Toronto, Ont.

References: O. Holden, S. W. Black, J. J. Traill, A. W. F. McQueen, H. R. Brownell.

THERIAULT—ANTONIN, Brigadier, C.B.E., of Artillery Park, Quebec. Born at Rimouski, Que., May 10th, 1887; Educ.: B.A.Sc., C.E., M.E., Ecole Polytechnique, 1910; 1907-10 (summers), survey for the Dept. of National Defence, Ottawa; 1910-14, survey and military engrg., Dept. of National Defence, Ottawa; 1914-18 (overseas); 1918-20, College of Science, Woolwich, England, grad. p.a.c. and attached to Woolwich Arsenal; With the Dominion Arsenal, Quebec, as follows: 1920-36, asst. supt., 1936-40, supt., and 1940 to date, chief supt. of arsenals and office in Quebec.

References: A. G. L. McNaughton, A. R. Décary, J. Ruddick, J.-E. St. Laurent, A. Frigon, A. Larivière, A. Laframboise.

WALLACE—JOSEPH WILLIAM, of 23 Bannerman Ave., Winnipeg, Man. Born at Ottawa, Ont., March 9th, 1895; Educ.: 1920-24, Civil Engrg., Univ. of Manitoba; 1916-18, jr. concrete inspr., G.W.W.Dist., Winnipeg; 1920, rodman, Winnipeg Beach Highway; 1921, concrete inspr., Pt. du Bois Power House and Man. Good Roads; With the C.N.R., Winnipeg, as follows: 1924-31, asst. to res. engr., bridge dept., 1931-40, in various capacities, track welding work; 1940-41, engrg. dept., God's Lake Gold Mine; 1941-42 inspr., surveying and airfield constrn., civil aviation divn., Dept. of Transport; 1942 to date, bldg. inspr., R.C.A.F. (Civil) No. 7, Air Observers' School, Portage La Prairie, Man.

References: W. M. Scott, A. E. Macdonald, J. A. Macgillivray, C. V. Antenbring, N. M. Hall.

WOODALL—GORDON, of Toronto, Ont. Born at Winnipeg, Man., Dec. 14th, 1917; Educ.: B.A.Sc., Univ. of Toronto, 1941; 1941 to date, designing struct'l. engr., for E. A. Cross, consltg. struct'l. engr.

References: E. A. Cross, R. F. Legget, D. Shepherd, S. H. de Jong, E. R. Graydon.

### FOR TRANSFER FROM STUDENT

CODD—PERCY, of Chatham, N.B. Born at Moose Jaw, Sask., June 5th, 1916; Educ.: B.Eng., Univ. of Sask., 1939; 1939-41, research assistant, Hudson Bay Mining & Smelting Co.; 1941-42, 1st chemist, Defence Industries, Ltd.; at present U/T Navigator "B", No. 10 A.O.S., Chatham, N.B., with rank of L.A.C. (St. 1940)

References: I. M. Fraser, C. J. Mackenzie, R. A. Spencer, E. K. Phillips, W. E. Lovell.

DRYNAN—DAVID ALAN, of 10 Anne Street, Peterborough, Ont. Born at Winnipeg, Man., March 12th, 1914; Educ.: B.Sc. (Elec.), Univ. of Man.; with the Can. Gen. Elec. Co. Ltd. as follows: 1935-36, test course, 1936-37, ind. motor engrg. dept., 1937 to date, asst. switchgear engr., Peterborough, Ont. (St. 1936)

References: G. R. Langley, B. I. Burgess, D. V. Canning, V. S. Foster, W. M. Cruthers.

DUNN—RUSSELL ARTHUR, of Toronto, Ont. Born at Montreal, June 14th, 1916. Educ.: B.Eng., McGill Univ., 1938; Summers: 1936, Engrg. Road Materials; 1937, Consolidated Mining & Smelting; With Canadian Liquid Air Co. Ltd., Toronto, as follows: 1939-41, field engr., field supervisor, equipment installation, and 1941 to date, asst. Manager, Ontario, i/c all process promotion outside technical operations and rendering of service. (St. 1939)

References: F. W. Cooper, E. Brown, J. R. Stewart, C. S. Kane, A. Scott.

GAUTHIER—GASTON-C., of Saint-Joseph-de-Sorel, Que. Born at Montreal, Que., May 18th, 1914; Educ.: B.A.Sc., C.E., Ecole Polytechnique, 1942; R.P.E. Quebec; 1941 (summer), mining; 1942 to date, time study on prodn. for electrical instlln. on ships, Marine Industries, Ltd., Sorel, Que. (St. 1939).

References: J. A. Lalonde, S. A. Beaulne, A. Circé.

LUSCOMBE—WILLIAM CHARLES MURRAY, of 154 Dover St., Arvida Born at Sarnia, Ont., June 21st, 1914; Educ.: B.Sc., Queen's Univ., 1941; 1938-40 (summers), H.E.P.C. of Ont.; 1941-42, Canadian General Electric Co.; 1942-43, shift engr. i/c rectifier station, and 1943 to date, mtce. engr., Arvida Works, Aluminum Co. of Canada. (St. 1941).

References: D. M. Jemmett, D. S. Ellis, J. Cameron, A. L. Malby, A. T. Cairncross.

PASQUET—PIERRE AUGUSTE, of Niagara Falls, Ont. Born at Geneva, Switzerland, June 12th, 1918; Educ.: B.Sc. (Civil), Queen's Univ., 1942; 1939-41 (summers), highway constrn., Frontenac County, instr'man., airport constrn., McGinnis & O'Connor, and asst. engr., rainbow bridge, for Hagey & Gray, consltg. engrs., Fort Erie; 1942 to date, designing engr., H. G. Acres & Co., Niagara Falls, Ont. (St. 1941).

References: H. G. Acres, J. H. Ings, H. E. Barnett, D. S. Ellis, R. A. Low.

SCHWARTZ—HARRY H., of 2210 Dorchester St. W., Montreal, Que. Born at Montreal, Oct. 31st, 1916; Educ.: B.Eng. (Elec.), McGill Univ., 1938; S.M., Mass. Inst. Tech., 1942; 1938-41, design of radio receiver equipment, etc., Canadian Marconi Co.; 1941-42, lab. asst., divn. of industrial co-operation, Mass. Inst. Tech.; 1942 to date, design of radio equipment, Northern Electric Co. Ltd., Montreal, Que. (St. 1937.)

References: L. Schector, E. S. Kelsey, J. J. H. Miller, C. A. Peachey, L. A. Duchastel.

SOLOMON—JULIUS DENISON, of 76 Proctor Blvd., Hamilton, Ont. Born at Dartmouth, N.S., March 22nd, 1921; Educ.: B.A.Sc. (Civil), Univ. of Toronto, 1942; 1940 (summer), ship's fitter, etc., Halifax Shipyards Ltd.; 1941 (summer), design and drfting., and 1942 to date, development engr., on design of armoured fighting vehicles, Hamilton Bridge Co. Ltd., Hamilton, Ont. (St. 1942).

References: W. P. Copp, H. R. Theakston, C. R. Young, R. F. Legget, H. J. A. Chambers, W. S. MacNamara, L. S. MacDonald.

WOODFIELD—PERCY RAYMOND, of 65 Robert St., Ottawa, Ont. Born at Winnipeg, Man., Nov. 12th, 1916; Educ.: B.Sc. (Elec.), Univ. of Man., 1939; 1936-38 (summers), helper mechanic and dftsman., Canadian Airways Ltd., Winnipeg; 1939 (summer), engrg. dept., City of Winnipeg; 1939-40, demonstrator, elec. machy. lab., Univ. of Man.; 1940-41, ap'tice, Canadian Westinghouse Co. Ltd., Hamilton, Ont.; 1941 to date, engr. officer, Flight-Lieut., R.C.A.F., Ottawa, Ont. (St. 1938).

References: E. P. Fetherstonhaugh, N. M. Hall, G. H. Herriot, A. Ferrier, G. Gould.

# Industrial News

## Industrial development — new products — changes in personnel — special events — trade literature

### EXPANSION JOINTS

Dominion Rubber Co. Ltd., Montreal, Que., have for distribution a 16-page catalogue describing the uses and general characteristics of "Dominion Rubber Expansion Joints" designed to avoid excess stresses due to expansion, contraction or vibration in pipe lines and miscellaneous mechanical equipment. Photographs of applications, cross-section drawings, test charts and dimensional tables are provided to make selection easy.

### CONVEYERS

Mathews Conveyer Co. Ltd., Port Hope, Ont., have issued a 32-page catalogue which is a compendium of information relating to materials handling in the brick, lumber and building industries. Its contents include illustrations of complete conveyer sections, enlarged and cut-away views, showing the details of the construction of individual rollers and wheels, also engineering drawings of all principal structural members used in the fabrication of the types of conveyers covered in the catalogue. Field photos of construction materials actually being handled in the conveyers provide an adequate idea of the capacity of this equipment to relieve manpower and reduce materials handling costs.

### HYDRAULIC PRESSES

Dominion Engineering Co. Ltd., Lachine, Que., have issued a 12-page article describing a new rapid-action self-contained hydraulic press developed for wartime industries in Canada. Since it employs oil as the pressure medium the power unit is of special interest. The operations for which the press is particularly adapted, namely, drawing, denting and loading cartridge cases, are described in some detail, as are also the methods of press control.

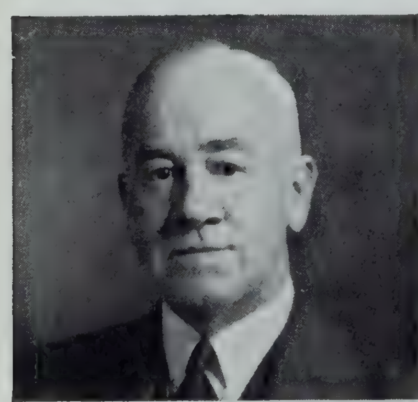
### MANUFACTURING RIGHTS

Through their office in London the Meehanite Metal Corporation announces the granting of manufacturing rights for Meehanite castings to the Indian Hume Pipe Company, Wadala, India.

### RECENT APPOINTMENT

Mr. A. C. Lewis has been appointed vice-president in charge of sales for Templeton Kenly & Company, Ltd., Chicago, Ill.

Mr. Lewis came to Canada in 1912 to open the Canadian manufacturing plant of this company, and after serving in World War 1 with the Canadians, he continued the distribution of the company's Simplex jacks through his own manufacturer's agency. A decade later this firm was taken over by Railway & Power Engineering Corp. Ltd., with Mr. Lewis as special sales representative. In his new capacity Mr. Lewis will continue contacts with Canadian distributors.



A. C. Lewis

### POST-WAR RECONSTRUCTION

Coming at a time when fast-moving war developments are focussing public attention more and more upon post-war employment prospects, the formation, here in Canada, of the Heavy Industries Federation is an event of unusual significance.

The Federation has been organized specifically to blueprint maximum employment through high levels of productivity in the years that will follow Victory. It is a free and voluntary effort on the part of industry to provide machinery necessary to plan and operate a programme of post-war economic and social stabilization.

The Heavy Industries Federation has been established in the belief that, despite the driving demands of war, the time to plan for post-war readjustment and rehabilitation is now. It is industry's acknowledgment of the fact that only by planning boldly and effectively can a bridge be forged strong enough and broad enough to carry the national economy safely and smoothly through the post-war period and set it upon an unbroken road of peacetime economic stability.

Estimates reveal that the ending of the war will release more than 1,500,000 Canadian men and women from war jobs in munitions plants and in the armed services. Even allowing for the maintenance of a peacetime military establishment greater than that of pre-war years and reckoning upon the return to domestic life of many women war workers and the retirement of many over-age men, Canada must still be confronted with the greatest employment problem in its history.

While it may well be argued that responsibility for employing this great post-war army of men and women should not fall entirely upon industry, yet, if free enterprise is to justify its continued existence, then industry must shoulder a full share of this responsibility.

Organization of the Heavy Industries Federation involves the establishment of a central industrial committee, of regional boards and of regional sub-committees for research, field development and particularized planning. The Federation will act as a clearing house for all post-war projects involving the capital goods industries. Contact is being made with other agencies concerned with post-war problems—industrial, governmental and municipal—with a view to co-operation and avoidance of duplication.

The activities of the Federation will be keyed essentially to the objective of providing jobs in private industry. Within this field it will seek to set up mechanisms which will be of real assistance to industry in the approaching period of post-war readjustment.

Typical fields in which the central committee and its sub-committees will be concerned will include the reconversion of war plants and the conversion of government-owned buildings to peacetime usage. It will explore the possibilities of federal and municipal public works. It will seek to provide guidance with regard to the disposal of surplus stocks and salvage.

The organizers of the Heavy Industries Federation acknowledge the magnitude and difficulties of their task. They hope, however, by securing the support of the Dominion's leading industrial concerns, to develop a programme which can contribute substantially to the maintenance and development of a free economy for Canada in the years that will follow the war.

Endorsement of the Federation has already been indicated by many important Canadian industrial associations. Members of Federal and Provincial Government Commissions have already endorsed the tentative plans of the Federation.

### VARIABLE VOLTAGE PLANER DRIVE

Canadian Westinghouse Co. Ltd., Hamilton, Ont., have issued a 12-page bulletin which presents characteristics of the company's variable voltage planer drive and contrasts these with comparable characteristics and performance of a constant voltage drive. The illustrations show installations of variable voltage planer drives and the design features of their component mechanisms consisting of a pendant push-button station, field rheostat, limit switches, control panel, motor-generator and drive motor.

### CHANGE IN NAME

According to a recent announcement, Staynew Filter Corporation of Rochester, N.Y., will henceforth be known as Dollinger Corporation. There is no change in the management, financial organization or general policies of the company.

### FERROUS AND NON-FERROUS RINGS

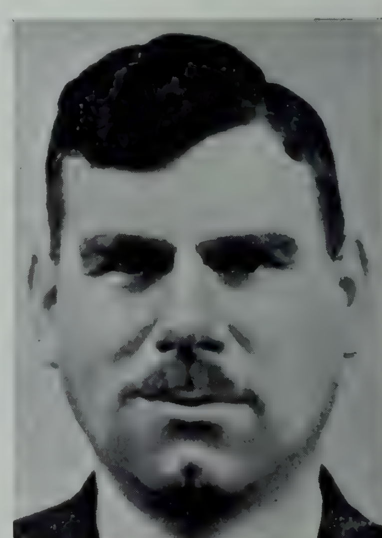
Dresser Manufacturing Company, Ltd., Toronto, Ont., have issued a 24-page catalogue, which describes and illustrates the company's facilities and capacity for producing large quantities of rings from ferrous and non-ferrous metals. Twenty-two different types of rings, flanges, bands or rims are shown made by various methods including cold formed, cold rolled, cold pressed, hot formed, hot forged, and hot pressed.

### PACKING SETS

Anchor Packing Co. Ltd., Montreal, Que., have issued a folder describing five types of automatic pressure sealing packing sets, each specifically fabricated according to the type of service for which intended, including hydraulic, oil, air and gas, acids and alkalis, and solvents. Included are diagrams showing methods of measuring for and installing these packings and a schedule of ring sizes.

### GOODYEAR APPOINTMENT

Mr. A. E. Smith has been appointed manager of mechanical rubber goods sales in the prairie provinces for the Goodyear Tire & Rubber Company of Canada, Ltd. Mr. Smith's twenty-five years of service with Goodyear have centred in and around Winnipeg and Fort William, and his duties will now expand to cover Winnipeg, Regina, Saskatoon, Calgary and Edmonton territories.



A. E. Smith