PAGES

MISSING

The Canadian Engineer

A weekly paper for Canadian civil engineers and contractors

Reinforced Concrete Railway Trestle at Toronto

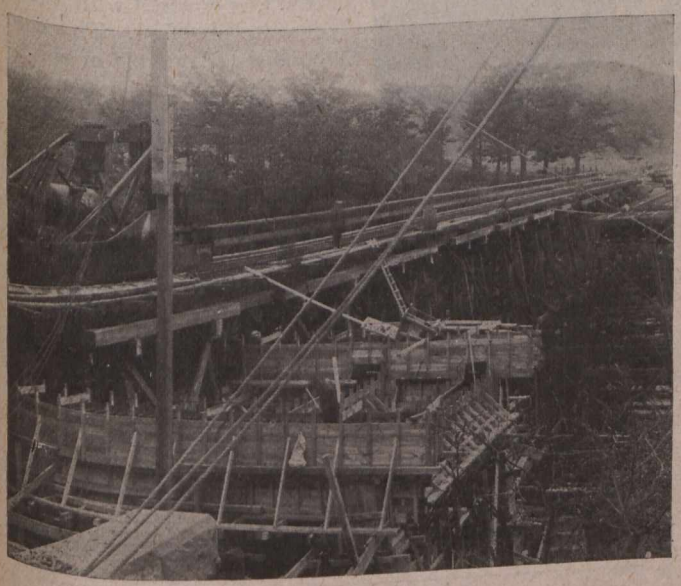
New Three-Track Structure Spans the Rosedale Ravine on the North Toronto Subdivision of the Canadian Pacific Railway—Premoulded Concrete T-Slabs Rest on Concrete Bents Supported on Concrete Spread Footings

By ARTHUR F. WELLS, B.A.Sc.,
of Wells & Gray, Ltd., Engineering-Contractors, Toronto

ABOUT one mile east of the Canadian Pacific Railway Company's station at North Toronto, a single track formerly crossed the Rosedale Ravine near Summerhill Avenue on a steel trestle. As traffic increased on this line, the trackage facilities became insufficient and it was decided to span the ravine at this point with a new, three-track trestle. In designing the structure for three tracks, provision was being made not only for present needs but also for a probable still greater increase of business over these lines in the comparatively near future.

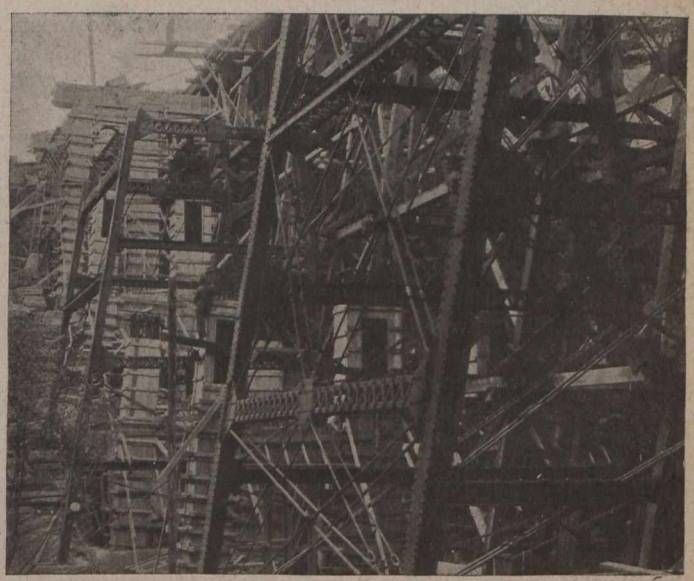
In view of its location, it was necessary to give due consideration to the aesthetic features of the design of the new structure. The ravine to be spanned is a continuation southwards of Reservoir Park, and is largely used in the summer months by a great number of citizens as a resting place and recreation grounds. The utilitarian was therefore not the only consideration in choosing a suitable design and the present reinforced concrete structure seems more in harmony with its surroundings than the former steel structure.

A general plan and elevation of the trestle is shown in Fig. No. 1. The clear height from top of concrete foundation to base of rail is 82 ft. 7 ins. The length from face to face of ballast walls is 368 ft., and the width out to out of concrete coping blocks is 41 ft. The general design is concrete spread footings supporting concrete bents on which rest the premoulded concrete T-slabs.



Temporary Timber Trestle

The details of the foundation are shown in Fig. No. 4. The nature of the soil remains practically unchanged across the whole ravine bottom, and the creek is too small to require to be taken into consideration. The bearing value of the soil was determined by comprehensive tests, by means of tables and weights, at each end of each pier. The necessary spread of the footing was then calculated accordingly. Near the top of the footing, seven-eighths inch round reinforcing bars, placed longitudinally, distribute the stresses transmitted from the bent posts and give additional security against unequal settlement. One and one-eighth inch round anchor bars, eight feet long, bond the superstructure to the foundation. There are one hundred and twelve anchor bars in each pier.



First Concrete Bents and Part of Old Steel Trestle

The reinforcing bars are medium open-hearth steel. The concrete is mixed in the proportions of one part of Portland cement to two parts of washed sand to four parts of broken stone.

The bents of the superstructure are spaced alternately 34 ft. and 36 ft. Each bent consists of four posts braced by struts, as shown in detail in Fig. No. 3. The bents themselves are braced longitudinally in pairs. The reinforcing in the batter posts consists of twenty-four round bars varying in size from seven-eighths to one and one-

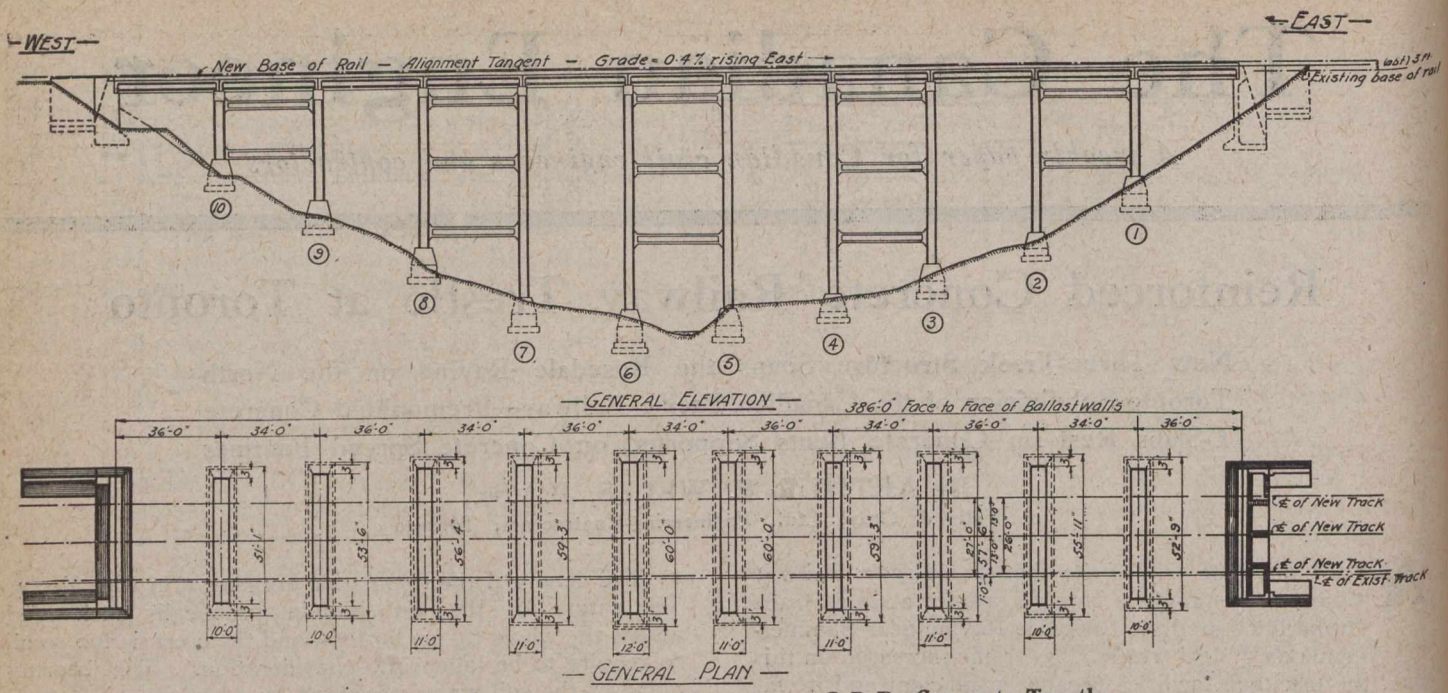
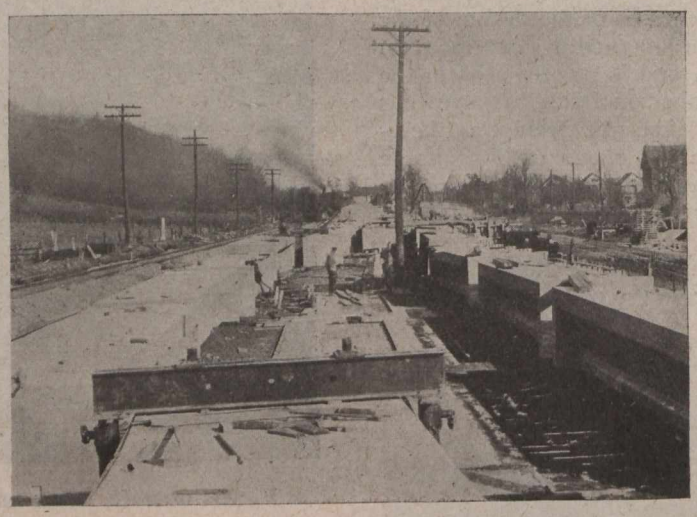


Fig. No. 1—General Plan and Elevation, C.P.R. Concrete Trestle

eighth inch. In the vertical posts the reinforcing consists of thirty-two bars of the same diameters. The outside post is battered one in twelve. All corners above ground are rounded off to a two-inch radius and the panelling of both posts and struts gives a particularly pleasing effect.

The ballast walls are each spaced thirty-six feet from the last bent and are of the standard retaining wall type.

The T-slabs which constitute the floor system were moulded on a site adjoining the railway track, a short distance east of the trestle. One concrete-mixing plant and special forms were used on this portion of the work exclusively. Referring to Fig. No. 2, it will be noted that in preparing the design, special attention was paid to the shearing stress in these slabs. Bent-up bars and stirrups, at comparatively close spacing, have been provided. These T-slabs are six feet high from bridge seat to base of rail. The outer slab carries an additional load of the coping blocks and the sidewalk brackets.



Pouring the Pre-moulded Concrete Slabs

The concrete throughout the entire superstructure is mixed in the proportion of one part of Portland cement, one and one-half parts of washed sand and three parts of broken stone. The reinforcing steel is placed as shown in detail in Figs. No. 2 and No. 3.

The deck of the trestle, consisting of the slabs described above grouted in place and anchored to the bents, is covered with a coat of waterproofing. This coat consists of one ply of waterproofing paper, lapped two inches; one ply of fifteen-pound bituminous felt, lapped two inches; two plies of unsaturated burlap, lapped half width; and one ply of bituminous felt, lapped two inches. All layers are mopped with bituminous cement, except the surfaces of contact with concrete slab or waterproof paper. The waterproofing is finished with a protective coat of three-quarters of an inch of mastic asphalt.

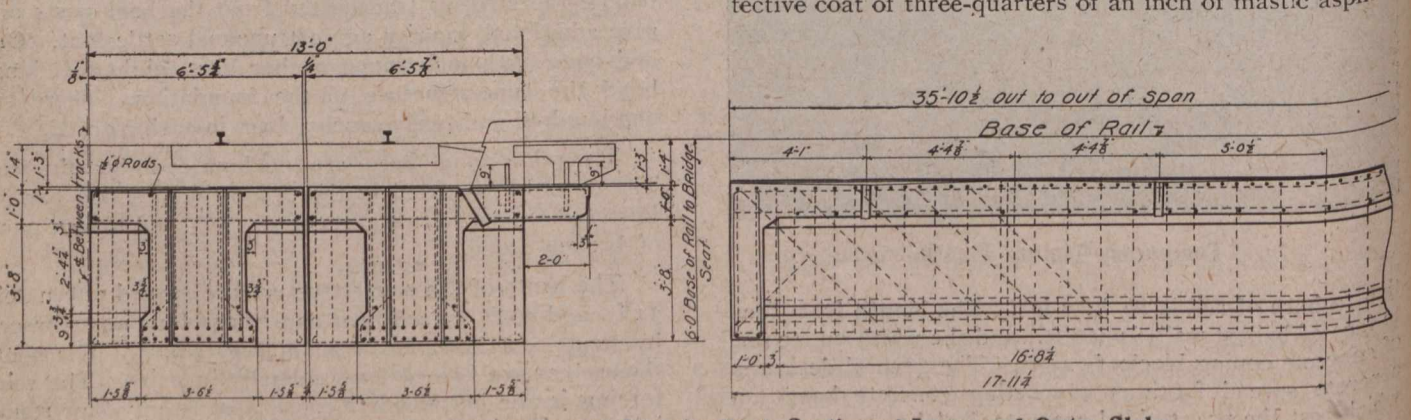
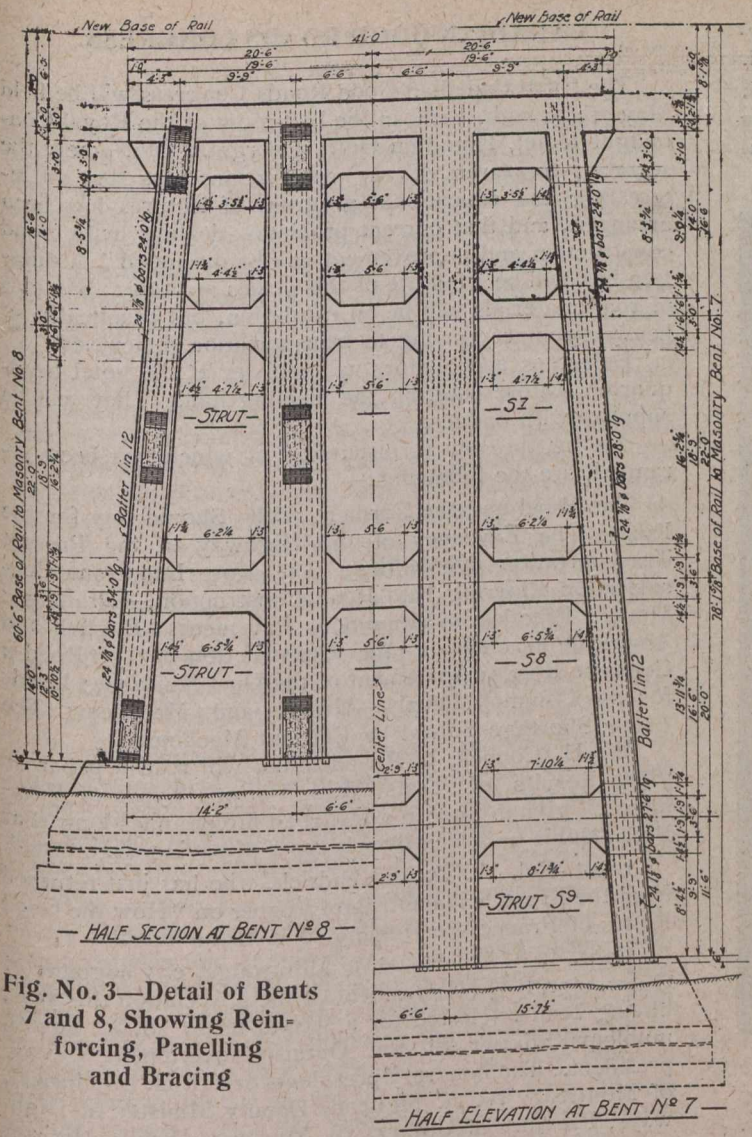


Fig. No. 2—Cross-Section and Longitudinal Section of Inner and Outer Slabs



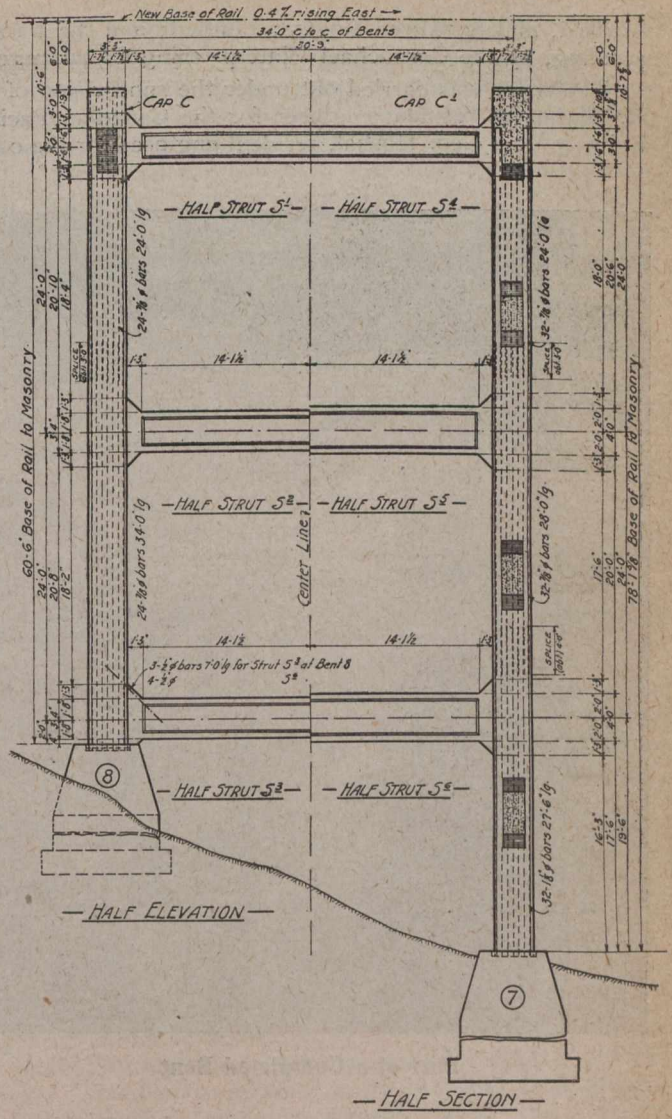


Fig. No. 3—Detail of Bents 7 and 8, Showing Reinforcing, Panelling and Bracing

The tracks are placed at thirteen-foot centres, and the ties are laid in broken-stone ballast. The axis of the bridge is east and west, and the alignment is all tangent, with a grade of 0.4 per cent. rising east.

The loadings for which the structure was designed were as follows:—

Dead load to consist of self weight of structure plus 500 lbs. per lineal foot of track, including rails, fastenings and ties.

Live load, Cooper's E-50 plus impact, the latter taken as 90 per cent. of $\frac{\text{L.L.} \times 300}{300 + y}$,

where L.L. = live load,
and y = loaded distance in feet.

Certain constructional difficulties were encountered during the carrying out of the work. It was necessary to erect a temporary wooden trestle so that single track traffic could be maintained across the ravine throughout the entire construction period. The old steel trestle was dismantled as the work on the new structure progressed.

One mixing plant was placed on each side of the ravine, and the concrete was carried to the forms in chutes. During freezing weather, double forms were placed around all concrete, and the intervening spaces were equipped with piping so that steam heat could be applied whenever necessary. The economy of construction consisted in being able to duplicate the use of the forms.

The structure contains in all 6,500 cu. yds. of concrete and 500 tons of reinforcing steel. It will be entirely completed about the end of next month.

The contractors are Wells & Gray, Limited, Toronto. The reinforcing steel was supplied by the Burlington Steel Co., Limited; the cement, by the Canada Cement Co.,

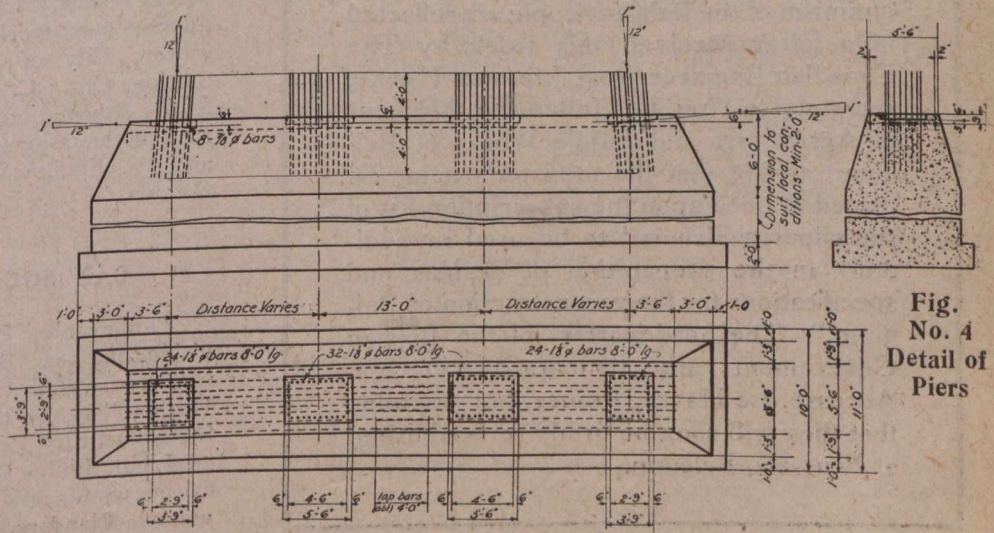
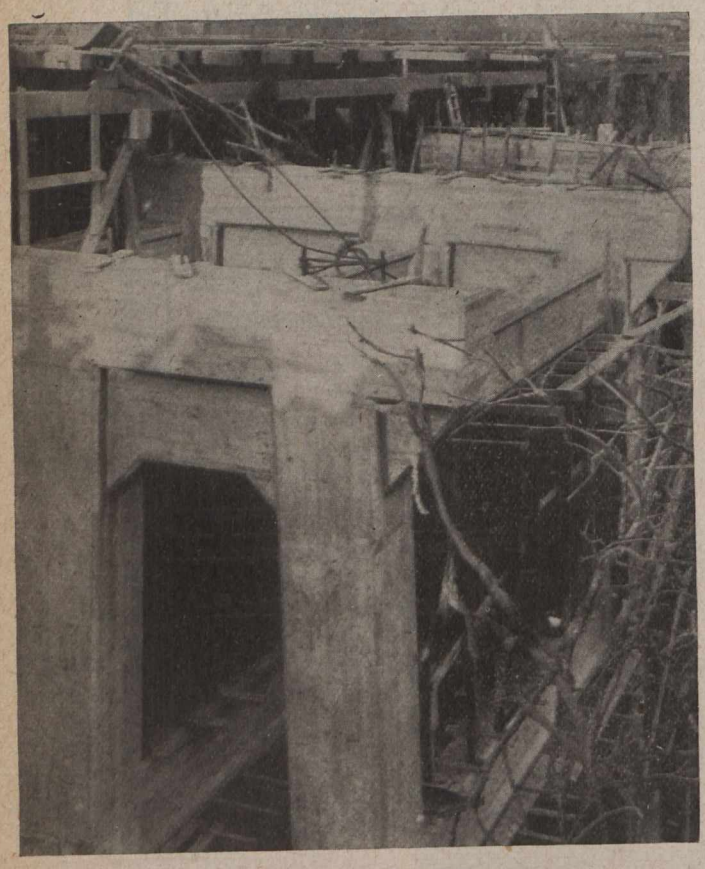


Fig. No. 4 Detail of Piers

Limited, and by Alfred Rogers, Limited; and the waterproofing, by the Carmichael Waterproofing Co., Limited.

The work was carried out under the supervision of J. H. Barber as resident engineer for the Canadian Pacific Railway Co.; Geo. Hoshal, resident engineer for the contractors; and Harry Rowe, superintendent for the contractors. The trestle was designed by the bridge engineering department of the Canadian Pacific Railway Co., at Montreal, under the direction of P. B. Motley.



Part of a Completed Bent

Reconstruction of Belgium

The magnificent courage and dauntless optimism of the Belgian people are reflected in a letter received this week by The Canadian Engineer from Alb. van Hecke, secretary to Hon. G. Helleputte, Minister of Agriculture and Public Works of Belgium, asking that the minister's name be placed at once upon the subscription list of the paper, which is "to be used immediately in the preparation of designs and specifications for the reconstruction of Belgium." The headquarters of the Belgian Government are temporarily at Ste. Adresse, Le Havre, France, but we hope that they will soon be firmly re-established at Brussels, Belgium.

CANADIAN GOOD ROADS CONGRESS

The Fifth Canadian Good Roads Congress will be held May 7th to 10th, 1918, in the ball-room at the Royal Connaught Hotel, Hamilton Ont. George A. McNamee, the secretary-treasurer of the association, says that an interesting and educational program of lectures has been arranged, and that current problems dealing with road construction and improvement will be discussed. A question box will be a feature of this year's meeting. Samples of road materials will be on exhibition, but practically no heavy machinery owing to transportation difficulties.

Delegates and visitors will register at the hotel headquarters before entering the meeting hall. They will be supplied with badges.

Among the topics, discussion of which has been arranged, are the following:—

The Road and the Farmer; Who Should Pay for the Road; The Efficiency of the Highway in the Present Transportation Difficulties; The Most Important Consideration Entering Into Road Construction,—Drainage; Modern Practice in Bituminous Pavements; English and American Practice in the Construction of Tar Roads; Concrete Roads; Abatement of the Dust Nuisance; Roads for the Common People,—Gravel and Macadem; The Labor Shortage Solved by Efficient Machinery.

W. H. Connell, of Philadelphia, will read a paper on "The Results of Tests With Various Types of Pavements," giving data on a test road fifteen miles long near Philadelphia on which twenty types of paving were tested.

Lieut.-Col. W. G. McKendrick, who has just returned from the Front, will contribute a paper on "How the Good Roads of France are Helping to Win the War."

Capt. J. A. Duchastel de Montrouge, city engineer of Outremont, P.Q., is president of the Association this year, having been re-elected for a second term. S. L. Squire, municipal adviser of the Ontario Government, is vice-president. The honorary presidents are U. H. Dandurand, of Montreal; W. A. McLean, Deputy Minister of Highways, Province of Ontario; B. Michaud, Deputy Minister of Roads, Province of Quebec; and Capt. O. Hezzlewood, Toronto.

The directors are the above-mentioned officers and Thomas Adams, town planning adviser, Commission of Conservation, Ottawa; A. L. Caron, president, Automobile Club of Canada, Montreal; Dr. E. M. Desaulniers, M.L.A., deputy speaker, Provincial Legislature, St. Lambert; R. S. Henderson, president, Manitoba Good Roads Association, Winnipeg; Geo. Hogarth, chief engineer, Highways Department, Province of Ontario, Toronto; J. W. Levesque, M.L.A., Montreal; A. F. Macallum, commissioner of works, Ottawa; P. E. Mercier, chief engineer, City of Montreal; J. A. Sanderson, Oxford Station, Ont.; C. R. Wheelock, president, Ontario Good Roads Association, Orangeville; W. G. Yorston, assistant road commissioner, Province of Nova Scotia, Halifax; and W. Findlay, business manager, The Journal-Press, Ottawa.

CAN. SOC. C.E., MONTREAL BRANCH

This evening Ulric Valiquet, M.Can.Soc.C.E., supervising engineer Department of Public Works, Ottawa, will read a paper on "Champlain Dry Dock for Quebec Harbor," before the Montreal Branch of the Canadian Society of Civil Engineers.

Lieut. Philip Bruneau, of the Canadian Machine Gun Corps, who is now on furlough, will describe machine gun work in Flanders.

MEMORIAL TO THE GOVERNMENT

A memorial has been forwarded to the Prime Minister, protesting against the employment of American architects, engineers and contractors on Federal Government work, and making the request that in the construction of Dominion public works, Canadian architects, engineers and contractors be given an assured preference. While the government has made no reply, it is unofficially understood that the majority of the members of the Cabinet, including the Premier, recognize as self-evident the soundness of the basic contentions outlined in the memorial, and that there will be more careful observance of national interests in the future by the various departments at Ottawa. It is pointed out that while some appointments of American individuals and firms on public work for the Dominion Government, have been well justified by special circumstances, other such contracts and appointments by the Federal Government have been not only unnecessary but also really against the national interest from many broad viewpoints. No mention of private contracts or municipal or provincial undertakings is made in the memorial, which is evidently aimed chiefly at the award of the Lindsay Arsenal contract to Westinghouse, Church, Kerr & Co. The full text of the memorial is as follows:—

"The undersigned, for themselves and the several interests represented by them, desire to lay before the government certain considerations arising upon the persistent and growing practice of employing alien architects, engineers and contractors on large public works in Canada.

"The matter has assumed such proportions as to render inevitable the humiliating suggestion that Canadian architects and engineers are considered incompetent to undertake work of the character in question. This suggestion itself, apart from any economic consequence, is of such serious import to Canadians and to educational institutions, in which their professional men have received their training, that it cannot be allowed to pass without earnest protest. That the Canadian Government should give ground is so unmistakable a fashion for the inference of Canadian inferiority is a matter of painful concern to every educationalist and technically trained man in Canada.

"The immediate occasion of this Memorial is the awarding of the contract for the new Government Arsenal at Lindsay, but the submissions to be made have reference to principles and economic effects which this contract serves to illustrate, and which has been otherwise exemplified. As regards the construction of the Government Arsenal, it is desired to submit that if any special devices, inventions or designs were required, the natural recourse would be to Great Britain.

"It should not be necessary to point to past achievements by Canadian architects, engineers and contractors in the construction of our public buildings, railways and other works. We submit what we hold the government should assume as axiomatic, that Canadian brains and skill are adequate to undertake any public works in Canada. If any special requirements were in view, it is submitted the proper course would be to follow the established usage in Great Britain, *viz.*, to send local architects and engineers to visit cities and countries where models are to be found, rather than to employ foreign architects and engineers.

"But there are other considerations of serious importance. Foreign architects and engineers naturally tend to employ materials with which they are familiar. Hence the practice of specifying materials, devices and designs of foreign manufacture to the serious prejudice of Canadian manufacturers and workmen.

"Similarly, in the matter of contracts and subcontracts, there is an inevitable discrimination against Canadian contractors.

"Apart from the fact that alien architects, engineers and contractors have no community interests in Canada, and escape its fiscal burdens, the employment of foreign firms has the inevitable effect of discouraging Canadians who have, and who might take up, architectural, engineering and other professions in this country, and of encouraging them to practise those professions in other countries instead, thus draining the country of service, skill and young manhood resources which should be preserved to Canada.

"Furthermore, the policy of which we complain is inconsistent with the efforts which are being made through our universities and other educational institutions to develop into a high state of efficiency the young men of the country. The conservation and development of the manhood resources of the country, no less but rather more than our material resources, are the concern not only of the interests represented by the undersigned, but of the whole country, and we submit they should receive the most careful consideration of the government.

"It is desired therefore:

"(*a*) To protest against the action of the War Purchasing Commission, acting for the Federal Government, in employing aliens for the construction of the Government Arsenal at Lindsay;

"(*b*) The protest against the increasing frequency with which foreign professional men are employed on important public undertakings in Canada;

"(*c*) To urge that the government should not create precedents which of necessity influence private owners of works against the employment of Canadian architects, engineers and contractors;

"(*d*) To urge that in construction of Canadian public works, Canadian architects, engineers and contractors should be given an assured preference."

The following signatures are attached to the memorial, per the authorized officials of the various organizations:—

Council of Royal Architectural Institute of Canada.
Royal Architectural Institute of Canada.
Ontario Association of Architects, Toronto, London, Ottawa and Hamilton Chapters.
Manitoba Association of Architects.
Alberta Association of Architects.
Saskatchewan Association of Architects.
Province of Quebec Architects.
Architectural Institute of British Columbia.
Association of Architects, Quebec.
Canadian Society of Civil Engineers.
Engineers' Club of Toronto.
American Institute of Electrical Engineers, Toronto Branch.
Engineering Alumni of Toronto University.
Engineering Society of Queen's University, Kingston.
Toronto Builders' Exchange, Master Masons' Section; Master Carpenters' Section; Master Plasterers' Section.
Builders' Exchange (Incorporated), Montreal.
Ottawa Builders' Exchange.
Owen Sound Architects, Engineers and Contractors.
Peterborough Builders' Exchange.
Essex Builders' and Architects' Association.
Stratford Builders' Exchange.
London Builders' Exchange.
Woodstock Builders and Supply Dealers.
St. Mary's Builders' Exchange.
Hamilton Builders' Exchange.
St. Catharines Builders' Exchange.
Galt, Preston and Hespeler Builders' Exchange.
Roofers and Sheet Metal Manufacturers' Association, Brick Manufacturers; Reinforced Concrete Section; Builders' Supply Section; Provincial Builders and Supply Section.

CORROSION OF SERVICE PIPES*

SOME trouble has been experienced with corrosion of service pipes, presumably due to the carbonic acid in the water, and a series of tests were made with the waters from the different purification plants. At Mt. Hope, 48 ft. of new ¾-inch galvanized wrought iron pipe was tapped into a 4-inch cast iron main running through the pipe gallery, which furnishes the supply of water for the ordinary daily use in the camp. An ordinary brass faucet was placed on the discharge end. Water was turned into this pipe on June 23rd and run through it continuously, with two exceptions, at the rate of about 1 gallon per minute from 8 a.m. to 5 p.m. each day. From 5 p.m. to 8 a.m. the water stood in the pipe, the faucet being closed. Each morning daily determinations of alkalinity, free carbonic acid, color and iron were made of samples of the first water drawn off in the morning, designated as "over-night" samples; also of running water collected about one hour later and designated as "running" samples. The pipe was under observation for 373 test days. Up to August the free carbonic acid in the "over-night" samples was much higher than in the "running" samples. The alkalinity was lower, and the color and iron were about equal. The free carbonic acid ordinarily ranged between 35 and 40 parts per million in the over-night samples and 3.5 to 5.0 in the running samples. After September 20th the free carbonic acid contained in the over-night samples was less than that in the running samples.

It was concluded from these tests that the effluent from this filter plant exerts only a slight corrosive action on pipe that has been properly galvanized, and will form only a thin coating on the interior. This conclusion has been corroborated by examination of the pipe used in this experiment and also of a service pipe from Cristobal.

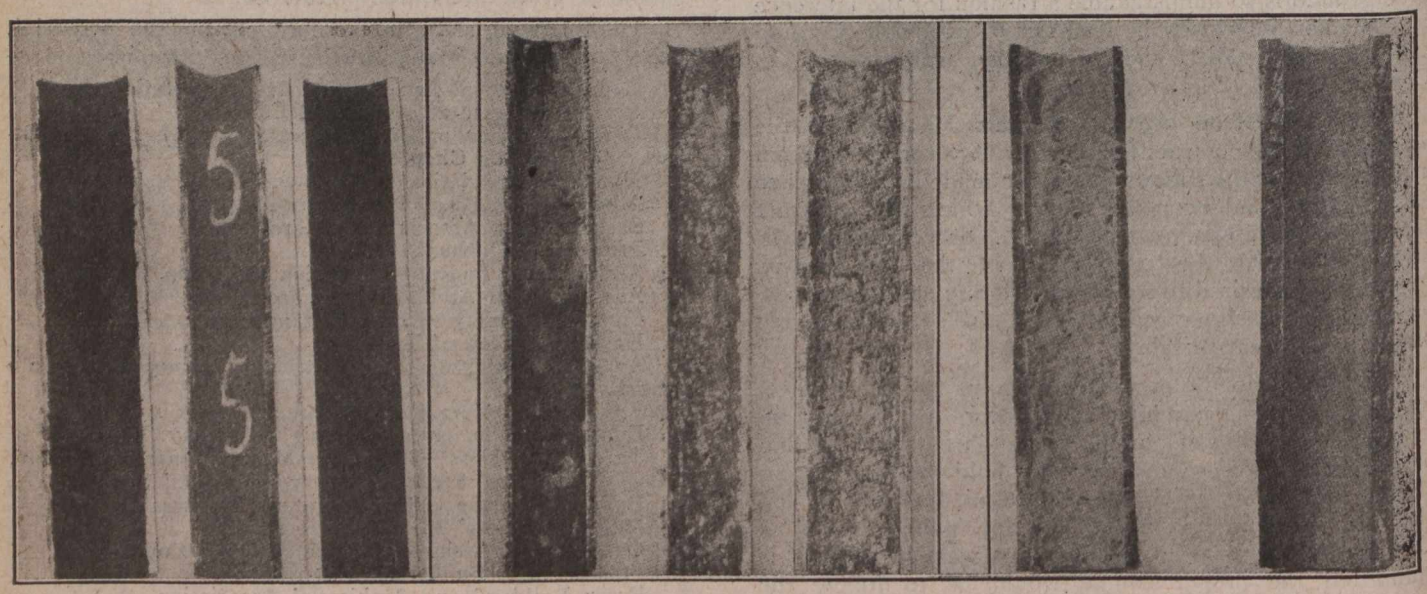
Similar experiments were made on lead pipe with effluent at the Agua Clara purification plant, 25 ft. of new 1-inch lead pipe being used. In the over-night samples the amount of lead increased to a minimum of 2.33 parts twenty-one days after the water was turned into the pipe, and from this time there was a decrease, and three months later the lead contained in 19 out of the 21 samples was 0.3 parts or less. As would be expected, the amounts of lead dissolved by the water standing over night diminished as the free carbonic acid was replaced with carbonate alkalinity. Of the running samples, only three contained as much as 0.1 part per million, and the majority less than 0.06 part. At the end of the test a section of the pipe was split, and the inside was found to be covered with a very thin coating of calcium carbonate. From these experiments the conclusion was drawn that the use of lead service pipes in the districts supplied by water from this plant is attended with no danger of lead poisoning so long as a carbonate alkalinity is maintained. It would be advisable, however, to allow the water which has been standing over night in a lead service pipe to run to waste during the first two months after its installation.

At this plant a test was made of the effect on galvanized iron pipe also. Throughout this experiment, lasting 380 test days, the alkalinities of the over-night samples were higher than those of the running samples, but the difference was always less than on the first two days, ranging from 1 to 11 parts. The colors of the over-night samples also were always higher than those of the running samples. They were also always higher in iron.

Gravimetric determinations of zinc were not made on the water from the galvanized iron pipe, but at the end of the run the residue from 100 c.c. of an over-night sample was tested micro-chemically and zinc crystals obtained; while a similar test of a sample of running water, collected on the same day, showed the absence of zinc. There was a cloudy appearance of the over-night samples that may be explained by the presence of iron and zinc in suspension.

While it was known that galvanized iron was not suitable for service pipes with a filtered water of low alka-

*Abstracted from 1917 report on Water Supply for Municipal Purposes in Panama Canal Zone.



Split Service Pipes, Showing Interior Conditions

No. 1.—Galvanized iron pipe removed after 5 years' service. Galvanizing removal and iron incrustation due to low residual alkalinity and free carbonic acid in filtered water.

No. 2.—Experimental galvanized iron pipe at Mt. Hope purification plant. In service one year.

No. 3.—Galvanized iron service pipe removed after 10 months' service, Ancon, C.Z. Water from Miraflores purification plant. Thin coating of iron oxide.

No. 4.—Experimental galvanized iron pipe at Agua Clara purification plant. In service one year.

No. 5.—Experimental galvanized iron pipe at Agua Clara purification plant. In service one year.

No. 6.—Galvanized iron pipe removed after 7 months' service from a house connection in Gatun, C.Z.

No. 7.—Service line to Incinerator, Gatun, C.Z. Flow through pipe about 3,000 gallons per month.

No. 8.—Experimental lead pipe at Agua Clara purification plant.

linity and a free carbonic acid content of 5 parts or more, on account of the removal of the zinc and corrosion of the iron, it was thought that if a normal carbonate alkalinity were maintained the corrosive action would be slight and the physical appearance of the water standing one night would not materially differ from that running a few minutes. It was observed, however, that while the overnight water was not colored yellow to the extent that it was prior to the removal of the free carbonic acid, yet it presented a slight milky appearance and was not as clear as water drawn off a few minutes later. At the end of the test this pipe was split open for examination, and at the end bearing the brass faucet there was a uniform soft deposit of a brownish color that shaded off to a cream color about one inch back. This was undoubtedly the result of galvanic action. It is reasonable to assume that particles of this soft deposit might have been loosened when the faucet was opened in the morning, thereby accounting for some of the higher iron contents. The zinc coating on the interior of the pipe was in good condition with the exception of a few small pin-head deposits. There was a very thin slate-colored coating over it. A section cut from about mid-length of this pipe did not contain any rust, but was spotted with cream-colored tubercles ranging in size from a pin-head to irregular deposits 3/8-inch long, 1/4-inch wide and 1/16-inch thick. Near the cast iron main the thin coating over the zinc was colored brown in spots and cream-colored tubercles also were present. The interior surface of this piece was much rougher than that from the mid-length of the pipe, and it was evident that dross from the spelter bath had adhered to the surface.

Examination was made of a one-inch galvanized iron pipe that had served as a service to a cottage for about six months. About 12,000 gallons of water per month had passed through this pipe. A piece was also cut out of another service about 1,000 ft. long which had been in use about seven months. The condition of these two pipes was such that the continual use of galvanized iron pipe was considered inadvisable, not on account of the corrosion of the zinc coating, but because the soft deposit will reduce the capacity in a comparatively short period. The rate of accumulation of this deposit varies with the amount of water passing through the pipe, the smaller the flow and the greater the periods of time between discharges, the more quickly the incrustation forms.

It is evident that at the temperature of water prevailing in service pipes in the tropics (24 degrees to 30 degrees Centigrade), the normal carbonate alkalinity as $CaCO_3$ must not exceed 8 parts per million as a provisional standard, with the possibility that this limit may be too high; instead of the 13 parts given by Whipple as a maximum beyond which precipitation will occur.

A piece of one-inch galvanized iron pipe which had been in service for five years was found to be covered on the interior with a rust-colored deposit from 1/16 to 3/16 of an inch thick. All of the zinc coating had disappeared. This furnished an excellent illustration of the action of a soft water that had been treated with alum with the resultant residual alkalinities varying from 2 to 10 parts per million and containing an average of 6 parts per million of free carbonic acid.

Saskatchewan province has been divided into eight districts under the Highways Act, and superintendents have been appointed as follows:—Battleford, F. Kissack; Prince Albert, F. McDougall; Saskatoon, W. Grant; Yorkton, E. B. Webster; Regina, C. F. McLellan; Weyburn, J. T. Cameron; Moose Jaw, A. McCallum; Swift Current, J. R. Reid.

ESTIMATING SEWAGE FLOW FROM FLOOR AREA*

By Walter S. McGrane
Assistant Engineer of the Bureau of Sewers, Manhattan Borough.

THE usual method of estimating sewage flow on the basis of resident population is unreliable and misleading for a municipal district like that of lower Manhattan, with its tremendous daily influx of transients in the office buildings, hotels, department stores and manufacturing buildings. In certain wards the resident population is steadily decreasing, although the number of individuals in the ward during business hours probably is not. In fact, the areas where most losses in resident population occur, owing to business buildings replacing residences, are the areas in which the amount of transient population is the greatest. This transient population, especially that in hotels, contributes a material amount to the sewage of the district.

This population is dependent upon the area of floor surface occupied; that is, in the case of a building that extends full size to the roof, upon the ground space occupied by the building times the number of floors in the building. Some statistics taken by the Sewer Bureau in department stores and hotels show actual densities of daily working population in department stores varying from 865 to 2,670 per acre (including street surface), this varying with the season of the year; while in hotels the density varied from 770 to 2,630 per acre. These figures do not include the number of people shopping in department stores or those in the hotels who are not either guests or employees.

William W. Brush, in making estimates for the Catskill water supply, made an investigation from which he decided that "other things being equal, the amount of water used in any building would be dependent upon the ground area covered and the number of stories in height." He decided that the amount of water used in any building is proportional to the size and height of the same. The total floor area can readily be obtained from available atlases of the city. Meter readings of hotels and business buildings taken in 1916 show the average consumption of six of the best hotels to be 526 gallons per thousand square feet of floor area, varying from 368 to 694. Five tenement and apartment houses gave an average of 230 gallons per thousand square feet, varying from 138 to 295; and five office and manufacturing buildings gave an average of 250, varying from 194 to 271. Each class of buildings gave a peak load about 25 per cent. higher than the average.

In most cities, anything like accurate forecasting of consumption would be complicated by the difficulty of estimating the number of floors to which the buildings in the several districts would be carried; but New York now has zoning laws which limit the heights of buildings in the different zones, and it can be assumed as a maximum that all of the buildings in a zone will reach the maximum permissible height. In the calculation for Manhattan, the total area is reduced by 33 per cent. to allow for streets, and this net area is further reduced by 15 to 30 per cent. for court areas required by law. The building area thus obtained is then multiplied by the average number of floors, giving the total floor area; and this area, expressed in units of 1,000 sq. ft., is then multiplied by the constant gallons-per-day factor for the class of buildings which is

*Abstract of paper read before the Municipal Engineers of the City of New York.

expected to occupy the district in question. For convenience in sewer calculation, this is reduced to cubic feet per second per acre of total area.

Gaugings of sewage flow from typical areas were made from time to time in different parts of the city to assist in determining the factors to use in calculations of this kind. In making these sewer gaugings, various appliances were used, including floats, pitot tubes, current meter and one or two others. The writer, who had charge of the work, decided that the float method, properly checked by pitot readings, was probably the most practical for gauging sewage flow under conditions found in Manhattan Borough. Difficulty was experienced in carrying on the work because of the presence in some sewers of great quantities of gasoline vapors, illuminating gas and steam; also, occasionally, great depth of mud near the outlets, obstructions from pipes, back-water from tides, excessive velocities, poor light, and last but not least, the influence of large house connections.

Having decided upon the point for making a gauging, the sewer was cleaned for a distance 100 feet each way from the section by the cleaning gang of the department. The distance between the centres of two manholes was accurately measured, an extension-leg level and short rod were used for running a line of levels on the sewer invert with readings at 10-foot intervals, and the cross-section of the sewer at a point near each of the two manholes was measured. The party usually consisted of five men when engaged in putting floats through and six men when taking pitot readings. In the former case, one man remained on top at the up-stream manhole and two men at the bottom of this manhole, one to start the floats and the other to keep the time. At the down-stream manhole there was one man on top guarding the hole and one on the bottom to receive the floats and call out the time. While sending the floats through, the height of the sewage is taken at regular intervals, being measured down from a plank set horizontal and whose elevation is taken accurately. The surface floats used at first consisted of wooden strips 4 inches by 8 inches by ½ inch, but it was finally decided that better results were obtained by using a float to the bottom of which were nailed two tin vanes at right angles to each other and extending 3 or 4 inches at right angles to the board; the object of the vanes being to catch the maximum velocity, which was about one-fourth of the depth below the surface.

The mean velocity used in calculating volumes of flow was obtained by multiplying the float velocity by a coefficient varying from 0.75 to 0.80. To check the coefficient, a pitot tube was used, consisting of a glass tube two feet long and ½ inch in diameter, bent 45° at one end and tapered off as a cone which terminates in a small cylinder about 1/32 of an inch in diameter. The tube is set so that the lower end is horizontal and the main part of the tube makes an angle of 45° with the vertical. This position serves the purpose of exaggerating the velocity head to facilitate the accurate measurement. The combined virtues of the nozzle and standard short tube are found in the shape of the cone and tip, giving a very high coefficient of 0.98. In spite of the fact that the tip was continually clogging when immersed in the flow, this appliance gave very good results. In using the pitot tube, a frame was employed to which the tube was fastened, this frame being so constructed that it could be slid along a horizontal board set in the sewer, and the tube slid up or down along the 45° bed of the frame so that the pitot end could be brought to any part of the cross-section. The cross-section was then divided into a number of small imaginary sections of equal area and a reading taken at the centre of each section. The difference between the static elevation and velocity head was measured directly from the tube.

In rating the floats, these were put through the sewer at the same time the pitot readings were being taken and for as short a distance above and below the pitot station as it was practicable to use and obtained precise velocity readings.

One of the greatest sources of error encountered in measuring sewage flow arose from the influence of house connections, especially the larger sizes. If the house connection entered above the surface of the sewage, or if the sewer section was narrow or the velocity flow more than 3 feet per second, the effect was not so marked. But when the house connections were near the flow line, the sewer section wide, and the velocity below 3 feet per second, the effect on float velocities might be considerable. In making a velocity determination, five floats were put through, one after the other. From a considerable number of observations it was decided that if the five floats did not vary more than 2 per cent. or 3 per cent., probably no house connections were operating and the arithmetical mean was used. If one float varied 3 per cent. to 6 per cent. from the mean of the other four, the length of route covered by the float was assumed to be greater than the straight length of sewer by eight-thirds of the extreme variation caused by the float swinging first as far as possible to one side and then the same distance to the other side of the centre line of the sewer. If the tardy float was 6 per cent. to 10 per cent. behind the others, sixteen-thirds of the extreme variation was added. If the tardy float was more than 10 per cent. behind the others, it was discarded as an observation.

In one case a standard sharp-edge weir with a stilling-box arrangement was used and gave very accurate results; but it was concluded that placing weirs in sewers is seldom practicable, since the weir must be made water-tight and yet so constructed that it can be removed readily in case of storms in order to prevent the flooding of cellars; and it was found almost impossible to satisfy both conditions. In addition to this, the presence of the weir causes the precipitation of great quantities of solid matter behind it which tends to back up the sewage into the house connections. Attempts made to measure the sewage flow by means of a current meter were unsatisfactory, owing to the fact that suspended matter clogged the mechanism.

At the time of writing this paper, a few weeks ago, the writer was experimenting with what is known as the Sanborn automatic gauge, utilizing pneumatic pressure, which had up to that time given better results than others which had been tested, although it required more or less constant attention.

The Vancouver Gas Co., Ltd., have installed new gas retorts which considerably enlarge their output of coal gas. Ammonia liquor—formerly wasted—is now being made in the new plant, and is used by the Victoria Chemical Co., Ltd., Victoria, in the manufacture of their product.

A plant for the construction of concrete ships is to be erected at Cleveland, Ohio, by the Cleveland Builders' Supply Company. Construction will be limited exclusively to concrete ships and barges. The plant will be the first of its kind on the lakes. The size of the vessels will permit their passage through the Welland Canal. Ships of 2,000 tons capacity and barges of 1,200 tons capacity will be built. They will be more than 200 feet long and 38 feet wide. The plant's output is expected to be about four ships per month.

Letters to the Editor

FEDERAL ENGINEERING SERVICE

By C. E. W. Dodwell

Sir,—I cannot doubt that your valuable journal is open at all times to the advocacy of a good cause, especially when that cause is identified with the welfare and advancement of the engineer and the elevation of the profession of engineering, therefore I have confidence that you will find room in your columns for a brief history of the cause to which I refer, and a presentation of its grounds and objects.

Before proceeding, let me say here that this cause is the establishment of a proper and thoroughly organized engineering service for the Federal Government

Seventeen Years of Effort

For seventeen years the engineers in the employ of the Federal Government have been striving to ameliorate, or work a reformation of, the disabilities and anomalous position under which we have always labored. Up to the present time our efforts have not been rewarded gy any appreciable measure of success, and were it not for the fact that the overcoming of difficulties is the pride and the distinguishing feature of our profession, we should ere this have succumbed to discouragement, ceased our endeavors and accepted the apparently inevitable.

Last February, the result of a general election was that for the first time in the half-century of the history of Canada, a Union or Coalition Government was established, and the old party lines were, temporarily at least, obliterated.

The avowed policy of the new government is "civil service reform with a view to extending the principle of the Civil Service Act to the outside service and thus abolish patronage, and to make appointments to the public service upon the scale standard of merit." Therefore, in spite of the intensity and the absorbing character of the government's war efforts, we believe that the present juncture offers a favorable occasion in which to urge the reasonableness and justice of our cause.

As briefly and concisely as possible, let me set forth the history of our movement.

History of the Movement

In March, 1901, the engineers of the Public Works Department from the Atlantic to the Pacific, forwarded to the minister, through the chief engineer, a petition praying that the engineers of the Public Works Department might be included in the civil service and given an improved official status. We have heard nothing of it since, nor even had an acknowledgment of its receipt.

In February, 1906, Mr. Hyman, then Minister of Public Works, who seemed to take more interest in the engineering service of his department than any former minister, summoned all the resident engineers, from the Atlantic to the Pacific, to meet him in Ottawa. We assembled to the number of about thirty-five and had four days at the capital at public expense. The minister gave us a good dinner at the Russell House, at which in a very nice speech he told us that we were the very finest body of men and engineers that ever were; that he had in preparation a comprehensive scheme of reorganization of the whole service, including substantial increases in salaries, and that he hoped in a very short time to be able to make known to us the details of this long-hoped-for reformation. The minister's promise as to salaries was made good to the extent of two subsequent increases, and for that we were not without at least that gratitude which has been described as "a lively sense of favors to come." At this meeting, which seemed a very and peculiarly fitting occasion for presenting in person before the minister our views and wishes in regard to improved official status, we were not afforded any opportunity of so doing, and there was not a man among us with sufficient courage to take the bull by either the horns or the tail.

Other Engineers Included

For five years nothing was done. In the interim, however, our ideas very properly expanded, and our efforts were directed to the inclusion not only of the engineers of the Public Works Department, but of all engineers in the permanent employ of every department of the federal government, in one comprehensive, regularly constituted and organized service.

On the 17th of January, 1910, the Hon. A. B. Warburton, M.P. (Queens, P.E.I.), in an able speech in the House of Commons, championed our cause and advocated the establishment of an engineering service in Canada similar to the corresponding services in India and Australia. To this speech the Hon. W. Pugsley, Minister of Public Works, replied in favorable and encouraging terms.

On the 25th of January, 1910, at the annual meeting of the Canadian Society of Civil Engineers, the subject of "an improved and regularly organized engineering service for the federal government" was discussed at length. The sympathy and support of the society as a body was pledged to the movement, and a committee was appointed to take up the matter, draft a memorial to the premier and take such other steps as might appear wise and efficacious. So far as I am aware, the society did nothing further in the matter.

In 1910 the engineers in federal employ, with excellent parliamentary and legal advice, prepared a "bill to organize and establish the engineering service of the government of Canada"; of which more anon.

On the 14th of November, 1910, a meeting of prominent government engineers, representing all departments, was held in Ottawa, at which it was resolved to carry on a vigorous campaign, and a committee was appointed.

Prime Minister Meets Delegation

On the 20th of January, 1911, the premier, Sir Wilfrid Laurier, received a delegation of about thirty engineers, most of them in government employ, but including the president and secretary of the Canadian Society of Civil Engineers and several other eminent engineers not in government employ. At this meeting a carefully prepared petition or memorial, signed by all engineers in federal employ, was presented to the premier.

Our cause was admirably presented in eloquent and forceful speeches by Col. W. P. Anderson, chief engineer of the Department of Marine and Fisheries; Mr. Marceau, past president, Canadian Society of Civil Engineers, representing the Department of Railways and Canals, in charge of canals in the province of Quebec; and W. F. Tye, president Canadian Society of Civil Engineers, chief engineer of the C.P.R'y. To these speeches the premier and the Hon. William Pugsley, Minister of Public Works, replied in favorable terms, the former requesting the latter, as having more engineers in his department than there were in others, to take up the matter. Dr. Pugsley suggested the formation of a small and active committee, with which he could deal directly and conveniently, and

for this purpose he named the chief engineers respectively of the departments of Public Works, Marine and Fisheries, and Railways and Canals, and of the Railway Commission.

On the 30th of January, 1911, Dr. Pugsley received this committee and requested it to prepare a bill for presentation to council on the 3rd of February, 1911.

Several times since the last mentioned date our bill has been *very nearly* presented to Council, but, owing to one reason or another—the urgency of other measures, etc.—it has not yet been taken up by the government, and we still live in hope.

In regard to the bill itself. Its objects in the order of (my conception of) their importance and desirability are:—

First, a higher professional standard.

Second, a recognized official status by enrolment in the civil service.

Third, a system of pensions and superannuations.

Higher Professional Standard Wanted

With reference to the first object: The engineering services of the several departments of the federal government have, at present, no recognized professional standard whatever, and the individual engineers in government service are certainly not, as they ought to be, conspicuous by their professional superiority over engineers who are not in government employ; indeed, a larger measure of truth would attach to the converse proposition. When an engineer is appointed to a government post, he is not required to pass an examination; he is not asked to produce testimonials, diplomas or credentials; he is not questioned as to where or how he acquired his professional knowledge and training, or whether he has ever had any education whatever,—scientific, technical or general. **He is, or may** be, at once put into a position of responsibility in which the judicious expenditure, or waste, of public money depends upon his knowledge and experience as an engineer, and upon his judgment, integrity and commonsense as a man.

If the engineering service of the government were properly constituted and organized, and a high standard of knowledge and experience made essential, it would be one of the most useful and profitable institutions of the country, and millions of public money would be saved. In a young country like Canada, with an area equal to that of the United States but with a population less than that of the city of London, with all the industrial capabilities and natural resources that go to make a country great, it is hard to over-estimate the importance of the civil engineer in the national development.

A distinguished English engineer, James Charles Inglis, president in 1909 of the Institution of Civil Engineers, in his inaugural address, said:—

Qualified Engineers Should Be in Control

"It ought to be laid down as a principle, that all public money derived from rates and taxes, should, so far as it is applied in engineering construction, be expended under the direction or control of definitely qualified engineers, as is already the case in many countries."

If this is true of a country like England, which has, in a sense, reached its maturity, it is infinitely truer of a country in a vigorous infancy, like Canada.

It appears to me that as a first step towards a higher professional standard for government engineers, one of two requirements should be an indispensable qualification for appointment:—

(*a*) The passing of a proper examination; or,

(*b*) Membership in some recognized engineering society.

In another part of his address, Mr. Inglis said:—

"Several important departments of state rely to a considerable extent upon the work of the council and, in some cases, upon advice given by it with respect to questions of the qualifications of engineers and of their selection for public services. The result of all this strengthening of the efficiency of the Institution is that a higher average technical proficiency is undoubtedly attained by the young engineers attached to it than was formerly the case, and this state of affairs has been notably marked by the action of the India Office with respect to engineering appointments in the Public Works Department; and very recently, by the War Office, which has entrusted to the council of the Institution the important function of selecting and recommending young engineers for nomination to the newly organized reserve of officers for the Royal Engineers. . . . The War Office has assigned to the president of the Institution the duty of selecting men for nomination to this reserve, as may be required from time to time."

British Institution is Consulted

If the Imperial Government can thus find it profitable and expedient to consult the Institution of Civil Engineers (the leading society of its kind in the world, with a membership, in all classes, of nearly nine thousand, scattered all over the globe) it will surely be worth while, and in the public interest, for the Canadian Government to consult the Canadian Society of Civil Engineers in regard to appointments and corresponding subjects.

It is proper that membership in some one of the several classes in the Canadian Society of Civil Engineers should be required as a just and proper indispensable condition precedent to appointment in our service. Unlike other professions,—law, medicine or even plumbing,—engineering, except in the provinces of Quebec and Manitoba, has no legal status, recognition or standardization by legislative enactment or statute, and any man, however uneducated, ignorant or incapable, has the right to style himself an engineer, and to solicit practice, and to undertake the design and execution of engineering works. Membership in the Canadian Society of Civil Engineers is the only guarantee, test, diploma or certificate that a man is a qualified engineer. The society was established in 1887 by Federal Charter, and under rules, regulations and by-laws prepared with extreme care and mature judgment, and with the sanction and approval of the government. The second clause of the charter clothes the society with "power to make and pass regulations and by-laws for the direction and management of the said society, including all rules that may be necessary for the maintenance of the honor and dignity of the profession." The government, therefore, has the right to expect, and may reasonably and confidently expect and demand, that the society will jealously guard admission to its ranks, and insist upon proper and adequate education, with scientific and technical training, as indispensable conditions precedent to membership therein.

Society Exercising More Discrimination

It is to be admitted that the society's list bears the names of a few men who should not be in it, but this is true of every similar society in the world. At this date the society, with a steadily growing membership of over 3,000, with encouraging development of influence, and, we hope, of usefulness, is capable of exercising, and does exercise, a greater discrimination in admission to its rank than was practicable in its early days.

In view, therefore, of the above considerations, I contend, and I think I speak for the society, when I say that

it would be in the public interest that no engineer should be appointed to the government service unless he is a member, in good standing, of one or other of the several classes of the society.

Regarding a recognized official status by enrolment in the civil service: When the Civil Service Act was passed in 1876, there were comparatively few engineers in any department of the Federal Government, and they would appear, at that time, to have been regarded as fifth wheels to the coach, as more or less necessary evils, temporarily employed to carry out specific works, and to be discarded at the earliest possible moment.

The Civil Service

Either by design, or through a remarkable lack of foresight on the part of the originators of the act, no provision whatever was made in it for the incorporation in the public service of a corps of engineers in any department of the government, and the fact that at no time during the thirty-two years which have elapsed since the passage of the act in question has there been, so far as I am aware, any attempt to so amend it as to make it include civil engineers, would seem to indicate that their exclusion from its provisions was by design and intent. Be this as it may, it is surely nothing more than common-sense, justice, and in the public interest, that civil engineers in the regular employ of the government, and in receipt of yearly salaries, should have and enjoy all the rights, privileges and responsibilities, official status and security of tenure, possessed by the various clerks and other officers, for whose ordering and behoof the Civil Service Act was passed.

By this act the service is divided into two classes:—

(1) Schedule A, Inside Service, *i.e.*, officers employed in Ottawa,—

(*a*) Deputy heads of departments.

(*b*) Officers who have special professional or technical qualifications.

(*c*) Chief clerks.

(*d*) First class clerks.

(*e*) Second class clerks.

(*f*) Junior second class clerks.

(2) Schedule B, Outside Service, *i.e.*, subordinate officers in departments of Customs, Inland Revenue and Post Office, employed outside Ottawa.

Under class *b*, schedule A, it would appear that engineers attached to and employed in the departmental offices and staff at Ottawa, might, and should be, in the civil service, but as a matter of fact, out of the dozen or more engineers in the Public Works Department, resident in Ottawa, only two are in the civil service.

Engineers Not Mentioned

Schedule B makes no provision for, or mention of, engineers, and therefore no engineers outside Ottawa, in whatever department or of whatever rank, can be put on the civil service list. The act provides minutely and exhaustively for the examination, appointment, promotion, salaries and retiring allowances of clerks and officers of all kinds and grades,—except engineers.

To determine, however, where a civil servant stands in regard to salary, increase of salary or superannuation, an exhaustive study must be made of the following Acts:—

Chapter 7, R.S.C.—An act respecting the civil service of Canada, 1876.

46 Vic. Ch. 18, R.S.C.—An act relating to the superannuation of persons employed in the civil service of Canada, 1886.

56 Vic. Ch. 13, R.S.C.—An act respecting government civil servants' insurance, 1893.

60-61 Vic. Ch. 15, R.S.C.—An act further to amend the Civil Servants' Superannuation Act, 1897.

61 Vic. Ch. 17, R.S.C.—An act to provide for the abolition of the Civil Servants' Superannuation Act and for the retirement of members of the civil service, 1898.

3 Ed. VII. Ch. 9, R.S.C.—An act to amend the Civil Service Act, 1903.

3 Ed. VII. Ch. 10, R.S.C.—An act to amend the Civil Service Superannuation Act, 1903.

7-8 Ed. VII. Ch.—An act to amend the Civil Service Act, 1908.

Inside Service and Outside

For my part, I could never see the object of the discrimination made by the Civil Service Act of 1876, and perpetuated in every subsequent amendment, between the inside service and the outside service. Such division has always appeared to be anomalous and uncalled for, creating unnecessary complications in the administration of the government service, and doing an injustice to the majority of the employees of the government throughout the Dominion. Surely a man is equally a servant of the government whether he performs his duties in Cape Breton, Ottawa or Vancouver Island, and it cannot surely be fair and reasonable, or in accordance with the most rudimentary principles of justice or the eternal fitness of things, that a responsible officer of the government in Halifax or Vancouver, with a salary of $2,000 or $3,000 a year, should be in a different and inferior position as regards status and tenure of office, to a junior third class clerk in Ottawa with a salary of $200 or $300.

It is my opinion, shared, I may say, by abler and more prominent men than I, with whom I have discussed the subject, that the whole of the acts cited above should be swept from the statute books and replaced by one comprehensive act dealing exhaustively with every department, abolishing the anomalous distinction between outside service and inside service, and bringing every permanent servant of the government into one fold, one category and one national and harmonious system.

Engineers Listed as Clerks

In the Public Works Department there are now over one hundred engineers, of which only three are on the civil list, and in it they appear not as engineers but as clerks; one as chief clerk, Engineers' Branch, Public Works Department, and another as a first class clerk. I cannot say why these three engineers are on the civil list, or why the other engineers at headquarters at Ottawa are not.

Early in 1908, when a commission was appointed by the government to make a thorough investigation into and report upon, the civil service, it was hoped by many interested persons, among them the engineers of the government, that the fruit of the commission's labors would be some such reformatory legislation as I have indicated. When, a little later, it became known that an amendment to the Civil Service Act was to be introduced before parliament at its last session, we thought that the fruit was already on the bough, and that the millennium was at hand. The amendment, which was introduced and in due time became law, makes no mention whatever of engineers, continues the thirty-two-year-old anomaly of sheep and goats, of an inside and outside service, and the latter is relegated to even greater obscurity than before. It is, indeed, mentioned only twice in the whole act; *viz.*, in section 3, where it is described as "the rest of the civil service," and in clause 3 of section 4, where it is provided that "the Governor-in-Council may bring the outside service within its operation."

Engineers in the government service, not being included even in the outside service, the act would require radical amendment and extension before they would be beneficially affected.

Pensions and Superannuations

While a system of pensions and superannuations has not the first place in the desiderata of the engineers of the government, it is a matter of great importance and one that might well engage the serious attention of the government.

I discuss "pension" as meaning money periodically paid to the widow or family of a deceased engineer, and "superannuation" as money periodically paid to an engineer honorably retired from active service.

Under existing conditions there is no pension whatever for the widow or family of an engineer dying in government service, even though he may have been in it for the best part of his life.

Section 43 of the new act provided that "if a person dies while in the public service after having been at least two years therein, an amount equal to two months of his salary shall be paid to his widow, or to such person as the Treasury Board determines." But it is not quite clear from the context, whether the words "in the public service" include persons not in the civil service; and to make the meaning quite clear, one way or the other, the words "public service" should be changed to "civil service," or after them should be inserted the words, "whether in the civil service or not."

In Sections 24 and 25 of the new act, where the words "in the public service" also occur, it is obvious from the context that they include persons not in the civil service, and therefore, in Section 43 the benefit of the doubt or ambiguity would no doubt be given in favor of an engineer dying in government employ, and his widow would be able at least to give him decent burial.

Hard to Save on P.W.D. Salaries

There are many engineers in the Department of Public Works and Railways and Canals, that have been in the respective services for periods ranging from twenty to forty years, men long past the prime of life, who have not been able either to save or invest enough out of their salaries, or to pay premiums on sufficiently large policies of life insurance, to enable their widows to pass their declining years in decency or comfort. To the question, "Should not these widows have pensions?" there is, of course, an answer, and so far as it goes, it is a pretty good answer. An engineer enters the government service presumably with his eyes open, and knowing well that if he dies in the service his widow will get no compensation. Therefore, he must be thrifty and himself provide a pension for his widow and family by devoting a substantial part of his not-too-large salary to the payment of premiums on a good, round life policy, or by putting aside what he can spare, or a little more than he can spare, in safe and profitable investments. But this presupposes a greater measure of thrift and prudence in the engineer than in other men, and it leaves out of account the fact that the widows of certain other employees of the government would and do enjoy pensions after their breadwinners have been taken from them. In no phase of the whole question is there a better illustration of the anomaly and injustice of the exclusion of government engineers from the civil service.

In the matter of superannuation, the government engineers are in precisely the same position as they are in regard to pensions. Even though they may have given their country faithful and efficient service for half their lives, they cannot look forward to any superannuation or retiring allowance, and their only resource is to die in harness before they are struck from the pay-list from incapacity due to age or infirmity, so as to secure for their widows and families the meagre allowance of two months' pay.

Value of Services

In striking contrast to this treatment is that accorded to servants of commercial and financial corporations. A well-known banking man, some few years deceased, on his retirement from the managership of one of the leading banks of the country, received his full salary, $20,000 a year, for two or three years after his retirement, a cash bonus of $50,000 and a retiring allowance of $6,000 per annum for life. Is there such a vast disparity between the value of service and responsibility of duties of a bank manager and those of the civil engineer in government employ as might be inferred from this difference in their treatment at the close of their useful careers? Surely not.

I have said before that there are a number of engineers who have been in the government service for twenty to forty years, and the question is, what is to become of them? Those of longest service and most advanced years ought, of course, to be retired on not less than two-thirds their salaries, and younger and more energetic men put in their places, but for this there is no provision whatever and they will drag along on the pay-sheet, the more onerous of their duties being performed by assistants, until some stony hearted new broom in the portfolio of public works—to use a somewhat mixed metaphor—throws them out on the scrap-heap.

But worse cases than these should be considered. Suppose a man in vigorous middle age meets with an accident, either in discharge of his duties or not, or is seized with blindness, paralysis, locomotor ataxia or some other dire ailment which, without killing him outright, absolutely incapacitates him from all further work. What is to become of him? He cannot continue to draw his salary because his place must be filled and his duties performed by another, and it is an axiom of government service that two salaries cannot be paid for one duty. He cannot be superannuated, because there is no provision for it. If he had the good luck to be killed outright, his family might have drawn two months' pay and given him a respectable funeral, but he continues to live, and, what is worse, to be a burden of trouble and expense to his family in doctors', nurses' and hospital bills, and the softest-hearted law on the Statute Book is powerless to help him.

Discrimination That Ruffles

In this case, as in that of the absence of pension for his widow, the engineer would have less ground, or even no ground, for complaint, if other employees of the government, certainly not more useful or of greater value to the public service, were not provided with superannuation at the close of their active careers. And it is not that the engineer begrudges the civil servant his pension, or would deprive him of it for the sake of establishing a uniformly ungenerous treatment throughout the public service, but it is the unjust, ungenerous and, as it appears to him, remedial adverse discrimination that ruffles and disturbs his ideas of the eternal fitness of things.

With the details of either a pension or a superannuation system, I need not here attempt to deal, further than to say that they present little difficulty. An accumulating annual deduction from an engineer's salary could be applied on ordinary actuarial principles to the purchase of an annuity for the engineer himself on his retirement, or for his widow on his death. Such a system, if properly estab-

lished and managed, would be automatic and self-supporting.

Having now dealt separately with each of the three aspirations of the engineering service of the government, let me, in conclusion, say a few words in regard to them collectively, because they are not distinct, separable or independent.

Doubtful Economy

I have tried to show that it would be in the public interest if the standard of qualification for government engineers were raised; that an engineering service of highest professional excellency is a matter of very great importance and would prove of vast practical value to the country. This may be illustrated in a crude and homely manner by supposing a great national work to be undertaken, as a means for the development of the country, such as a railway, canal, bridge or harbor. The work, under thoroughly competent engineering design and supervision, ought to be well done for a million dollars. It is designed and superintended by the best that government service can produce, an engineer enjoying a salary of $3,000 or $4,000 a year. It takes four years to complete and is so badly designed and built, that a second million has to be expended upon it before it can fulfil the object of its construction. If this hypothetical work had been designed and superintended by an engineer worth, and enjoying, a salary of, say, $10,000 a year, it would have been a success at the cost of the original million. The country has saved the difference between the $10,000 and the $4,000 engineer for four years, or $24,000, but to effect this saving has cost a million!

This is, perhaps, a rough and homely illustration, but, I submit, a fair one, and many a parallel could be found in the engineering history of the country in the past twenty years.

As an argument against a general increase of salary for government engineers, I have heard the fallacy advanced that the whole question is covered by the eternal laws of supply and demand, that the government would not be justified in paying higher salaries when as many engineers as are required can be employed at present rates of pay. To show the weakness of this line of reasoning, I have only to say that the government could to-morrow replace every engineer in its service by a new set of men at half the salaries now paid. But what sort of men would they be, and what sort of public works would they turn out?

Bigger Salaries, Smaller Costs

It is not a very far-fetched figure of speech to say mathematically that the cost of engineering works is inversely and their value directly in proportion to the salaries or rewards paid to their designers.

An an object lesson in the value of an efficient engineering service to the development of a country, look at that of the Public Works Department of India, of which the achievements in the construction of roads, bridges, railways and irrigation works are not only the admiration of the world, but have been of incalculable value to the country and to the Empire. As a service, it is unquestionably the best in the world. The competition for entry, the standards of qualifications, the educational training and the salaries, pensions and superannuations, etc., being all on a commensurate and magnificent scale. So far from there being any reasons why Canada should not have an equally good engineering service, the fact of ours being a larger and better country offers many cogent and obvious reasons why we should have, and some day will have, an even better.

If every engineer in the employ of the Federal Government would sink differences of opinion, petty objections and adverse and captious criticism on points of detail and minor importance, and direct their energies with unanimity and vigor to the furtherance of the cause that we have so much at heart, we may have confidence of a finally successful issue, but not otherwise; and this, through the columns of *The Canadian Engineer*, I urge them to do.

C. E. W. DODWELL,
M.Inst.C.E., M.Can.Soc.C.E.
District Engineer, P. W. Dept.

Halifax, N.S., April 11th, 1918.

WESTERN FUEL SITUATION

By John O. Newton

Sir,—It is only within the last few days that I have had the opportunity of reading the report appearing in your issue of January 31st last of the very able address delivered by B. F. Haanel, B.Sc., at the annual meeting of the Canadian Society of Civil Engineers, on the subject of the fuels of Canada.

It is only regarding the portion of his address that deals with the coal situation in Manitoba and the greater part of Saskatchewan, that I wish to trouble you. This stretch of country contains a population of about 360,000, reckoning only cities and those towns of over 1,000 inhabitants. The total population is probably nearer half a million, of which, roughly, half live in Winnipeg and its vicinity; consequently I think I may be pardoned if I confine my remarks on the coal situation in this area chiefly to Winnipeg, and to its ultimate dependency to a very large extent on the Souris Valley lignite fields, which are less than 300 miles distant, the nearest coal fields in Alberta being about 760 miles by rail, while Fort William is roughly 450 miles away.

May Influence the Government

The copy of your issue referred to was sent to me by a friend from Ottawa and was accompanied by a report on the economic possibilities of the carbonizing and briquetting of lignites by W. J. Dick, M.Sc., mining engineer of the Commission of Conservation. I understand that both were obtained from Mr. Haanel, and I therefore presume that Mr. Dick's report will have a very considerable bearing on whatever action is taken by the government with regard to the development of these very important lignite deposits.

It is reasonable to suppose that the importation of American anthracite and bituminous coal to Canada will be greatly curtailed in the near future, if not entirely eliminated. These coals are handled three times en route; firstly, at the American lake port; secondly, from the ship into storage at Fort William; and thirdly, from storage at Fort William to the train for final destination; the distance covered from the mine to Winnipeg being roughly 1,500 miles: a needless waste of rolling stock, tonnage and man power at any time, but more particularly during war. If we were left to the tender mercies of the Germans, this practice would soon be discontinued, and even with our slack methods of procedure, the chances are that it will in the very near future.

No Storage Facilities

If importation were prohibited, Winnipeg would be almost entirely dependent on the Alberta coal fields, from 760 to 860 miles away by rail. No facilities exist at any point in the West, excepting at Fort William, for storing coal in very large quantities, consequently coal for supply-

ing Winnipeg would have to be carried an average distance of 800 miles by rail almost direct from the mine to the consumer, and by trains moving in the same direction as grain is being moved. How can the railways handle such a situation? It looks to me so serious that public interest should be aroused and that immediately, and that some drastic remedy is required at once.

Possibilities of Raw Lignite

I take it from both Mr. Haanel's and Mr. Dick's statements that they lay too little stress on the possibilities of lignite in its raw state, and too much on the recovery of by-products. A good grade of the Souris Valley lignite can be used most successfully during the winter months in its raw state as substitute for other coal, provided it is burned in a furnace having a large combustion chamber and a good draught, and provided the public is instructed in its use. The latter is very important, for, if this lignite be treated like hard coal, satisfaction cannot be obtained.

I am not a coal chemist, neither am I a mining engineer. I am merely an average member of the public, who has looked a good deal into the fuel situation for the last few months from a commonsense point of view, and used no fuel but lignite all through the winter. I hesitated, and would continue to hesitate, about making any remarks on this subject at all, as I feel there are many others much more competent to do so than I, but when I see the possibilities of a report such as Mr. Dick's being taken into serious consideration, I cannot refrain from burdening you with these remarks, as I consider the situation so very serious that microscopic examination from all angles is required. In my humble opinion, an increase in the output of Souris Valley lignite by at least 1,000% is infinitely more important at the present time than the production of by-products that would to a large extent be wasted.

To obtain this output, seams of lignite should be mined close to a railway, at least 6 ft. 6 ins. thick and preferably a foot or two thicker, with ash content as small as possible, with water content as low as possible, the seams to have a hard roof that will stand the vibrations of coal-cutting machines, the seams to be free from clay or black-jack, and the calorific value of commercial samples to be as high as possible. I may state, however, that all such conditions cannot be obtained at Estevan, nor yet at Bienfait.

More Harm Than Good?

Upon close examination, I cannot but conclude that Mr. Dick's report is both inconsistent, inaccurate, too vague to be of any service, and misleading, and as such likely to do incalculable harm to instead of assisting those interested in developing this coal field. I presume you have already received a copy, so take the liberty of going somewhat fully into details:—

On page 13 of his report, the cost of U.S. anthracite in Winnipeg is stated to be $9.50 to $10 per ton; on page 17, it is shown as $11.25. No dates are given, but the actual winter 1917-18 price is $12.50 per ton delivered.

On page 12 it is stated that the freight charges on bringing coal from Shand to Estevan amounts to 40c. per ton (1917 rates); and from Bienfait to Estevan, 60c. per ton (1917 rates). Fifteen cents per ton must now be added.

On page 20 the B.t.u. of three samples of lignite on the dry basis are shown at 7,605, 8,073 and 6,388 respectively. If this is correct, we had better try elsewhere.

On the same page, the ash content of Taylorton coal is given on the dry basis as 8.1% and Bienfait mine, 5.90%. I am quite satisfied that if you take forty or fifty samples of coal from different parts of this area, analyze them as they come out of the mine and average the results, you will find the ash content between ten and eleven per cent. on the commercial sample, the content on the dry basis being roughly 25% higher. It is obviously unfair in any case to take three or four isolated samples, give no account of how they were obtained, and expect to procure reliable data therefrom.

Next, as to carbonized residue and gas. On page 9 it is stated that two tons of raw lignite will produce one ton of briquettes; and on page 11, that there will be a surplus of 4,000 cu. ft. of gas after firing retorts and by-product equipment, the calorific value of the gas being from 400 to 450 B.t.u. If this is correct, it is something entirely new to me, my limited knowledge showing a surplus of about 2,500 cu. ft. of gas per ton of a calorific value of from 390 to 400 B.t.u., when less than the above amount of residue is obtained. I must confess I should like satisfactory confirmation of Mr. Dick's figures on this point.

"Most Extraordinary Proposition"

On pages 10 to 13 are given particulars of the most extraordinary proposition I ever came across. We are shown an estimate of the cost of the raw material based on figures that are, to say the least, peculiar. No account is taken of the fact that there are bands of clay and in one case of black-jack in several of the seams of coal mentioned, that would have a very serious effect in raising the ash content of the slack. The fact is entirely ignored that raw lignite as mined is much to be preferred for carbonizing purposes to air-slacked lignite, and that the capacity, size, construction and design of the retorts will be dependent on the moisture content of the lignite concerned and its ultimate analysis.

We are told that a large part of the gas is to be used for brick burning, but we are not told that under present conditions only a very limited quantity of bricks is being burned.

Estevan is advised to buy 84 million cubic feet of gas per year, but we are not told what Estevan has to say about the matter.

It is admitted that even when all these things have been accomplished, 30% of the total output of gas will still be wasted.

On the other hand, we are not told about any of the by-products, such as the gas and fuel oils that could be used to great advantage at the present time, nor do we receive any information about ammonia compounds, perhaps because the price of sulphuric acid is so high.

We are told that the total cost of plant would be $366,534, but we are not told what this cost covers, whether we can only procure gas for this amount, whether we can get tar in addition, or whether we are to be provided with benzine, toluene, naphthalene, anilin, etc.

Detailed Figures Wanted

Detailed figures are not supplied as to the final cost per ton of the carbonized residue, nor as to any of the following: Cost of material and supplies for briquetting, apart from carbonized residue; labor in connection with briquetting; briquetting breakages; fixed charges.

The sum total of the information supplied is:—

(1) That large supplies of lignite slack mixed to a greater or less degree with clay, black-jack and other impurities are to be lumped together at a central plant, these various lignites differing considerably on analysis.

(2) That the freight charges alone, not to mention the additional cost of handling on a large part of these sup-

plies, amounts to about 60c. per ton, so that the fixed cost of the briquettes is to be needlessly increased from $1 to $1.20 per ton.

(3) That, as large quantities of lignite cannot be stored, the plant would be operated chiefly in the winter months, the time lignite can be used quite well in its raw state.

(4) That a large part of the gas produced at this excessive cost would be wasted.

The $400,000 Appropriation

I have been told that $400,000 is to be supplied by the government for briquetting purposes,—$200,000 by the Dominion Government and $100,000 by each of the provinces of Manitoba and Saskatchewan. I am greatly interested, as are many others, in seeing that this money is not wasted and that thoroughly sound information shall be forthcoming from this large expenditure. Personally, I am quite satisfied that any expenditure along the lines suggested by Mr. Dick would be almost entirely wasted. It is solid fuel that we want, at a reasonable cost, and not gas that cannot be utilized. I would respectfully suggest that before the expenditure of one cent of this $400,000 takes place, a much more practical and thorough examination be made into all the circumstances of the case, then if conditions warrant, install a small plant with one or two vertical retorts of commercial size instead of eight or ten, but located right at the mine from which the raw material is obtained.

At comparatively small cost we should then be able to procure the fullest possible information on a commercial basis, after which it will be time enough to go in for the larger expenditure. I quite agree with Mr. Dick that the waste of lignite slack is very great and that it could be saved by carbonizing and briquetting; I maintain, however, that briquetting slack and run-of-mine lignite in the summer time is infinitely more important than during the winter months, as by that means lignite mines could be successfully operated throughout the year, but that a far larger output of lignite in its raw state is infinitely more important than either at the present time.

Means to Procure a Plant

Up-to-date methods of producing lignite in large quantities at a low cost per ton is the most important consideration of all; next comes the manufacture of a briquette that will not disintegrate; and lastly the installation of a by-product recovery plant. I think I can safely say that for half the amount the governments propose spending, I can procure a plant that will turn out as good an article and in larger quantities, and I mean to do it; but even so, a large outlay is required, and I straightforwardly confess that I would prefer to see Manitoba and Saskatchewan going much more fully into the question than they have already done before subscribing their share of the $400,000.

If the government could be induced to admit a briquetting plant duty free, to cut down the duty during war time on mining equipment and to take in hand the foreign labor situation in a reasonable way, the solution of the coal situation would be very appreciably nearer.

I am personally very optimistic and firmly convinced that the briquetting problem will be solved in the very near future, but on lines entirely different to those suggested by Mr. Dick. There will be no wasted gas and the cost per ton will be ever so much lower.

JOHN. O. NEWTON.

Winnipeg, Man., April 15th, 1918.

TESTING WATER MAINS IN TRENCHES*

By R. O. Wynne-Roberts, M.Can.Soc.C.E.
Consulting Engineer, Toronto

ABOUT a year ago I was making enquiries as to what could be done to test water mains with air, and it may interest your readers if some of the information obtained was placed at their disposal.

John Vipond Davies, on October 6th, 1915, read a paper before the American Society of Civil Engineers on "The Astoria Tunnel Under the East River for Gas Distribution in New York City." In that paper he described how two 72-in. gas mains were tested with compressed air. The requirements were that each joint should be subjected to a test by air-pressure at 20 lbs. per square inch. Mr. Davies designed a portable machine, consisting of a double bulkhead on a wheeled frame, which could be pushed by hand through the inside of the pipe and enclose any joint within an annular space. The two bulkheads consisted of pneumatic tires inflated to make a tight joint between the testing machine and the inside wall of the pipe. The machine consisted of a cast-iron piston 71½ ins. in diameter or ½ in. less than the internal diameter of the pipe. The piston was 24 ins. long, with exterior flanges giving an annular space between flanges of 12 ins. The two flanges were designed of cove form to give close support to soft and elastic rubber tubes. These tubes were 2½ ins. in diameter, ⅜-in. rubber walls, and made of the finest inner-tube rubber, and fitted with a standard tire valve.

As the pressure to which the joints were to be subjected was 20 lbs. per square inch, it was found that 50 lbs. was ample to inflate the tubes and make an absolutely tight contact for testing purposes. When everything was ready, 20 lbs. air-pressure was applied to the annular space, and the lead joints were painted with soap and water to detect leaks, if any. Drawings and further details may be studied by referring to the Proceedings of the American Society of Civil Engineers. The pipes were afterwards air-tested at 40 lbs. per square inch and the joints were found satisfactory.

The superintendent of Louisville Gas and Electric Company (Ky.) informed me that he tested a 12-in. steel gas main by pumping natural gas into it to a pressure of 350 lbs. per square inch. This was done to ascertain if the leakage on the pipe line did not exceed one-half of 1 per cent. in twenty-four hours. The actual test covered a period of forty-eight hours, during which observations were taken at fifteen-minute intervals, gauges being read at each end of the line. Thermometers were also read for the purpose of making corrections in case of any considerable variation in temperature. This was not found necessary, however.

The pressure at both ends of the line was 350 lbs. at the start of the test, and gas was pumped into one end of the line at intervals during the test so as to maintain the required pressure, the gas supply being measured by a standard orifice meter with one ½-in. orifice in an 8-in. tube.

The superintendent stated that he believed it would have been more desirable to have made the test by pumping the line up to 350 lbs., then closing the valve and shutting the line off from the supply connection, reading the drop in pressure over a period of twenty-four hours. This method is simpler, and does not require accurate measurement of the gas supply to offset the leakage; and moreover it does not introduce waves of pressure into the line

*From "The Surveyor," London.

when supplying gas for an interval and the lessening or interrupting the supply. This was an acceptance test. During the construction, various sections were tested as laid, partly by gas and partly by air. The bellholes were not back-filled until after the test had been completed and the line found to be tight.

C. C. Simpson, the general superintendent of the Consolidated Gas Company of New York, informed me that he tested mains by compressed air, using a portable gasolene (petrol driven) air-compressor. If the mains are newly laid, and have not been tapped for services, it is only necessary to plug up both ends and make connections at one end for air and for a recording gauge. After this has been done air can be pumped in to any pressure desired. Changes in the pressure caused by changes in the volume of air in the main due to possible heating or cooling must be taken into account. It is usually the practice after the desired pressure has been secured to allow the main to stand for a while before observing the gauge for leakage.

Under 100-lb. pressure leaks should be apparent, if the main is uncovered, by the noise of the escaping air, but if not then apply a wash of soapsuds. The question as to the standard of permissible leakage is a hard one to answer. If the test is made at 100 lbs. per square inch, for the reason that this is the working pressure, Mr. Simpson considers that the main should be made absolutely tight at that pressure. If, however, the test is to more easily detect leakage, the pressure could be reduced. 100-lb. air pressure is a very severe test to apply to a main. He stated that if he was a contractor he would prefer to have his work tested under 100-lb. water-pressure rather than the same air-pressure. Gas mains in Pittsburg, Pa., are tested by compressed air, and the amount of leakage estimated by the drop of pressure in a given time.

As I was associated with the construction of a few miles of water mains where it would be inconvenient to obtain water to test them, I drafted a clause which permitted the contractors to apply either air or water. The clauses read as follows: "The pipes and connections shall be tested either hydraulically or by compressed air, by and at the expense of the contractor. When the hydraulic test is applied the leakage of water shall not exceed one Imperial gallon per hundred lineal feet of joint in two hours under a static pressure of 100 lbs. per square inch. The contractor shall make his own arrangements for a supply of water and to establish the static pressure. Or, if a compressed air test is applied, then the pipes and connections shall be charged with air at a gauge pressure of 45 lbs. per square inch and the leakage shall not cause the gauge pressure to fall more than 15 lbs. per square inch in two hours from the time when the required pressure has been established and the supply of air cut off. Allowance shall be made in this test for changes in temperature and pressure." The contractors evidently preferred the hydraulic test, because they were more accustomed to it. Circumstances, however, arose, owing to the conditions caused by the war, that prevented the specials and hydrants being supplied on time; consequently the test when applied extended throughout the whole section and under working pressure. The hydraulic test, nevertheless, was applied in certain smaller sections with the result that the leakage was slightly more than that specified.

Work on the development of power on the Nipigon River may begin before the end of the month.

St. Thomas city council has decided to appoint C. J. Macdonald, at present in St. Paul, Minn., gas works, as the superintendent of the city's gas plant.

LIQUID CHLORINE TREATMENT INEXPENSIVE

Cost of operation of two liquid chlorine plants is summarized in a recent technical paper of the New York State Department of Health, prepared by C. M. Baker, assistant engineer, Division of Sanitary Engineering. The figures show the approximate cost of apparatus, maintenance and operation of the plants at Hudson Falls, N.Y., and Westfield, N.Y., as follows:—

HUDSON FALLS

Apparatus—		
Chlorinator	$400.00	
Apparatus for testing B. coli	25.00	
Incubator	10.00	
Total	$435.00	
Yearly cost, interest at 5 per cent.		$21.75
Operation—		
Chlorine, 100 lbs., at 9½ cts.	$ 9.50	
Freight	1.05	
Trucking	.50	
Total	$ 11.05	
Yearly cost based on treating 600,000 gallons per day with 3 parts per million of chlorine		60.44
Maintenance per year		15.00
Total yearly cost		$97.19
Cost per 1,000,000 gal. water treated		0.44

WESTFIELD

Plant—		
Apparatus	$450.00	
Building	125.00	
Stove	10.00	
Total	$585.00	
Yearly cost, interest at 5 per cent.		$29.25
Operation—		
Chlorine, 100 lbs., at 17½ cts.	$ 17.50	
Freight	.65	
Cartage	1.25	
Total cost of chlorine per 100 lbs.	$ 19.40	
Yearly cost of chlorine based on treating 1,000,000 gallons per day with .3 parts per million of chlorine		177.00
Attendant per day		100.00
Oil for heater		20.00
Maintenance per year, estimated		20.00
Total yearly cost		$346.25
Cost per 1,000,000 gal. water treated		0.95

At Hudson Falls the plant is located in the pumping station and is attended by the engineer, thus eliminating the cost of the building, heating and attendance, while at Westfield the plant is two miles in the country and a new and separate building had to be constructed to house the apparatus. The other item of difference in cost is chlorine. With the cost of chlorine the same at Hudson Falls as at Westfield, *viz.*, 17½ cents per pound, the total cost per 1,000,000 gallons of water treated would be $0.64 instead of $0.44.

Thomas Adams, the town planning engineer, of Ottawa, is expected in Vancouver, to assist the town planning section of the civic bureau of the board of trade in preparing a Town Planning Act for British Columbia. This act will likely be passed by the provincial government during the present session.

ESTIMATING CONTRACTORS' OVERHEAD COSTS IN SANITARY SEWER CONSTRUCTION*

By Stanley D. Moore
Waterloo, Iowa.

A SEWER system, successfully constructed, might be described as one that properly meets the present and immediate future needs of the community, conceived and designed by an engineer who is competent, and whose remuneration is commensurate with the service he should render; built by a competent and responsible contractor, under a contract that is fair to all concerned, and at a price that makes it possible to carry out the intent and spirit of the undertaking without friction or litigation. Many projects will not come under such a classification. The fault is not all with the contractors, nor all with the engineers, or the communities, but each contributes its share.

Trouble could largely be avoided if each of the elements mentioned would recognize that their interests are mutual, and if the work was undertaken in a spirit of co-operation instead of the too often prevailing attitude of antagonism.

There has been too much secrecy on the part of contractors, lack of frankness and a failure to give real information; too much suspicion on the part of communities, and a regrettable lack of consideration of the rights of the contractors by both engineers and communities. There has been too much guessing as to cost on the part of both contractors and engineers. It has been customary among engineers to figure costs of labor and material, taken from actual observation, plus 10 per cent. as a basis for estimates. Contractors being a little closer to conditions have been adding 15 to 20 per cent. to such costs. Hence the usual discrepancy between the engineer's estimate and the bids received. I say usual, because for the present I wish to ignore the ridiculous bids of irresponsible and uninformed contractors, and the misguided efforts of responsible men who feel it their duty to meet such competition. Responsible engineers should not allow contracts to be let below their estimate. They should be broad-gauged enough to know the fallacy of attempting to get something for nothing and should protect the community from inevitable trouble.

Recently the Federal Trade Commissioners conducted an exhaustive study of corporations in the United States and made the astounding discovery that less than 5 per cent. of them were profitable. A similar study of the business of engineering and contracting would show that less than 1 per cent. of those engaged are successful, or even solvent, and the answer to all this is "Overhead."

Overhead is very deceptive, because in this age of quantity production we have kept our eyes only on the lessened cost of the actual operation, and have forgotten that much of this saving is eaten up in overhead charges that did not formerly exist. That is why the price of commodities regulated by the government after scientific study of cost is usually raised, or at least established on a higher basis than the prevailing level.

I have here an analysis of overhead charges taken from a compilation of actual records during the last five years of $500,000 in sewer contracts, running better than the average in soil conditions, at better than the average price, handled with better than the average efficiency, by a well-equipped, well-financed and well-organized concern. I have purposely omitted the year 1917 from these records, because of unusual conditions and extra expense that would increase these overhead costs so much as to destroy their value as a record of average conditions.

*An address delivered before the 30th annual meeting of the Iowa Engineering Society.

In Table I. I have divided the overhead costs on one-half million dollars worth of sewer work and have predicted the probable increase in these costs for the year 1918. I should like to explain these items as follows:—

Job Expense: This is the cost of freight on equipment, miscellaneous drayage, the transportation of men, the expense of lost time for men receiving steady pay, the cost of bunk houses, storage and job office rent.

Maintenance: Getting the job ready for acceptance after the main construction is completed, and daily cost sheets stopped; care of streets and trenches; repairs under guarantee.

Plant Repairs: The cost of repairs to machines and equipment, small tools and repairs, cost of tools lost and stolen, blacksmith repairs.

Table I.

Based on contract price which turned out to be gross cost, as business yielded no net profit.

Items of overhead.	Average cost for 5 years. Per cent.	Estimated cost for 1918. Per cent.
Job expense	1.4	1.7
Maintenance	.6	.6
Plant repairs	1.5	1.8
Small tools and repairs	1.1	1.3
Depreciation	1.0	2.0
Incidental material	2.4	2.4
Bonds	.7	1.7
Insurance	1.6	1.9
Interest on jobs	1.1	1.3
Discount	1.0	2.0
Promotion expense	1.8	1.8
Office expense	.6	.7
Salaries	2.3	2.3
Traveling expense	1.3	1.5
War tax	..	.5
Interest on investment	..	.5
	18.4	24.0

Depreciation: This is a cost that every contractor has on his machinery and equipment and this item should be doubled at least to meet average conditions.

Incidental Material: This item represents the cost of lumber, jute, dynamite, coal, gasoline, kerosene, cement sacks that are lost, rubber boots, etc.

Bonds: This item represents the cost of surety bonds, the rate for which is high because so many bond companies have had to finish contracts for bidders who did not know how to estimate.

Insurance: This item represents the cost of workmen's compensation and public liability insurance, and will likely increase very materially every year.

Interest on Jobs: This is not interest on investment, but interest only on money borrowed to carry on construction.

Discount: This item should be five times as much as it is to meet the average conditions of the average contractor, but as this is a true record of actual costs of one firm it is thus set out, and is probably a much smaller amount than can be shown by any other contractor doing business in this territory.

Promotion Expense: This item covers the expense of promoting jobs, dues to associations, etc.

Office Expense: This item represents postage, telephone and telegraph bills and other expense of a like nature that every business must pay.

Salaries: This item is entirely too small to cover average conditions and is only intended to represent a very small salary drawn by the head of the firm who is sole

owner of the business and gives his entire time to same. It probably should be called expense rather than salary.

Traveling Expense: This item represents the expense of traveling to bid on jobs that you do not get, the expense of trips to jobs under construction, and the many trips necessary to the town after the work is completed in order to get final settlement.

War Tax: This item must be a part of all estimates for 1918 and represents not only tax on any profits, but on postage, telegrams, telephone and freight bills.

Interest on Investment: This item must be a part of all estimates of cost. Even the Tax Department of the government admits it is a legitimate cost.

With these proven figures for overhead and assuming that we have accurate data on quantities and costs of material and labor, there remains in an estimate but the one item, "profit."

Bearing in mind that a portion of the "profit" must necessarily be represented by investment in equipment on a reasonable basis of depreciation, what is a fair profit? The accepted basis is 10 per cent. That means that on a contract for $100,000 there should be a profit of $10,000, even though a portion of this is represented by equipment. I do not think this is enough to cover the hazards involved, but for purpose of illustration we will use it.

In almost all lines of business except the construction business all computations are made back from the selling price and not up from costs. As it seems necessary for us to work on the net cost of labor and material as a basis, we must make adjustments of percentages to produce the same result.

Table I. shows that "Overhead" for 1918 is 24 per cent. of gross cost. Then the net cost of labor and material was 76 per cent. of given cost; 24 per cent. equals 31.7 per cent. of 76 per cent. Or, in other words, using net cost as a basis the overhead charge is 31.7 per cent. of the net cost of labor and material.

In order to yield 10 per cent. net on the contract price the following computation must be used, although an engineer would express the same thing in an algebraic formula:—

Table II.

	Per cent.
Net cost of labor and material = ...	100.00
Overhead 24% of 76% of given cost = ...	31.7
Gross cost percentage of net cost = ...	131.7
10% of $\frac{100}{90}$ of 131.7 = ...	14.7
Contract price percentage of net cost of material and labor	146.4
Contract price to yield 10% net = net cost plus 46.4%.	

But a contractor cannot afford to do business on a 10 per cent. margin for the reason that an increase of 10 per cent. in labor cost which is as close an estimate as can be made, and which is many times unavoidable, is enough to wipe out his entire profit. He cannot afford to figure less than 15 per cent., which means adding 53 9/10 to his net cost instead of 46 4/10.

The following list of items all enter into the cost of building sewers and I have starred those which the contractor usually takes into account in making up his figures, but many items remain, all of which he must pay for, but which he fails to get into his estimate:

*Sewer pipe	*Labor
Jute	Bad weather
*Bonds	Freight on tools
*Insurance	Straight time
City council	Storage
Cement	*Discount
Tools	Lumber
Inefficiency	Repairs
Depreciation	Shipping delay
Interest	Office expense
Errors	Manholes
Salaries	Drayage
Bad work	*Association dues
Attorneys' fees	Promotion expense
Taxes	Bad luck
Transportation	Traveling expense
Engineer's errors	Hope
Engineer's delays	Water pipes
Engineer's estimates	Gas mains
Maintenance	

The question of "Overhead," while perhaps a recent development, is just as sure as "death or taxes." No contractor can get away from it.

He may be able to save on a few of the items but will go wrong on others. If he looks only at the saving, he is hiding his head in the sand. Many items of overhead have recently increased from 50 to 300 per cent. That is why many contractors have gone wrong, who have their overhead included in their estimating tables and have figured increased cost on a general percentage. This charge for overhead may seem high, but it is not, compared with similar commercial enterprises. For instance, the manufacturing business is similar to the contracting business. They take material and labor and sell a finished product and the average cost of overhead and selling expense in manufacturing is 70 per cent. over the factory cost. The retailer who has no labor to contend with has an established overhead of 20 per cent., but no contractor can hope to equal such figures. Furthermore, the contractor's rate of turnover is slow and below the average.

To better his condition the contractor must first confer with the engineer. As a class, the engineer is not unreasonable and is open to conviction, and the contractor must show him frankly the whole situation and convince him of his mistakes in estimating. A number of engineers have recently told me that they had never been able to get any real information from contractors, and would be glad to have a basis to work from.

The next trouble is with the communities, although they usually get their ideas from the engineers. If the price is too high, let them wait until they are ready to pay it. That is what other business men do, and it is better to let the job wait than to do it for nothing. Every community is better off if they pay a fair price and get a good job satisfactorily executed than if they try to get something for nothing and get skinned.

The irresponsible competitor is another factor that often originates with the engineer, who many times has a mistaken idea that the contractor is making a lot of money, and who therefore encourages some inexperienced person to enter the field of competition. It is unfortunate that engineers are not compelled to do two years of contracting before they are allowed to practice their profession. They then would not get wrong ideas in their heads, and would not spend a lifetime trying to prove that their first impressions were right. Many methods of overcoming unreliable competition may suggest themselves; none of which, however, justify the wrong idea that a contractor had better do work, even if there is nothing in it, than to be idle.

The last and greatest trouble is with the contractor himself. Let him get out of the old rut and start estimating properly, discarding all his old estimating tables, retaining only his records of labor, and material cost, for his first basis in estimating, making proper allowance for increases in wages and material, and the ever-decreasing efficiency of labor; then include a proper percentage for overhead and profit.

Committee on Prestige Offers Resolutions

Members of the Toronto Branch of the Canadian Society of Civil Engineers Meet To-night to Adopt, Amend or Reject Nine Resolutions Tending Toward Improvement in the National Status of Engineers

THE following nine resolutions have been prepared by the Committee on Prestige of the Toronto Branch of the Canadian Society of Civil Engineers, and will be discussed at a meeting to be held this evening at the Engineers' Club, Toronto:—

1.—That the Ottawa Branch be invited to co-operate with the Toronto Branch in the drafting of a bill for the restriction of the employment of engineers upon public works, such as federal, provincial and municipal works, to those who have conformed to the requirements which shall be defined therein; and such draft, after being approved by the respective branches, to be submitted to the council of the Institute for consideration and action.

2.—That legislation be obtained forbidding the expenditure of public funds upon the construction of bridges, roads, docks, harbors, waterworks, sewerage and sewage works, electric light and power works and other undertakings, unless the plans for the same shall have been prepared by and the supervision is under the control of engineers who have conformed to the requirements defined in the proposed draft bill mentioned in Resolution No. 1.

3.—That it is desirable that the branch shall make provision for the payment of the branch secretary, and that it shall be deemed part of his duty to keep in close touch with the members and to render every assistance for their professional advancement.

4.—That the council of the Institute be asked, in order to secure material for further discussion, to issue an enquiry to the members generally to ascertain the compensation received by engineers of various ages and in different classes, and employed in various technical services, and that steps be taken, if possible, to ascertain also the compensation paid to men of corresponding ages, classes and services in other professions.

5.—That the council be asked to organize a scheme for the defence of members who have been attacked in the performance of their professional duties on what may appear unjustifiable grounds.

6.—That the technical work of the Institute can be most successfully carried on by means of technical sections to which shall be entrusted the organization of ordinary meetings, special sectional conventions, etc.

7.—That the executive committee be requested to consider the suggestion of holding weekly or fortnightly lunch meetings, at which addresses will be delivered and facilities given for the members to become better known to each other. Such practices as obtain at meetings of the Rotary or the Electrical Clubs might be followed.

8.—Whereas in the vocation of engineers, technical knowledge is necessarily of primary importance, that the council be asked to adopt every means in their power to make transactions of the Institute a complete record of Canadian engineering achievements and of Canadian engineering studies.

9.—That it is desirable to appoint sectional technical committees who shall undertake special studies and investigations to be assigned to them. The appointments to such committees to be made only after formal acceptance of office by the nominees, and the work of the technical committees to be carefully supervised by the executive committee. In the case of appointees failing to carry out the work, the executive shall, after due notice, request their retirement and elect others in their places.

TWO ENGINEERS TO LOSE POSITIONS?

Unless some further influence is brought to bear upon the city of Vancouver, B.C., two of the three engineers who are now department heads in the city's employ will be discharged in the near future. The city council has unanimously adopted a recommendation that the city engineer, F. L. Fellowes, be instructed to dispense with the services of any two of his three present assistants, merely in order to economize in the engineering department.

The three engineers concerned are A. G. Dalzell, in charge of sewers; Chas. Brakenridge, in charge of paving; and E. M. Le Flufy, in charge of waterworks.

At the council meeting a letter was read from E. G. Matheson, vice-chairman of the Vancouver Branch of the Canadian Society of Civil Engineers, protesting against any reduction in the city's engineering staff, and urging that "a strong staff be maintained and its time and energy devoted to planning for the future growth of the city, to the end that its development may be along economical lines and its sanitation and beauty be safeguarded."

The reduction in the city's engineering department was one of the planks in Mayor Gale's election campaign, and he has persistently advocated a reduction of the engineering staff from four to two.

AMERICAN SOCIETY OF M.E., ONTARIO SECTION

A meeting of the Ontario Section of the American Society of Mechanical Engineers was held at 8 p.m. April 18th, at the Engineers' Club, Toronto. Professor Angus presided and the local members and a number of visitors and prospective members were favored with a very interesting paper on "Heat Treatment of Low Carbon Steels," by W. M. Wilkie, of the steel department of the Imperial Munitions Board.

The discussion that followed the paper bore principally on the troubles encountered by the producers and users of shell steel. Among the engineers present were a number of those connected with local munitions plants, and their remarks were based on actual experiences and the solution of various troubles under war-time conditions.

Before the paper was read, the meeting appointed W. P. Robinson, of the Northern Crane Works, Limited, to be chairman of the committee on increase of membership, re-appointed the secretary, C. B. Hamilton, as delegate to the Joint Committee of Technical Organizations (Ontario Branches), and appointed a nominating committee of two, Messrs. Flettemeyer and Ward, to prepare a slate for the election of section executives which will take place by letter ballot within the next few weeks.

The Engineer's Library

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer, 62 Church Street, Toronto

RELIEF FROM FLOODS

Reviewed by W. H. Breithaupt, C.E.
Kitchener, Ont.

By John W. Alvord and Charles B. Burdick. Published by the McGraw-Hill Book Company, Inc., New York. First edition, 1918. 175 pages, 22 tables, 54 figures, 6 x 9 ins., cloth. Price, $2 net.

In the past number of years there has appeared a large bulk of literature on the question of flood relief. The exhaustive report of the Pittsburg commission on regulation of the Allegheny and Monongahela rivers in 1911, numerous reports of State commissions, notably the New York State reports since 1913, the Ohio flood reports, and many others. This book, while giving more attention to the Ohio problems, is a general compendium, aimed somewhat at the general public, but a good book for the engineer. It has good illustrations and instructive diagrams and tables.

The frequent reference to Ohio floods the authors frankly explain on the ground that this is their particular field. The enormous flood losses in the United States since 1900 are emphasized and particularly those in Ohio. Factors affecting stream flow and floods are precipitation, character of water-shed and climate. The wide variation, depending on topography and condition of surface, on subsoil conditions and on saturation of the ground, is discussed.

Forestation, while no doubt of not much effect in many cases, is rather underestimated by the authors as to its effect on particular rivers as combined with topography and climate; as, for instance, with snowfall in northern climates.

In chapter 2, means for flood relief are discussed. These consist of flood prevention, flood protection, and flood diversion. In the United States no large detention basins have so far been built primarily for flood protection. There are many for conservation of municipal water supply. A detention basin is defined as a dam across a river valley having in its base an opening large enough to pass the channel capacity of the river below it. River control by means of levees is an old practice, as are also dykes protecting low lands on the sea-shore. The French were practically first in Europe in the art of river control by storage. Two dams on the Loire date from 1711. In Germany and Austria such work has been particularly extensive since 1900. A table is given of storage dams in France, Germany and Austria. The largest artificial storage reservoirs in Europe are in Russia, on the Volga and Meta Rivers. There are also considerable works of this kind in Spain. In the United States the largest capacity reservoirs are those on the headwaters of the Mississippi River, with capacity of 96 million cubic feet. These reservoirs have been effective in improving the low-water stage at St. Paul by 14 inches. The Ottawa River water storage, still under way, will be of larger capacity, and less cost than that on the Mississippi. A table is given of recommended reservoirs on the Allegheny and the Monongahela water-sheds.

In the Ottawa River project, and again in tables, pp. 133 and 153, reservoir capacity is given in acre-feet. The term "acre-feet" pertains, properly, to irrigation projects only. As applied to storage capacity in general this term is involved and to that extent confusing.

Chapter 3 discusses flood investigations and the importance of comprehensive exposition to the public.

Chapter 4 further discusses flood investigation, under three heads—Values and Losses, Topographical and General Physical Condition of the Water-shed, and Hydrology; annual flood losses, what territory can be profitably included in a protection project, rainfall records and stream flow, rating curves, etc. The Ohio River is in the path of most of the great rainstorms in Central North America.

Chapter 5 treats of probable magnitude of greatest floods to be provided for in relief works, discusses Kuichling's data and formulæ and the comparison ratios suggested by W. E. Fuller. A map of the United States is given showing mean annual flood coefficients.

In Chapter 6 flood protection by channel improvement is considered, under the methods of levee construction and channel betterment, and by cut-offs. Any such channel improvement delivers the water more rapidly to the river below and is therefore to that extent objectionable. In channel improvements it is necessary to observe the limiting velocity, to prevent scour. The protection afforded by sod on flooded areas is illustrated, and varieties of channels and conduits are discussed.

Chapter 7 deals with flood prevention by water-storage, distribution of stream flow, incidental storage, and storage for floods; the location and required capacity of flood reservoirs; detention basins and their automatic operation, spillways, outlets and drift barriers. The Dayton detention basins and the proposed works for the Scioto River are described. A final conclusion is that local conditions must govern the particular type of relief best adapted.

An appendix gives a comprehensive and valuable table of great floods in the United States, with record period of from 10 to 70 years, drainage areas, maximum and average annual floods and their ratios.

The book has a good index.

WHAT INDUSTRY OWES TO CHEMICAL SCIENCE

Reviewed by L. J. Rogers
Canadian Inspection and Testing Co., Toronto

By Richard B. Pilcher and Frank Butler-Jones. Published by Constable & Co., Limited, London. 150 pages, 5 x 7½ ins., cloth. Price, $1 net.

The authors deal with the great advancement made in industry in the last century, and indicate the manner in which chemistry has brought about changes. Possibly the most noteworthy of these are the steel and dye industry. "Experience accumulated slowly and at great cost had done great things, but the rate of progress in industry developed in the past century defies comparison with all the centuries combined since time was—so far as we know."

This book is readable to the layman and will give a comprehensive view of the value of the application of chemistry to most any manufacturing business.

To the student it is concise history of scientific advancement during the last century.

RAILROAD STRUCTURES AND ESTIMATES

Reviewed by J. R. W. Ambrose
Chief Engineer, Toronto Terminals R'y. Co.

By J. W. Orrock, M.Can.Soc.C.E. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London; Canadian selling agents, Renouf Publishing Co., Montreal. Second edition, 1918. 574 pages, 272 figures, 6 x 9 ins., flexible binding. Price, $5 net.

The author has covered the field so thoroughly that the work is invaluable to the experienced engineer as well as to the student, and every superintendent would do well to keep a volume in his office bookcase for ready reference.

To make an exhaustive review of this work would require more space than is at my disposal. It will suffice to say that there is no department of the construction and maintenance of railways that is not covered. The book is so profusely illustrated with detail drawings and estimates that even the comparatively inexperienced is enabled to check or design railway structures of all kinds.

Estimates of costs are given in all cases, and while these are based upon pre-war prices, they can easily be changed to suit local conditions.

The formulæ given for estimating the cost of steel and wooden bridges are new and based upon actual experience, making them of exceptional value.

The work really embodies a complete set of railway standards which has required years of experience to formulate.

MECHANICAL LABORATORY METHODS OF TESTING MACHINES AND INSTRUMENTS

Reviewed by Prof. Robt. W. Angus
University of Toronto

By Julian C. Smallwood, M.E. Published by the D. Van Nostrand Co., New York. Second edition, 1918. 399 pages, 5 x 7½ ins., 114 illustrations, flexible leather. Price, $3 net.

This is the second edition of a very useful and practical book for use mainly in engineering laboratories, although it contains many things that will prove of value to the practicing engineer. The author has divided the treatment of the subject into three parts, *viz.*, the testing of instruments, the analysis of combustion and the testing of power plant units.

The testing of instruments deals with a most useful, and too-frequently neglected, matter—the calibration of the scales, gauges, indicators, planimeters, etc., and the author has covered very fully and completely the ordinary instruments used.

The section on combustion is rather short but deals with useful matters, while under the testing of power plant units the author has discussed steam engines, boilers, pumps and other steam apparatus, gas engines, refrigerating machines and air compressors. He has devoted relatively little space to the matter of hydraulic turbines and pumps, which, however, seems consistent with the title of the book. There is practically nothing on electric testing.

On the whole, the book is very well written, and is a helpful guide in the laboratory, and will prove suggestive to the consulting engineer who is doing mechanical testing at more or less infrequent intervals.

NOTES, PROBLEMS AND LABORATORY EXERCISES IN MECHANICS, SOUND, LIGHT, THERMO-MECHANICS AND HYDRAULICS

Reviewed by Prof. Peter Gillespie
University of Toronto

By Halsey Dunwoody, late acting professor of Natural and Experimental Philosophy. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London; Canadian selling agents, Renouf Publishing Co., Montreal. 369 pages, illustrated, 6 x 9 ins., cloth. Price, $3 net.

This book is essentially a book of problems supplemented by various theoretical and historical notes intended to elucidate the subjects to which the problems relate. It was prepared by the author as a reference text in connection with his course in "Natural and Experimental Philosophy" at the U.S. Military Academy, and to a large extent is a compilation of notes and exercises drawn from the syllabi of several technological schools, including the Massachusetts Institute of Technology and the Worcester Polytechnic. The problems are exceedingly varied, covering as they do dynamics, machines, heat, sound, light, hydromechanics and graphic statics and should afford an excellent field for selection for those entrusted with the teaching of those subjects in engineering schools. The theoretical treatment is generally brief but adequate.

TESTING FOR THE FLOTATION PROCESS

Reviewed by F. C. Dyer
University of Toronto

By A. W. Fahrenwald, Professor of Mining and Metallurgical Engineering, New Mexico State School of Mines. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London; Canadian selling agents, Renouf Publishing Co., Montreal. First edition, 1917. 173 pages, illustrated, 4¼ x 6¾ ins., flexible binding. Price $1.50.

This book is a convenient and compact resumé of the latest ideas concerning flotation. Before describing the laboratory tests and apparatus the author gives enough of the theories and fundamentals of the various processes to make the actual testing intelligible. The part concerning colloids and emulsions is well written, leaving out a lot of unnecessary phraseology and ambiguous terms. The chapter on oils will be found useful, much of the success or failure of flotation being due to a choice of oils. The chapters on oxidized ores, flotation costs, and tables help to complete a book that will be found very handy for anyone engaged in flotation practice.

DIFFERENTIAL AND INTEGRAL CALCULUS

Reviewed by Prof. Alfred Parker
University of Toronto

By H. B. Phillips, Ph.D., Massachusetts Institute of Technology. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London; Canadian selling agents, Renouf Publishing Co., Montreal. 356 pages, 5 x 7¼ ins., cloth. Price, $2 net.

The lines along which an elementary text-book on the calculus should proceed are fairly definite, almost as much so as is the case with text-books on elementary algebra. Dr. Phillips' book will be found an excellent work for use in classes. There is great clearness of treatment, important parts of the subject are properly accentuated and parts of minor consequence are left where they should be. There is a great wealth of practical examples and problems for the student to work, with the result that the student who follows Dr. Phillips' treatment will realize how intimately the infinitesimal calculus is associated, one may almost say, with the affairs of everyday life. Very properly, a chapter on different equations has been introduced as a continuation of the work on integration.

ELEMENTS OF SANITARY ENGINEERING

By Mansfield Merriman, M.Am.Soc.C.E. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London; Canadian selling agents, Renouf Publishing Co., Montreal. Fourth edition, 1918. 250 pages, illustrated, 6 x 9 ins., cloth. Price, $2 net.

This useful volume has been revised and brought up to date with the assistance of Richard M. Merriman, Assoc. Mem.Am.Soc.C.E. and assistant engineer of MacArthur Bros. Co., New York.

Like the previous editions of this work, it is primarily intended for the use of students, and at the end of each chapter are given exercises and problems which require that the student shall consult encyclopedias, books and engineering literature in order to obtain details of special topics.

Since the publication of the first edition of this book in 1898 many important advances in sewage disposal have been made. Accordingly, the chapter dealing with sewage disposal has been rewritten and expanded. The articles on the Imhoff tank and the article on the other methods of sewage purification are new matter. Fourteen new pages of text have been added and a number of new problems and exercises introduced and several sections have been entirely rewritten.

PUBLICATIONS RECEIVED

Estimates for the Fiscal Year Ending March 31, 1919. Federal Government, Canada. Sessional paper 3. Price, 5 cents.

Temiskaming and Northern Ontario Railway Commission.—Annual report, 1917. Ontario Government Railway.

Records of Scientific Literature.—November to December, 1917. Published by D. Van Nostrand Company, 25 Park Place, New York City.

Electrification of Railways.—By S. T. Dodd, General Electric Company, Schenectady, N.Y. Issued by the Commission of Conservation, Canada.

Nox-Aer-Leek.—Pamphlet on the uses and application of this cement. Issued by the Barrett Company. Prepared by the Erickson Company, New York.

The Niagara Power Shortage.—By Arthur V. White, consulting engineer, Commission of Conservation. Issued by the Commission of Conservation, Canada.

Power Possibilities on the St. Lawrence River.—By Arthur V. White, consulting engineer, Commission of Conservation. Issued by Commission of Conservation, Canada.

Tide Tables for Nelson, Hudson Bay—Also tidal data for Hudson Strait and James Bay for the season of 1918. Issued by the Tidal and Current Survey in the Department of the Naval Service of the Dominion of Canada.

Navigation.—By George L. Hosmer, Massachusetts Institute of Technology. Published by John Wiley & Sons, Inc., New York. First edition, 1918. 214 pages, 52 cuts, 4⅛ x 6⅛ ins., cloth. Price, $1.25 net.

Iron Ore Occurrences in Canada.—Volume II. with magnetometric and geological maps. Compiled by E. Lindeman, M.E., and L. L. Bolton, M.A., B.Sc. Issued by Mines Branch, Department of Mines, Canada.

Manitoba Hydrometric Survey.—For the calendar year 1916. By M. C. Hendry, A.M.Can.Soc.C.E., chief engineer. Water Resources Paper No. 22. Dominion Water Power Branch, Department of the Interior, Canada.

Comparative Tests of Six Sizes of Illinois Coal on a Mikado Locomotive.—By Edward C. Schmidt, John M. Snodgrass and Otto S. Beyer, Jr. Bulletin No. 101, published by Engineering Experiment Station, University of Illinois, Urbana, Ill. Price, 50 cents.

Annual Report (1917) of the Hydro-Electric Power Commission of the Province of Ontario.—Vol. I. Legal proceedings. Transmission systems. Operation of the systems. Construction work of the commission. General activities of the commission.

Interests Dependent on Winnipeg River Power.—With special reference to the capital invested and the labor employed. By H. E. M. Kensit, M.Am.Inst.E.E., M.Can. Soc.C.E. Water Resources Paper No. 20, Dominion Water Power Branch, Department of the Interior, Canada.

A Dictionary of Aircraft.—By W. E. Dommett, A.F.Ae.S., M.I.Mar.E., A.M.I.A.E., author of "Aeroplanes and Airships," etc. Published by Electrical Press, Limited, Fisher Street, Southampton Row, London, W.C.I. New York agents, D. Van Nostrand Co., 23 Murray Street.

Creosoted Wood Block Factory Floors.—Causes and prevention of failure. Paper read by Lambert T. Ericson, contracting engineer, at convention of American Wood Preservers' Association, Chicago. Published by the Jennison-Wright Company and the Midland Creosoting Company, Toledo, Ohio.

Proceedings of the Victorian Institute of Engineers, 1917.—Containing papers and discussions on the subjects of "Training of an Engineer," "The Influence Line," "Road Construction to Stand Modern Traffic," "Gas Holder Construction," etc. Published by the Institute, 57-59 Swanston Street, Melbourne, Australia.

Steam Tables for Condenser Work.—A hand book of steam tables, with pressures below atmospheric expressed in inches of mercury referred to a 30-in. barometer; also including a discussion of the use of the mercury column, the errors in such measurements and constants for their correction. Published by Wheeler Condenser and Engineering Company, Carteret, N.J.

McAvity Marine Specialties.—Sixty-eight page catalogue, 8½ x 10¾ inches, coated paper, well illustrated, describing McAvity marine specialties to pass British Admiralty, Lloyds and Imperial Munitions Board's specifications, including marine valves, fittings, hardware, etc., used on steamers and vessels both in building and maintenance. This firm also recently published a catalogue of similar size on "World" corporation specialties, including fire hydrants, gate valves, globe valves, indicator posts, hose nozzles, sewage pumps and ornamental lighting posts.

The Canadian Engineer

Established 1893

A Weekly Paper for Canadian Civil Engineers and Contractors

Terms of Subscription, postpaid to any address:

One Year	Six Months	Three Months	Single Copies
$3.00	$1.75	$1.00	10c.

Published every Thursday by
The Monetary Times Printing Co. of Canada, Limited

JAMES J. SALMOND, President and General Manager — *ALBERT E. JENNINGS*, Assistant General Manager

HEAD OFFICE: 62 CHURCH STREET, TORONTO, ONT.

Telephone, Main 7404. Cable Address, "Engineer, Toronto."

Western Canada Office: 1208 McArthur Bldg., Winnipeg. G. W. GOODALL, Mgr.

Principal Contents of this Issue

THE MINISTER OF PUBLIC WORKS

PATRONAGE really appears to be doomed in the Public Works Department under the direction of Hon. Frank B. Carvell, now Minister of Public Works. Contractors throughout the country will read with considerable satisfaction the official correspondence recently tabled in Parliament and subsequently published in the "Toronto Globe." On motion by an opposition member, the administration tabled correspondence between the Minister of Public Works and the Conservative-Unionist member for Ottawa, A. E. Fripp. Two months before the general election, Mr. Fripp wrote the new Minister of Public Works, asking that a certain firm in the former's constituency be placed upon the patronage list. The minister promptly replied as follows:—

"Your friends will have opportunity of tendering on any work coming within their line, but, so far as this department is concerned, there will be no patronage list in the future. As far as possible, everything will be done by public tender and contract, and every member of the community will have an equal opportunity of working for the government. Efficiency and economy will be the guiding principles in carrying on the business of the department."

Soon after the general election Mr. Fripp again wrote the minister and suggested the names of certain individuals to act as employment agents on certain public works. The minister replied immediately upon receipt of the letter, stating that he was unable to agree with the suggestions made and saying that he could not and would not have his time taken up with small matters of patronage. He advised Mr. Fripp to take the same stand. The Ottawa member replied that his purpose was merely to get rid of the fifty or sixty people who crowd his office daily, and said that the people of Ottawa have lived on patronage for fifty years, and that it would require some tact to eradicate the practice.

Mr. Carvell wrote to Mr. Fripp a week later, saying that he had given instructions regarding employment of the class of people referred to by Mr. Fripp, and stating that it would not be necessary for them to produce a letter from either Mr. Fripp or Dr. Chabot (junior member for Ottawa) or to use any other influence for the purpose of obtaining employment in the Public Works Department.

It is evident, however, that Mr. Fripp was still unconvinced that patronage had been banned, because on February 12th, 1918, he wrote Mr. Carvell asking that certain Ottawa concerns be given an opportunity of tendering for the construction of the new 700-room office building which the department proposed to build in Ottawa. In reply, Mr. Carvell wrote:—

"Every contractor, not only in Ottawa but in Canada, will be given the opportunity to tender. The contract will go to the lowest tenderer, providing the firm has the financial ability to carry out the work."

The "Toronto Globe" says that Mr. Carvell is to be congratulated upon his honest and businesslike stand, and *The Canadian Engineer* would second these congratulations. The Department of Public Works is the big spending branch of the administration, and if Mr. Carvell sticks to his announced policy of carrying out all public works honestly, impartially and efficiently, his administration of that department is likely to constitute a bright and shining spot in the Borden Government. This is particularly true if, at the same time, he really adheres to the policy which he outlined recently in a speech before the Ottawa Branch of the Canadian Society of Civil Engineers, when he said:—

"I propose doing nothing in my department except on the advice of the responsible engineers employed to give me that advice. . . . I have learned that the man who attempts to construct anything without taking the advice of technical men, is on a par with the lawyer who conducts his own case,—and I suppose you know the rest of it, he has a fool for his client. Being both a lawyer and a minister of public works, and knowing something of the consequences of not taking the best course in these matters, I have decided that so far as I am concerned, I will rely on the advice of my technical officers on all technical questions."

A CLOSED PROFESSION

IN a "Letter to the Editor" published on page 361 of this issue, C. E. W. Dodwell, of the Public Works Department, very interestingly outlines the struggles of the engineers in that department to obtain higher remuneration and some of the special privileges accorded to clerks and others but not to engineers. As a partial remedy for existing conditions, Mr. Dodwell suggests "closing" the profession. He says:—

"It is proper that membership in some one of the several classes in the Canadian Society of Civil Engineers should be required as a just and proper indispensible condition precedent to appointment in our service. . . . . Membership in the Canadian Society of Civil Engineers is the only guarantee, test, diploma or certificate that a man is a qualified engineer."

If only members of the Canadian Society of Civil Engineers were to be allowed to practice engineering in Canada, the entire procedure of admission to the society would have to be changed. Graduation from a recognized engineering course or the passing of a national board's examinations, should then *entitle* any man to corporate membership in the society, without any voting or ballot-

ing; disciplining or dismissal from membership should be solely in the hands of the same representative, impartial and carefully constituted board that conducts the examinations for admission; and nobody should ever be admitted to membership other than graduates of recognized engineering universities, those who from time to time might pass the examinations of the national board, and those who in the opinion of the national board had been clearly practising engineering for a certain term of years prior to the passing of the Act closing the profession.

Engineers differ widely in their opinion whether a closed engineering profession is feasible or practical. Many believe that it depends a great deal upon whether a satisfactory administrative or examining board could be obtained, and upon whether examinations could be devised which would be sufficiently rigorous to bar out the undesirable applicant and at the same time sufficiently broad to reveal the practical skill and knowledge of the engineer who might be well qualified along some lines and yet deficient in certain fields of theory.

PERSONALS

Major ATHOL H. MACFARLANE, M.C., who recently received his majority, went overseas as private in the 4th C.M.R. He is a graduate of the School of Practical Science, University of Toronto.

J. B. CHALLIES, superintendent of the Dominion Water Power Branch, was in Halifax last week in conference with the Nova Scotia Water Power Commission with regard to the investigation and administration of the water powers of that province.

Major J. COLIN KEMP, M.C., who was recently appointed brigade major with the 3rd Brigade, 1st Division, has been severely wounded in the recent fighting. Major Kemp, in civil life, was a mining and civil engineer connected with the firm of R. A. Ross, Montreal.

E. L. COUSINS, chief engineer and general manager of the Toronto Harbor Commission, has returned from a trip to Vancouver, where he enquired into harbor conditions and was consulted by the city engineer, F. L. Fellowes, regarding the development of the upper basin of False Creek.

Lieut. C. F. SZAMMERS, B.A.Sc., '11, University of Toronto, who went overseas with the 2nd Canadian Pioneers, has been appointed O.C. of the Canadian Corps Tramways, Section 1, engaged in building light railways to the front line in France. Before enlisting, Lieut. Szammers was connected with the firm of Sherwood and Sherwood, Toronto.

Prof. L. A. HERDT, M.Can.Soc.C.E., E.E., Macdonald professor of electrical engineering at McGill University, recently appointed to the Montreal Tramways Commission, is also chairman of the Electrical Commission of Montreal, the representative of the provincial government on that board. Prof. Herdt was born in France in 1873, came to Canada when a boy, and was educated at the Montreal High School and McGill University, whence he graduated in the Faculty of Applied Science in the department of mechanical engineering in 1893. After a short term with the Laurie Engine Works, Dr. Herdt decided to specialize in electricity and with this in view went to study in Paris and Liege, where he graduated with first-class honors. He returned to Canada in 1900 and joined the staff of the Electrical Department of McGill as demonstrator. In 1907, he was made associate professor and in 1909 succeeded Prof. R. B. Owens to the chair of electrical engineering. In 1905, he was appointed Officier d'Academie by the government of France and in 1907 was the Canadian delegate to the International Electric Technical Commission which met in London, Eng. He was consulting engineer for the large hydro-electric development of Winnipeg in 1910, built at Point du Bois, with a transmission line of 77 miles. He was also the consulting engineer of the Montreal Electrical Commission, and of the recent Tramways Commission which made a tour through the principal cities of the United States to study methods of operation. Dr. Herdt has done much electrical research and is the author of a number of works accepted as text books throughout the continent.

CANADIAN ASSOCIATION OF ENGINEERS

The third organization meeting of "The Canadian Association of Engineers" was held last Monday evening in the Engineers' Club, Toronto, with fifteen prospective members present. In the absence through illness of Hyman A. Goldman, chairman pro tem, the chair was taken by F. B. Goedike, secretary pro tem. A committee of five members, with G. L. Berkeley as chairman, was appointed to draft a constitution and by-laws.

It was decided to meet at the Engineers' Club on the third Monday of each month, beginning May 20th. Letters from the secretary of the American Association of Engineers were read, but it was decided to proceed with the organization and incorporation of a distinctly Canadian association which would co-operate with the American association, rather than to form a branch of the latter. A publicity committee was appointed for the purpose of securing a larger attendance, at the next meeting, of junior engineers who desire to join the organization.

The chief purpose of the organization, at present at least, appears to be a concerted action toward improving the remuneration of junior engineers and toward helping unemployed members to find positions. The suggestion by Prof. Peter Gillespie, chairman of the Toronto Branch of the Engineering Institute of Canada, that the organization of the new association be deferred, pending action along similar lines by the Institute, was not favorably considered. Five of the men who were present are members or associate members of the Engineering Institute of Canada, and they expressed the hope that the Institute would take active action along these lines but did not favor abandoning the organization of the new association, at least until the Institute had accomplished something definite along the lines which will be followed by the association.

The acting chairman stated that the need for their organization would disappear and that they would disband and all join the Institute, if they should see at any future time that the Institute in Canada is accomplishing for the junior engineers what the American Association of Engineers is accomplishing for them in the United States.

AMERICAN WATER WORKS ASSOCIATION

Arrangements have been made with the Planters' Hotel, St. Louis, for holding the convention of the American Water Works Association. The meeting room, secretary's office and exhibit room will be at this hotel. The American Annex, two blocks from the Planters, has been selected as the overflow hotel. Owing to freight conditions, there will be no heavy exhibits.