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MISSING

The Canadian Engineer

WEEKLY

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The Canadian Engineer

ESTABLISHED 1893.

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CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

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NOTICE TO ADVERTISERS

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TORONTO, CANADA, OCTOBER 15, 1909.

CONTENTS OF THIS ISSUE.

MUST THE YOUNG ENGINEER SERVE UNDER ARTICLES?

The old phrase, "History repeats itself," is so hackneyed that we are almost afraid to use it, but it draws attention so pointedly to a condition now developing in Canada that we may be pardoned for giving the quotation.

The profession of engineering in Great Britain, and for that matter in all European countries that have developed an engineering profession, is made up of men who served under articles in the offices of private individuals and city surveyors, or in the yards and shops of large corporations. Their terms of apprenticeship ran from three to seven years, and, in addition to becoming familiar with the routine and detail of the works, they received a certain amount, and frequently a very substantial amount, of systematic instruction of a technical nature in the scientific principles of the work on which they were engaged.

In some cases these men were college-trained men; in others, they were articled upon leaving the secondary schools. In any case they served long enough to become masters in their own right, and as a result European engineers are recognized as men, methodical, careful, able, and highly skilled in their own particular branch.

The first engineering work in Canada was undertaken by the British military engineer, and then followed a few British and foreign civil engineers anxious for adventure, and willing to neglect for the time being the finer requirements of the older lands. These men were the pioneers who prepared a body of younger men, who perforce had to accept an empirical and accidental training and carry on the work of a young country troubled with growing pains.

It is true that, coupled with all our great engineering works, we find the names of men who would have been a credit to the profession in other countries. Strong men, true artists. But the rank and file were pressed or paid men.

Then came the technical college, the University Department of Applied Science, and the young graduate went forth, large in theory, small in experience. But the country was growing, the supply of engineers was limited, the work was large, and men were in great demand. The college graduate very quickly became a full-fledged engineer. If he was resourceful, his promotion was sure and rapid.

But that has changed. Ten or a dozen Canadian colleges are conducting engineering courses. The supply is a little greater than the demand, and the young man no matter how good his technical training—finds difficulty in securing a position. When he does he expects a high salary, and as a result his employment is only temporary, so that at the end of two or three years he has been under a dozen different men and on a variety of work, and yet he is not master of any one branch.

The college graduate who wishes to become a surveyor must serve one year. This term of apprenticeship will be enforced, and perhaps lengthened, and the civil engineer, who finds that just when he requires the assistant that he has trained and put in the way of experience he has lost him, will be very much inclined to bind his men under articles also.

The time is almost ripe for such a step, and when it does come it will mean the production of men more highly specialized than engineers now usually are.

The careful, systematic and long training that has made the skilled engineer of Europe will have to be adopted in this country if we wish to keep abreast of the best work in older lands.

GUELPH AND HER PURE WATER SUPPLY.

In another section of this issue we give a detailed description of the recent additions to the water supply of Guelph, Ont.

The enlarged system was designed by Davis & Johnson, consulting engineers, Berlin, Ont., who were retained by the Guelph Water Commissioners, Messrs. G. B. Ryan, R. L. Torrence and John Newstead.

The formal opening of the new system during the last week of September was made the occasion of much speech-making, and incidentally of some editorial comment.

The system cost to date over $300,000, and now supplies water at an average cost of $9 per year for ordinary householders.

Guelph and her council and her visitors made great ado over the success that has attended their various public enterprises. Rightly so. A municipality that can handle electric light, gas, and an electric railway and show a surplus annually has much to be thankful for. We enjoyed hearing the Commissioners complimented for their loyalty and unselfish service. It is fortunate that men of prominence, ability and standing are willing to give their time and best thought to questions that concern the whole community. Hats off to the Guelph Commissioners and council, but do not let us forget the men who did the detail work. The men who accepted the responsibility for their recommendation, the men who, by continued application, by looking after the little things, worked out the success.

Guelph has a successful system, due largely to the ability and skill of William Malcolm Davis, their consulting engineer, and the aggressiveness, practical knowledge and administrative power of James J. Hackney, manager of the waterworks, lighting plant and street railway.

After all it is the men who do the work, the men that are not often in the limelight, that make public or private ownership a success. And just here we take pleasure in congratulating Guelph on being able to secure such careful, loyal municipal officials.

THE TECHNICAL PRESS AND ADVERTISING.

The technical press, in addition to furnishing reading material and technical information for the engineer has also another field—a field just as necessary and just as useful—that of bringing closer together with the least cost the seller and buyer. It is just as necessary for the engineer to know where he can get a turbine or a generator as it is for him to know how to place it or protect it. You may design and stake out, but unless you can secure the material to build with your planning will be of little avail, and it is part of the duty of the technical press to assist in furnishing the engineer with supplies. That is why just as much care is exercised in selecting the class of advertisements that appear in a technical paper as in selecting the articles for the reading pages.

And it is just as necessary for the producer (the manufacturer) to advertise if he wishes to secure business as it is for the engineer to read and study if he wishes to maintain his position in the profession.

A couple of years ago a large Canadian firm spent several thousands annually in advertising. A year ago they cut the advertising appropriation down to as many hundreds. For a time they did not notice any falling off in business. Their firm name and their goods were well known. A year later their salesmen found enquiries dropping off; the travelling salesman found it harder to talk business. Smaller firms were advertising, getting a little of the business, first one place and then another. New buyers were in the market—buyers who did not know the older and larger firm. As a result they must spend money to regain their former field.

Another firm doing a large business with contractors cut out all advertising, trusting to salesmen in various supply houses to place their goods. In just one year they went from the top to the bottom of the list of sales of those supplies in Canada.

Not long ago a salesman for storage batteries—a former advertiser—called and said: "Why do you take our competitor's advertisement? For years we carried an advertisement with you. They are newcomers. We have quit, 'tis true, but only for a short time. The worst part is we have **not made a single sale** since we quit and the other fellows commenced."

The right kind of advertising, like the right kind of technical literature, is read, and if not immediately used is put by for reference, and the right kind of engineer reads advertisements as well as editorial matter.

EDITORIAL NOTES.

Over eight million dollars worth of new buildings have gone up in Winnipeg during the last nine months.

* * * *

October the 1st saw the tides in the Peticodiac River, N.B., higher than at any time since October 4th, 1869. Great damage has been done in districts bordering Fundy Bay. Dykes have been broken down and much marsh hay land flooded.

* * * *

Mr. A. W. Campbell, Deputy Minister of Public Works for Ontario, has been for years carrying on a campaign on behalf of "good roads." First and always he has endeavored to educate the municipalities to adopt the best in management, design and construction. Mr. Campbell has made good as an educationalist (on roads) and as a builder, and when the late Timothy Eaton left $10,000 to be spent by Mr. Campbell on three miles of the Dundas Road in Etobicoke township, it was a merchant prince's tribute to Mr. Campbell, his work and his success.

Some of our readers are anxious as to the binding of The Canadian Engineer. The new size and binding will work with the old size, and the binder will find no difficulty in making Vol. XVII. as neat as Vol XVI.

PRECIPITATION FOR SEPTEMBER.

The precipitation was in excess of normal from Eastern Ontario to the Maritime Provinces, while from the Ottawa Valley and Middle Ontario westward to the Pacific there was a very general deficiency, except in the northern parts of British Columbia near the coast, where the rainfall was heavy. The largest positive departures occurred in New Brunswick, where the amount recorded was double the average, and the largest negative in the Western Provinces where the amounts recorded were in nearly all cases less than one inch, and in some but a small fraction of an inch.

The table shows for fifteen stations included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for the month.

Ten inches of snow is calculated as being the equivalent of one inch of rain.

Station.	Depth in inches.	Departure from the average of twenty years.
Calgary, Alta.	0.40	—0.71
Edmonton, Alta.	0.10	—1.38
Swift Current, Sask.	0.70	—0.64
Winnipeg, Man.	0.60	—0.99
Port Stanley, Ont.	1.00	—1.78
Toronto, Ont.	1.96	—0.77
Parry Sound, Ont.	4.90	+ 1.09
Ottawa, Ont.	3.10	+ 0.43
Kingston, Ont.	3.90	+ 1.20
Montreal, Que.	4.90	+ 1.64
Quebec, Que.	6.40	+ 2.69
Chatham, N.B.	8.20	+ 5.33
Halifax, N.S.	5.90	+ 2.06
Victoria, B.C.	0.80	—1.40
Kamloops, B.C.	1.20	+ 0.21

SOCIETY NOTES.

Mr. W. J. Francis, C.E., of Montreal, addressed the Engineering Society of Toronto University in the Chemical and Mining Bldg., on Wed. afternoon, Oct. 13, his subject being The Relation of Technical Education, Personality and Character, to the Engineer," which was a resume of his own experience in this line. Mr. W. D. Black was chairman. Mr. Francis is a graduate of the School of Practical Science, and has been engaged in government work as consulting engineer for some time. He was called into consultation regarding the danger threatening the Quebec bridge.

After the meeting Mr. Francis was entertained at the St. Charles Cafe by the past presidents of the society. Mr. H. E. T. Haultain, presided.

AMERICAN INSTITUTE ELECTRICAL ENGINEERS.

The annual meeting of the Toronto Section of the Institute will be held Friday, October 15th, at 8 p.m., in the rooms of the Engineers' Club, 96 King Street West. Mr. A. J. Soper, of Smith, Kerry & Chace, Toronto, will present a paper on "Transmission Line Calculations." The Executive Committee will submit, for final vote, the list of recent nominations for officers for the coming year.

An informal luncheon will be served at the St. Charles Cafe at 6.30 p.m. sharp, to which members are requested to invite their friends.

1,200-VOLT D. C. CAR EQUIPMENT.*

By F. E. Case, Engineer of Railway Equipment, General Electric Company.

Direct current of 1,200 volts has been adopted in preference to 600 volts as the trolley potential of a number of interurban and other railways on account of lower first cost and lower cost of operation. That 1,200-volt current can be more economically delivered to the car requires little argument. On a railway having a given size and length of feeder, a car equipped with 1,200-volt apparatus will entail a line loss of only one-quarter that of a 600-volt car of the same size operating at a similar speed. With dense traffic, where cars are required to run on a very close headway, consequently giving practically a uniformly distributed load, the substations at 1,200 volts can be located twice as far apart as at 600 volts for the same maximum per cent. line loss.

Under the other extreme condition of two cars or trains only between substations and passing midway the substations can be located four times as far apart as at 600 volts with the same maximum per cent. line loss. The latter condition, however, is rarely practical for interurban operation on account of the great headway between cars. Under the usual prevailing conditions of interurban service it will be found that the substations at 1,200 volts can be located from 2½ to 3 times the distance apart as at 600 volts to give the same percentage line loss.

The adoption of commutating poles has made the operation of 1,200-volt generators entirely practicable. Where alternating current is better adapted to long-distance distribution, rotary converters in substations are also well designed to translate the alternating current to 1,200 volts direct. No more complicated or less reliable pieces of switchboard apparatus are required in the power house or substation than for the ordinary voltages.

Either the third rail or trolley wire can be used for carrying current to the car. One road is now successfully using the former, and there are several others using the latter. The third rail is of the under-running type, and is installed in a similar manner to a 600-volt practice, but the insulators are of somewhat increased dimensions.

No radical departure from standard 600-volt practice is required in the line construction to ensure a safe insulation. Cross suspension, side bracket or catenary method of trolley wire support can be used, but additional insulation over that used for 600 volts is, of course, required. The catenary form of suspension is usually recommended, as not only does it require a minimum number of poles and insulators, but it provides the most flexible support, which is a great advantage for high-speed operation.

The standard trolley base, pole and wheel give better results than with 600 volts, as the current to be collected for a given weight and speed of car is only half, which increases the life of the wheel especially.

The motors are similar electrically to ordinary 600-volt commutating pole motors, with increased insulation, and there is no departure in mechanical features from other direct current motors for lower voltage. The brush holders are located in a similar manner, and there are no more of them, so that inspection is just as readily made as in other

* Abstract of paper presented on Section (k) of the report of the Committee on Equipment of the American Street and Interurban Railway Engineering Association, Denver, Col., October 4, 5, 6, 7 and 8, 1909.

direct current motors. The commutation of the motors is so good that no more attention to the brushes and commutator is required than with low voltage motors of similar capacity. As the motors have the same electrical characteristics as other direct current motors, the armature speeds are no greater, and in consequence the bearings are equally long lived.

Some motors have been furnished by the General Electric Company for operating directly on 1,200 volts and others two in series. With the former it is possible to operate at only half speed on 600-volt portions of the line, but the latter motors can be connected in multiple so as to give the same speed on the low voltage as the high, which in many cases is a great advantage.

The car equipment consists of apparatus similar to that used for 600 volts, many of the parts being identical. Cylinder platform controllers have not been used in any instance, however, as they require the motor current to be carried above the floor, and we have considered it advisable for obvious reasons to keep the apparatus that breaks the main circuit under the car, where it can be suitably isolated.

Sprague-General Electric Type M control, comprising electrically operated contactors, a reverser and a circuit breaker is used. These parts are practically the same as for 600 volts with additional insulation where required. Both automatic control as described in my paper of last year for 600-volt operation and hand, or non-automatic, control have been furnished. The circuit connections are identical, for both the master control and the motors, to that used for 600 volts.

Standard 600-volt contactors, operated by means of electro-magnets, are employed for making the motor and resistance circuits in the contactor box, a few extra contactors being used to provide the necessary breaks in series to safely open the circuit. Practice has shown that a 1,200-volt current can be very satisfactorily interrupted by the contactors, and that the burning is not excessive.

Proper insulation of the reverser contacts is easily secured, owing to the motor fields being reversed, instead of the armatures when the direction of car movement is to be changed, and also because the fields are connected to the ground side of the armatures. This connection of the motors has been adopted both in new cylinder controllers and type M control for 600 volts. For commutating pole motors, it is desirable, in order that the commutating field winding, which is permanently connected to one side of the armature may always be on the ground side of the armature. The connection has also the advantage that fewer of the contacts have a high potential between them, as the drop across the exciting field to be reversed is only about fifteen volts.

A magnetic blow-out circuit breaker, located under the car, similar to the one generally furnished with type M control, is used for an overload protective device. It is, however, provided with a more powerful magnetic blow-out and has an increased opening and insulation. The circuit breaker is set and tripped from the motorman's cab by means of the ordinary double-movement switch which connects to the proper train wires.

A magnetic blow-out copper ribbon fuse box is provided as an additional protective feature for the main circuit. Standard 600-volt cast-grid rheostats are used for providing the necessary resistance steps in starting the motors. These rheostats are effectually insulated from the angle-irons to which they are attached by means of large collars and tubes surrounding the supporting bolts. A new design of cast-grid rheostat has recently been brought out.

When a car equipped with four motors is required to operate at the same speed on both 600 and 1,200-volt sections, it is necessary to use a commutating switch for changing the connections of the motors. For 1,200-volt operation this switch connects the motors in two groups with the motors in each group in series, each group being handled as a single motor. This commutating switch is arranged for operating either by hand or with air controlled by a valve located near the motorman. An interlock device is provided which prevents operation of the contactors if the motors are not properly connected for 1,200-volt running.

On some roads the operating conditions are such that only on the interurban sections is it desirable to obtain the maximum speed. To meet these requirements the commutating switch is, therefore, not necessary, and having 1,200 volts on the high-speed section and 600 volts on the city division gives relative speeds of about 2 to 1.

Six hundred-volt current is used for operating the control, and also for the car lighting. With the earlier equipments the air compressors are also operated at this voltage. This current is obtained from a dynamotor, or motor generator, of waterproof design for mounting under the car.

The new feature of the dynamotor is a series field winding which is connected between the two halves of the armature, and is provided with a tap at its centre. In starting up, line current passes through the first half of armature, series field, and second half of armature to ground, thereby strengthening the normal field, and the machine operates as a compound motor. When current is being taken from the tap in the centre of the series winding for the control of lights, the two halves oppose each other, and there is no effect on the field strength. When the trolley leaves the wire with the dynamotor running, and the controller on, there is an immediate tendency of the dynamotor to deliver current to the motors, due to the momentum of the armature and the shunt field. The series winding now comes into play by demagnetizing, or beating down, the field, since the direction of the current has been reversed in the first half of the series field, and the two parts, therefore, no longer oppose each other. This action prevents an amount of current sufficient to blow the dynamotor fuse being taken by the motors.

The dynamotor is a very simple device, both electrically and mechanically. No mechanical load being driven by the armature, the strains on the bearings are negligible and the parts are long-lived. On recent equipments the dynamotor is started up automatically, when the car runs on to a 1,200-volt section, by means of a selector relay. The light and control circuits are disconnected from both the trolley and dynamotor when the relay is not energized, the proper connections being made to correspond with the voltage applied. To insure correct operation of this relay, a short, grounded section of trolley wire is interposed between the 1,200 and 600-volt portions.

The electric heaters can be operated either from the dynamotor or directly from the 1,200-volt circuit. As the conductors in the heater are insulated from the frame by porcelain, the requisite insulation is easily secured for 1,200-volt operation.

The air compressors on some recent equipments are wound for operating at 1,200 volts, as there is no difficulty in obtaining good commutation and insulation for this voltage. When the car is running on the 600-volt section the compressor will, of course, be required to operate for a longer period if air is used to the same extent as on the 1,200-volt portion, but this is easily taken care of in selecting the proper capacity of compressor.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

8177—September 20 — Approving rearrangement of the C.P.R. Company's tracks between Bents 2, 3, 4 and 5, and elevation and clearances of the overhead footbridge at Brown Street, West Fort William, Ont.

8178 and 8179—September 25—Granting leave to the Manitoba Telephone System to cross the track of the C.N.R at Glenforsa Siding, Man., and at Third Street, Belmont, Man.

8180—September 25—Authorizing the C.P.R. to construct industrial spur for the Speitz Fur. Company and for the Hanover Cement Company at Hanover, Ont.

8181—September 25—Authorizing the G.T.R. to construct branch line and three spurs therefrom to the premises of Asbestos Manufacturing Company, Lachine, P.Q.

8182—September 25—Authorizing the C.P.R. Company to construct branch line for the Sydney Brick Company, Sydney, Man.

8183 — September 25 — Authorizing the C.P.R. to construct branch line in the City of Calgary, Alta.

8184—September 25—Approving Supp. 2 to Canadian Freight Classification No. 14.

8185 — September 25 — Authorizing the C.P.R. to construct trestle bridge at mileage 63.5 on the Moose Jaw branch of its line.

8186—September 25—Authorizing the G.T.R. to construct branch line of railway for Sanderson-Harold Company, Paris Junction Station, Ont.

8187—September 25 — Authorizing the G.T.R. to construct branch line of railway for the Bechtells, Ltd., Waterloo County, Ont.

8188—September 25 — Authorizing the C.P.R. to construct spur for Messrs. Carbonneau, Leroux & Forget, Parish St. Vincent de Paul, P.Q.

8189 — September 25 — Authorizing the C.P.R. to construct branch line to the Asquith Ballast Pit on the Pheasant Hills branch of its railway, Province of Saskatchewan.

8190—September 25—Granting leave to the G.T.P. to operate its trains across Pembina branch C.P.R. at Oak Point Junction, near Winnipeg, Man.

8191—September 25 — Authorizing the C.P.R. to construct branch line in the Parish of Lachine and town of Lachine, P.Q.

8192—September 29—Granting leave to the C.N.Q. to place its wires and tracks under the wires of the Bell Telephone Company at Charlesbourg Road, County of Quebec, P.Q.

8193 to 8195—September 25—Granting leave to the Hydro-Electric Power Commission to place and maintain its transmission wires across the track of the G.T.R. at three points in the Province of Ontario, viz., Township of Glanford, County Wentworth; Village of Allenburg; and Township of Thorold, County of Welland, Ont.

8196—September 27—Authorizing the C.P.R. to open for the carriage of traffic that portion of the double track of its line of railway, known as the Kenora Section, from Busteed, mileage 16.0 to Deception, mileage 18.8.

8197—September 23—Approving and sanctioning location of the C.N.Q. Railway Company's line of railway from Hedleyville Junction to a point on the Montmorency River, County and Province of Quebec, mile 0 to 7.62.

8198—September 27—Authorizing the G.T.P. to operate its trains over crossing of the Pembina highway, Winnipeg, Man., without being brought to a stop.

8199—September 27—Authorizing the Brantford Gas Company to lay gas main under the track of the G.T.R., where the same crosses Colborne Street, Brantford, Ont.

8200—September 27—Granting leave to the Rural Municipality of Macdonald, Man., to place its wires across the track of the C.N.R. at P.C. 960 ft. south-west of Brunkild Station, Man.

8201—September 28—Granting leave to the Le Chemin de Fer de Colonization de Nord to construct its railway across certain highways between mileage 10 north-west from Nomining, and Rapide de l'Orignal County, Labelle, P.Q.

8202 to 8204—September 25—Granting leave to the Hydro-Electric Power Commission of Ontario, to cross with its transmission wires the track of the G.T.R. at three points in Ontario, viz., Township of West Flamboro, Lot 23, Con. 1; Township of West Flamboro, Lot 19, Con. 1, and Township of Nelson, County Halton, Ont.

8205—September 28—Authorizing the C.P.R. to construct branch line across several streets in the City of Regina, Sask.

8206—September 28—Authorizing the C.N.Q. to reconstruct the western trestle approach of its bridge over Ottawa River, near Hawkesbury, Ont.

8207—September 27—Dismissing application of the Canadian Freight Association, for an Order rescinding Order of the Board (Sec. B) dated October 10th, 1904, fixing rates on fruit, in C.L. from Eastern Canada to Winnipeg, Portage la Prairie, and Brandon, Man.

8208—September 14—Approving and sanctioning plan, profile, and book of reference of the Montreal Park & Island Railway and authorizing the deviation of its line of railway from a point in Lot 142 of Parish of Montreal to a point near Lot No. 1698, Parish Montreal, P.Q.

8209—September 28—Granting leave to the Saskatchewan Government to place its wires across the track of the G.T.P between Sections 32 and 33, Township 35, R. 4, west 3rd Mer., Province of Saskatchewan.

8210 and 8211—September 28—Granting leave to the Bell Telephone Company to cross with its wires the track of the C.N.Q. at St. Canute, P.Q., and ½ mile north of Duncan Station, Ont.

8212—September 28—Authorizing the Municipal Council of City of Medicine Hat, Alta., to lay water mains under track of the C.P.R. at River Street and at East Road Allowance, in said city.

8213—September 28—Authorizing the Sarnia Gas & Electric Light Company, Ltd., to lay and maintain its gas mains under the track of the G.T.R. where the same crosses South Christina Street, Sarnia, Ont.

8214 — September 28 — Authorizing the C.P.R. to construct branch line for the Joliette Sand & Gravel Company in Parish of St. Felix de Valois, Con. of St. Martin, P.Q.

8215—September 29—Authorizing the Vestry of St. James Church, Bethier, P.Q., to lay an eight-inch sewer under the track of the C.P.R., fifteen feet from the north side of Williams Street, Village of Berthier, P.Q.

8216—September 29—Granting leave to the Mt. McKay & Kakabeka Falls Railway to cross with its track the track of the C.N.R. at Montreal Street, Fort William, Ont.

8217—September 30—Approving and sanctioning revised location of the C.P.R. from McKay Avenue to Victoria Avenue, Edmonton, Alta.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal President, George A. Mountain; Secretary, Professor C. H. McLeod.

QUEBEC BRANCH—

Chairman L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—

96 King Street West, Toronto. Chairman, J. G. G. Kerry; Secretary, E. A. James, 62 Church Street, Toronto. Meet last Thursday of the month.

MANITOBA BRANCH—

Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—

Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University College.

OTTAWA BRANCH—

Chairman, C. R. Coultee, Box 560, Ottawa; S. J. Chapleau, Box 203.

MUNICIPAL ASSOCIATIONS.

ONTARIO MUNICIPAL ASSOCIATION.—President, Mr. George Geddes, Mayor, St. Thomas, Ont.; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. E. McMahon, Warden, King's Co., Kentville, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

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CANADIAN RAILWAY CLUB. — President, H. H. Vaughan; Secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto, President, C. A. Jeffers; Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Secretary, T. Nash.

EDMONTON ENGINEERING SOCIETY. — President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

MANITOBA LAND SURVEYORS.—President, George McPhillips; Secretary-Treasurer, C. G. Chataway, Winnipeg, Man.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, S. Fenn; Secretary, J. Lorne Allan, 15 Victoria Road, Halifax, N.S.

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ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que., Hon. Secretary, Alcide Chaussé, 5 Beaver Hall Square, Montreal, Que.

WESTERN CANADA RAILWAY CLUB. — President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Secretary, 1207 Traders Bank Building.

AMERICAN MINING CONGRESS. — President, J. H. Richards; Secretary, James F. Callbreath, Jr., Denver, Colorado.

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AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

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THE
Sanitary Review
SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

A GERMAN INSPECTION OF BRITISH SEWAGE DISPOSAL WORKS.

Dr. A. Schiele, of the Royal Testing Station for Water Supply and Sewage Disposal, Berlin, has recently issued a report of a monumental character, consisting of about 870 pages of text, fully describing and studying British sewage disposal works from the German standpoint. The conclusions and criticisms set forth are of considerable value to all interested in this matter.

Special attention is drawn to the fact that the experience gained in England demonstrates that the biological system of sewage purification has been found to stand the test of time so long as the works are properly designed and carefully managed, and the German authorities are strongly urged to study English methods on the spot by actual inspection. In Germany, as elsewhere, there still exist sceptics who are not prepared to accept the statement that the biological system can be universally applied with success, and this is due to the fact that they are in a position to refer to several failures in their own country. Dr. Schiele points out that these failures are not the result of any defects of the system itself, but are due partly to bad design, and, in far the greater number of cases to ignorance and inexperience, and above all to neglect in management.

The author insists upon the absolute necessity of employing experienced practical experts to supervise and design all works, and where towns are too small to employ an expert, they should combine to obtain the services of one man. The doctor also points out in the second instance the advisability of the establishment of a regular system of rivers inspection by men (with independent and unbiased judgment) who are capable of carrying out continuous tests and observations of the results obtained from the various purification works.

We publish in this issue a paper read before the American Society of Inspectors of Plumbing and Sanitary Engineers, entitled "The Cesspool and its Dangers," by Burton J. Ashley, C.E., Chicago, Ill.

This paper is brimful of real commonsense, and is one which should not only appeal to the engineer or architect, but could most usefully be read by the suburban householder and town councillor responsible for the management of our smaller towns, where the cesspool is the favorite method adopted for sewage disposal

In Canada we have scores of towns and villages, whose water supply is dependent upon shallow wells, sunk a few feet into water-bearing sand or gravel. Alongside such wells we find the cesspool doing duty. In many cases this structure consists merely of a pit or loosely-built tank, which allows the liquid sewage to percolate into the water-bearing sand or gravel.

It is only a matter of time before typhoid makes its appearance under the above conditions; and, unfortunately, it is as a rule only upon an outbreak of this dreaded disease, that reasonable attention is directed to a method of obtaining domestic water supply from a source which is made the disposal area for the town's sewage.

THE CESSPOOL AND ITS DANGERS.*

By Burton J. Ashley, C.E., Chicago, Ill.

During last year I received a letter from a prominent clubman of the Northwest, who wrote: "Our cesspools (three largest built locally) won't 'cess,' and have been useless and impossible for the past four years," to which we made the reply that the greatest trouble people find with cesspools, in our experience, is that they do "cess." A cesspool, derived from the word "cease," is a "cease" pool—that is, it is a quitter; it ceases and won't do anything. It may, and does, put forth a strangled effort, but nature's forces become so stultified in these ill-designed contrivances that the active natural agents of purification are completely smothered and die, and thereby the ceasing and consequent danger.

You may as well expect the average cesspool to be successful in disposing of your sewage as to expect a fire to burn in the bottom of a hole in the ground with the top of the hole covered.

The Saturday Evening Post recently gave the Merchants' Association Committee on Pollution of the State Waters of New York permission to reprint some articles for general distribution regarding the cause and spread of typhoid fever, and contained in them may be found the following:

"Great cities are developing some sort of a sanitary conscience. Farmers and country districts have as yet little or none. Bad as our city water often is, and defective as our systems of sewage, they cannot for a moment compare in deadliness with that most unheavenly pair of twins, the shallow well and the vault privy. A more ingenious combination for the dissemination of typhoid than this precious couple could hardly have been devised. The innocent householder sallies forth, and at an appropriate distance from his cot he digs two holes, one about thirty feet deep, the other about four. Into the shallower one he throws his excreta, while upon the surface of the ground he flings abroad his household waste from the back stoop. The gentle rain from heaven washes these various products down into the soil and percolates gradually into the deeper hole. When the interesting solution has accumulated to a sufficient depth, it is drawn up by the old oaken bucket or modern pump, and drunk. Is it any wonder that in this progressive and highly civil-

*A paper before the American Society of Inspectors of Plumbing and Sanitary Engineers.

ized country three hundred and fifty thousand cases of typhoid occur every year with a death penalty of 10 per cent.?"

Let me cite you an instance to illustrate to you the possibilities of water pollution through underground veins or crevices and its lamentable results. The case is an old one to sanitarians, but new, no doubt, to some. A small village in Switzerland; near Basle, is supplied with water from a spring situated at the foot of a mountainous ridge. An epidemic of typhoid fever broke out, which struck down over 17 per cent. of the panic-stricken inhabitants of the village. The fever was pretty well distributed through the village, but a group of six families had entirely escaped the scourge. Suspicions were aroused regarding the purity of the waters of this spring, and an investigation was made.

On the other side of the ridge before alluded to was a little valley, which when irrigated, always increased the flow of the spring on the other side of the mountain. It was found that a peasant, living in the valley, had returned from a distant city, sick with a fever, and that the water in a little brook in which his clothes had been washed and into which the slops of the house had been cast had been used to irrigate the meadows. Of course, the polluted water filtered through the surface of the soil and joined the underground water, to go—no one knew where.

In order to determine if it could be possible this spring was fed by the underground waters of the valley over a mile away, experiments were made. A large quantity of salt was thrown into a hole dug in the valley to a water-bearing vein of sand and gravel. In a few hours the waters of the spring became very salty.

They now mixed two and one-half tons of flour with water and poured this mixture into the hole, but after much waiting and close examination not a trace of the flour could be found in the water in the spring.

This proved conclusively that, though the water-bearing vein through which this water had to pass carried salt in solution to the spring, at the same time the granular constitution of the vein was sufficiently fine to prevent the finest particles of flour reaching it.

It should, then, be quite clear to the reader that the passage of water through underground veins is no assurance of its purity, and neither is clearness any proof of purity—for, says Mason: "It is a fatal error to fancy that because a water has a bright, sparkling, clear appearance and a pleasant taste, that therefore such water is wholesome. Carbonic acid gas is what causes brilliancy and refreshing taste of a ground water. When it is borne in mind that carbonic acid is one of the products of sewage decomposition, the inference as to its possible source is not a pleasant one." Neither is turbid water to be adjudged as dangerous merely because it is turbid. While visiting, a few years ago, the city of Defiance, Ohio, which then derived its water supply from the Auglaize river, and on drawing a glass of water from a faucet in the hotel, I was obliged to wait until the heavier suspended particles could settle to the bottom of the glass before it was sufficiently wholesome to drink. The water was roilly and unsightly as well as unwholesome, but was not regarded as unsafe at that season of the year, when the Auglaize river was nearly overflowing her banks in consequence of the prevailing rains.

I recently asked a wealthy maunfacturer how he disposed of the sewage of his summer home at one of the lakes in Northern Michigan. "Oh," said he, "I dig a cesspool down to the gravel, and then the stuff runs away." "Where is your well?" said I. "About one hundred feet away," was the answer, and then he proceeded to explain to me, in an assuring way, that the bowel discharges and sink wastes that went into his cesspool would be entirely purified by passing through the strata of fine gravel before reaching the well. Now, this man I know to be a gentleman of splendid intelligence, the mayor of a city and a leading light in his community, but, in spite of his intelligence, he was totally ignorant of what the essential processes are that produce sewage purification. He evidently had in mind that the substrata of gravel would filter the cesspool seepage to purity. He did not know that purification of such foul liquid is impossible without fresh air and the action of aerobes. And here lies the danger: that the common people, and even the most intelligent people, are led astray sometimes through lines of their own incorrect reasoning, and sometimes through erroneous information imparted by pretenders that know nothing of the principles of decay, but try to make folks think they do.

The opportunity for the contamination of well water, particularly in towns and villages or in the suburbs of towns and cities where sewerage is absent, is often very great. It is no uncommon practice for the owner of a small lot to construct his well and a cessool within a few feet of each other. The contents of this filth hole soak away and mingle with the ground waters, only to reach the well; for even the most ordinary mind can see that as water in drawn from a well the well is replenished by just so much of the ground water surrounding it, and if this ground water is polluted, health and life of your family or neighbors are jeopardized.

The question then might arise as to the advisability of using a cesspool where city water mains were available, but we answer that if we live up to the standard of righteousness and of model citizenship, then it would be an example of the grossest selfishness on one's part not to have an interest in the welfare and health of one's neighbors who might yet be using wells, for through such selfish indifference to the health and welfare of the neighbourhood we might be rightfully regarded as undesirable citizens.

Mason also says that "It is hopeless to depend upon the purifying influence of the intervening soil to protect the wells from privy and cesspool fouling, because soil filtration, in order to be effective, must be intermittent." With a constant flow of pollution on or through any soils, the purifying powers of the soil quickly cease to act. Intermittent flow is absolutely essential to admit air to the aerobic bacteria where present, if purification is to be effected.

E. Bailey-Denton, in one of his courses of lectures delivered to the students of the Royal Agricultural College, England, said of the cesspool as a method of sewage disposal: "It is a system of disposal which I do not recommend, and which should always be avoided if possible, and no matter if built under circumstances most favorable, will remain liable to all the objections to which cesspools are admittedly subject."

Rideal, the well-known English authority on sanitation, has pretty well described the results of harboring a cesspool. He says, and it is reasonable to believe, that "the soil about cesspools becomes water-logged with black fœtid matter which undergoes little or no oxidation." I here wish to add that without oxidation of the seepage of cesspools, say nothing of the liquids of the septic tank, purification of sewage is not accomplished.

Dr. Bashore, former inspector for the Pennsylvania State Board of Health, in his little work on the "Sanitation of a Country House," says of the cesspool: "It is a relic of medieval shiftlessness and carelessness for which no excuse can be offered."

Prof. Merriman, in his "Elements of Sanitary Engineering," says: "The privy or cesspool is walled up with loose

stone so that the liquid material may leak through them into the surrounding soil. The result of this is a gradually increasing pollution of the soil, and often a neighboring spring or well becomes contaminated so as to cause disease." He then cites an instance where a spring had been previously condemned by the board of health, but in spite of the warning the people of the neighbourhood continued to drink its water, with the result that twelve cases of typhoid fever occurred, and two deaths. Such an example of repugnant stupidity can scarcely be paralleled. Truly may we say: "What fools we mortals be." Thousands of such cases are recorded in medical journals that never reach the notice of the great groping public.

Dr. Frank E. Adams, of Piqua, Ohio, has the following to say in the "Ohio Sanitary Bulletin": "In our own city we have found traces of discoloration, when excavating for cellars, that were traced to old cesspools one hundred feet away, and no telling how far beyond the excavation the discoloration extended.

"The city engineer tells me that when excavating for a sewer they passed through a discoloration in the soil that extended forty feet in width, the odor arising from it almost compelling the laborers to cease working. He said they were about nine feet deep, and had passed through one foot of this stuff; how much deeper it extended he did not know, as they were then at the sewer bottom, nor the length of it, but that there was no cesspool nearer than forty feet."

Mr. Thomas S. Ainge, sanitary engineer for the Michigan State Board of Health, and a member of this society, in his recent work on the "Sanitary Sewage of Buildings," says that smaller cities and villages resorting to cesspools endanger the water in private wells and create an unwholesome condition of the subsoil in the immediat vicinity, and that such a practice is inexcusable, yet often permitted for years. That boards of health, even to the present day, have a misunderstanding of the relative inefficiency and dangers created by the use of leaching cesspools.

While in Madison, S. Dakota, last summer, a remarkable instance of the dangerous availability of a cesspool as a death trap was related to me. The filth hole in question was some four or five feet in diameter, and about ten or fifteen feet deep, reaching a gravel bed, which was supposed to absorb the filth, but did not, and this death trap, was full of unfermented human excrement and other foul matters, covered with boards and earth. As a child of the proprietor was passing above and upon the top of it, the top gave way and the child sank into the filth up to her arms. Screaming and sinking, she was only rescued in just time to save her life, and just as her head and chin were reaching the surface of the corruption. We leave you the mental picture to contemplate.

Many cesspools are similarly covered with boards and earth, on which the grass soon grows, and the location is forgotten. It does not take a very great stretch of imagination to realize the direful result which might be caused by such improper construction, which could be directly contributory to the loss of life by accident.

A letter was recently submitted to the writer by a well-known publication on sanitation, which, in part, read as follows:

"Will you let me know what is the best way in which to drain the surplus water from a cesspool. As matters now stand, we are compelled to haul this waste out of town, at an expense of about $15 per month."

A part of our reply was as follows:

"If your cesspool is costing you $15 per month to maintain, then the yearly cost would be $180, which is 6 per cent. on a capital of $3,000. An individual sewage disposal plant should certainly cost you much less than $3,000, in fact, the average price of plants for ordinary dwellings will only range from $200 to $500." I offer this illustration to show the maintenance of a cesspool from the financial viewpoint.

Some two or three years ago I received a letter from an eminent educator and president of a state institution and the following is an extract from the letter:

"We have dug perhaps a dozen cesspools in the past five years. As soon as one filled up we dug another, until our grounds (college campus) nearly are full of holes."

This institution has since abandoned the cesspool practice, and has installed a modern sewage disposal plant, and a letter dated December 18, 1908, from the superintendent, says:

"Inlet end of reduction tank, no odor whatever; sludge 8 inches deep; mat 10 to 12 inches thick and very tough; sludge slaty gray color. On opening outlet cover found slight odor, but not offensive, and slight scum, but water is perfectly clear."

Regarding this plant I will say that, after purifying this tank liquid by nitrification, the filtrate or water is disposed of by ground absorption wholly, and within the confines of the college campus.

Since the advocates of advanced hygiene have investigated, experimented with and employed modern rational means of self-preservation, and as one of the advanced means people have their surroundings properly sanitated, the death rate in the United States has been decreasing, until now the average human life has gone beyod the proverbial "three score years and ten." Some have erroneously believed that the hardy pioneers of our land were longer lived than we, but statistics do not prove it. As people employ means to better care for the body, just so is life lengthened.

Typhoid fever decreases in proportion to the increased installation of means of sanitary sewage disposal, and in cities it is in proportion to the increased abandonment of wells as a source of supply of drinking water.

Lawrence, Mass., typhoid death rate in 1890, per 100,000, was above 120, but after employing modern sanitary measures in sewage disposal and water supply, in seven years the typhoid death rate fell to but 16, a falling off at the rate of 104 deaths per year. The contemplation of the satisfactory effects of employing accepted sanitary expedients is rapidly arousing intelligent communities to the necessity of cleanness of person, and the sanitation of surroundings. Hence the introduction of modern devices for cleanliness, such as baths, lavatories and laundries in the modern home, with a rational, safe, sanitary and satisfying means of purifying the poisonous wastes of living and properly disposing of them, is on a speedy increase. The sanitary conscience is arousing everywhere.

A word to the summer hotel or resort keepers, and to the summer visitors themselves. I wish to call your attention to the following Health Bulletin which was recently issued in Chicago, and from which the following is an extract:

"These seekers after rest and happiness are liable to drink polluted surface water in lakes and streams. Open wells are often infected with typhoid fever germs, and are among other sources of typhoid fever. Each year in August there is in this city an increase in typhoid cases, and the investigations show that about one-fourth of all our city cases are contracted in the country, where the victim has been passing his vacation. Typhoid fever is a preventable disease."

From my own experience, and from information acquired from others, it is discovered that the average outhouse con-

veniences at these country resorts are vile and unrespectable, and are maintained by people who would be highly offended if one should assail their respectability, but I say that he who is the maintainer of one of these unspeakable privies and makes no attempt to abolish the nuisance, but continues to foster the nauseating pest spot and offers it to the use of others can not lay claim of decency.

To the summer visitor I would say there is something of more vital importance to you when enjoying your summer outing than front verandahs with easy chairs or beautiful shade and restful hammocks. Don't patronize the place that does not provide for the safety of your health, as well as for the conscious comforts of your mind and body. Modern methods of sanitation are available, and the average farmer or summer hotel keeper is abundantly able to possess himself of sanitary conveniences which advanced habits of living demand.

A word regarding the prevalence of flies. The prevalence of flies in either city or country very closely approximates the prevalence or approximate presence of manure piles, where most of the flies are atchhed. Available privy vaults or cesspools afford them sporting and feeding grounds some of the time, but the dinner table is a popular resort for them when not at the places above mentioned.

D. D. Jackson's report to the Waters Pollution Committee of New York called that body's attention to the presence of vast numbers of disease germs on the feet and legs of flies which had been caught in fly traps for the purpose of microscopical examination, and makes the statement that "the common fly is one of the most active agents in disseminating certain intestinal diseases."

"There are certain laws of consciousness," says Dr. Sedgwick, "that have for their object the preservation of human life to its appointed maturity, as, for instance, to grasp at a support to prevent a threatened fall. This same consciousness universally arouses an instinctive repugnance toward human excrement or any putrefying animal substance, and instantly warns one through this instructive intellectuality that these repugnant ingredients are baneful to life." No person with ordinary intelligence, after having reflectively contemplated the matter of sewage disposal by building a cesspool, ever dug such a cesspool and used it with a satisfying consciousness that the contrivance would be successful, safe and comforting, but he, on the contrary, must have been conscious that he had not satisfied himself in creating this pest spot. A cesspool is a thing that is untrustworthy, disquieting, noxious, harmful, corrupting and dangerous.

"Back to Nature!" is the present cry of city dwellers, and the city dweller who can afford a country home, even though inexpensive, is moving or laboring to the end of moving to the suburbs or to the country and its loveliness and quiet, and the number is legion. Many thousands of New Yorkers now have their country homes in suburban localities. Thousands upon thousands more spend the greater part of the warm season in country homes in the Berkshire Hills, the Adirondacks or the White Mountains, and yet thousands of others, from all the principal cities of the east and south and great middle west are joining in this one grand, determined, happy exodus back to the country that God made, and away from the cities which man made; but though back to the country, some of the conveniences of city life are too comforting to be left behind. To resort to Mosaic sanitation (Deuteronomy 13: 23) or to dig cesspools as the Indians do, is quite out of keeping with the character of sanitary conveniences some of these would-be country dwellers are used to, and so they are sufficiently wise to employ modern sanitation in these country homes, that there also they may have the modern comforts common to the better grade of city dwellers. To the discerning the cesspool is tabu.

We have read somewhere about a "septic cesspool." One of the words, "septic," signifies action, and the other word, "cesspool," from the nature of its derivation, stands for inaction. The logical definition of these two words conjointly used, therefore, would be "active inaction." The absurdity of such a claim is apparent.

I recently read a short article by some writer, who did not sign his name, that the secret of the septic tank was nothing more than that it must be air tight and have a submerged inlet and a submerged outlet, "and that is all there is to it." Just how can this information be harmonized with the fact that for the last ten years or more scores of septic tanks have been built without any cover whatever, and that chemical analysis has shown that the effluent from the open tank is as satisfactory, as that from the closed air-tight tank?

I also saw a published statement that tanks for residences would rarely need to be larger than to hold 24 to 36 hours' flow, and that a tank 3 feet wide by 6 feet deep and 8 or 10 feet long would ordinarily be large enough. I have computed and find such a tank to contain 1,300 gallons, which clearly shows the most lamentable ignorance on the part of the writer of the amount of sewage ordinarily produced by private residences.

Great care should be exercised in giving out such flat statements as these, for those who are not posted on the subject would surely be led seriously away from the truth, and would more than likely construct something that would be a flat failure.

One has to select a sewage disposal plant for his home in just the same way he would buy a heating plant. Proper capacity is one of the fundamental elements to successful operation. A party in Ohio once wrote me that if he could not get a sewage disposal plant for his home that would take care of the sewage of fifteen persons as readily as for two he did not want anything to do with it. I replied, asking him if he would expect a stove that was gauged to burn satisfactorily two scuttles full of coal per day to burn fifteen scuttles of coal with the same satisfactory results. This comparison should be convincing, for sewage disposal plant and stoves are strikingly analogous in their operation.

The laity has been wrongly led to believe that the septic tank purifies sewage. This is positively untrue. The septic tank, settling or reduction tanks, are only a primary means to the end of purifying sewage, the real purfication being effected by nitrification or oxidation, which process is accomplished only by bringing sewage or tank liquids into contact with surfaces covered with the aerobic film, and in which the aerobes are kept in active condition by intermittent application of organic wastes and with air.

There are occasional examples where cesspools seem to answer the requirements merely of disposal, but exceptions cannot be held up as an example to follow. Moreover, when a cesspool is able to liquefy the solids that enter it, then it is no longer a cesspool, but a septic tank or hydrolitic tank. But liquefaction in a septic tank is not purification, and moreover, when sewage disposal becomes oversepticized, purification will not take place. It is entirely possible to convert and purify sewage without the tank processes whatever, employing nitrifying bacteria to do all the work. By this means putrefaction does not take place, nor is any fermentative odor produced, for there is no fermentation.

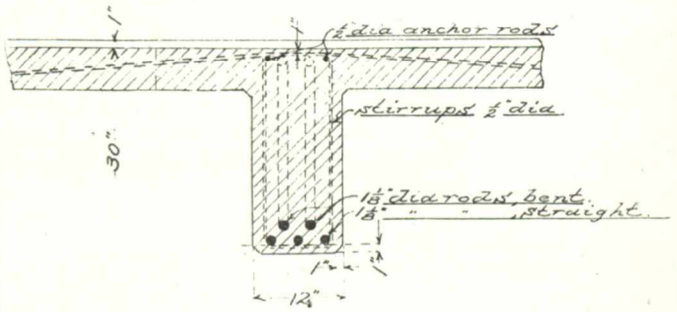
A prominent physician of one of the Southern States remarked in a recent letter, written me, that he did not see the difference between turning sewage loose in the soil and

nitrification. I answer that turning it loose into and four feet deep, say, beneath the surface of the soil would be a mighty difference, since nitrifying bacteria do not exist in sufficient numbers at such a depth to be satisfactorily effective. The depth beneath the surface of the ground where unconverted sewage may be applied has everything to do with the degree of nitrification that can be accomplished. Applying organic substance to the very surface of the soil for nitrification can hardly be improved upon by artificial expedients.

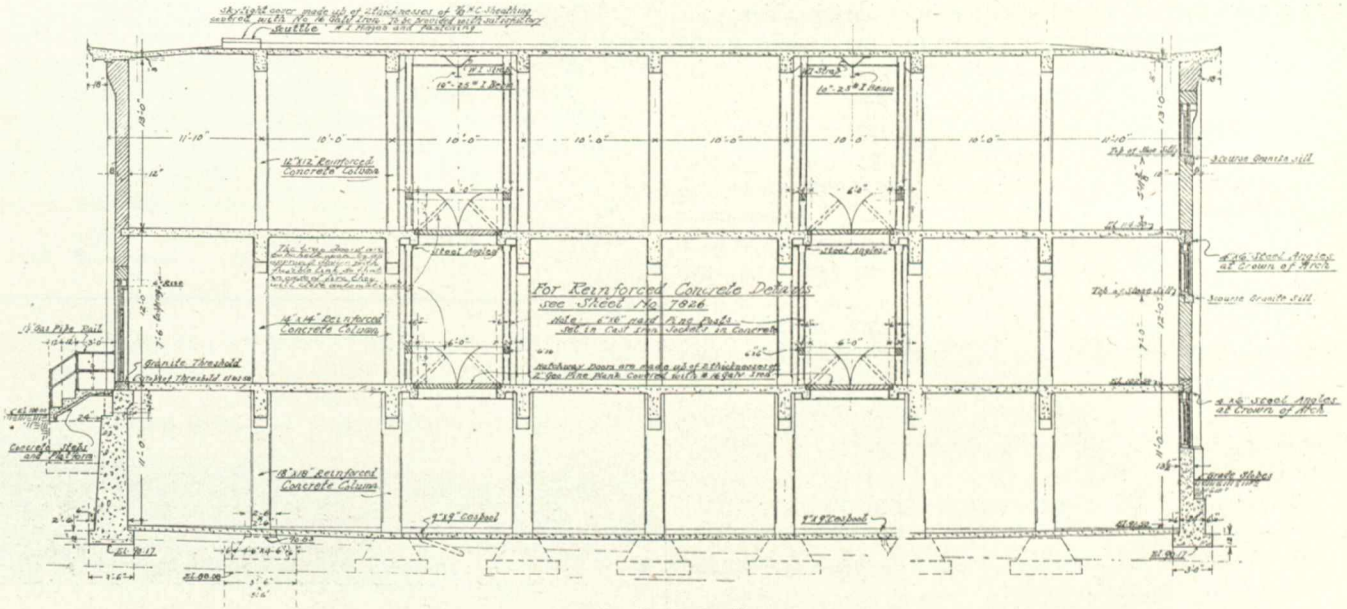
The filter bed, the underground nitrification duct or nitrification bed has, therefore, the object of producing the same final processes of purification as are so readily produced at the surface of the soil, and where quantities of sewage are not too large and the character and condition of the soil, water supply and a number of other essential items are fully understood, plants may be so designed for such known conditions as to successfully purify the sewage and then admit of the absorption of the filtrate or water into the soil. By this rational modern sanitary expedient the dweller is safe from the sorrow and desolation that may be caused by harboring that which sanitarians universally condemn—the cesspool.

COMPOSITE BRICK AND BUILDING CONSTRUCTION.

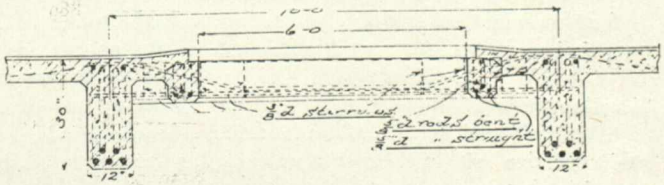
One obstacle in the way of securing cheapness in constructing reinforced concrete buildings is the cost of the forms which frequently cannot be used again. Mr. F. W. Dean, mill engineer and architect, of Boston, has recently designed a number of buildings with brick walls and reinforced concrete floors and roofs, which remove this obstacle and overcome the objections frequently urged against the appearance of reinforced concrete buildings. One building 48 ft. deep, 4 inches wide by 82 ft. long in outside measurement is two storeys in height with basement. The foundations are of concrete carried well below grade, the walls above are of brick 12 inches thick between pilasters of 20 inches thickness. Floors and roof are of concrete reinforced by galvanized wire cloth. The first and second floors, 6½ inches thick including "monolithic finish" are supported by integral reinforced concrete beams running crosswise of the building. These beams, 30 inches in depth by 12 inches in thickness, rest at their ends on the brick wall pilasters and at the middle are supported by reinforced concrete columns. They extend 16 inches into the pilasters and are bonded thereto by one inch parallel steel rods embedded in the walls.



Section of Floor Girder.



Longitudinal Section.



Section of Hatchways.

These rods, two at each end of the beam, pierce its ends at right angles. To make the bond still more secure the longitudinal top and bottom reinforcing rods are turned at their ends. On the sides of the building the floors butt against the brick walls, the granolithic finish filling in or smoothing over any space between the two. But at the ends these floors and the integral longitudinal hatch beams extend into and rest on the brick walls. The roof, 4 inches thick, is also reinforced with wire cloth, and bonded to the walls upon which it rests. The cornice, properly reinforced, overhangs 18 inches beyond the face of the pilasters.

The accompanying illustrations show the method of construction employed by Mr. Dean. The concrete girders and floor beams are connected to the brick work without difficulty.

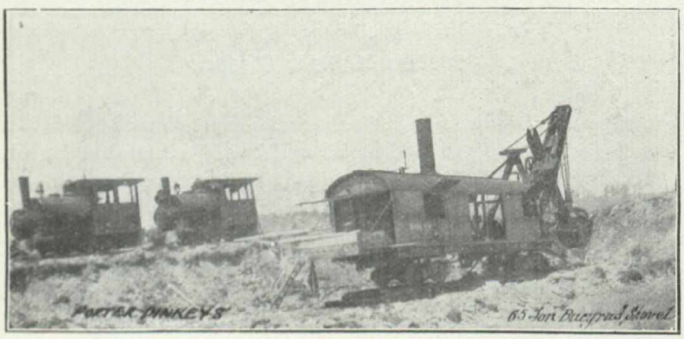
A PAGE OF COSTS

ACTUAL, ESTIMATED and CONTRACTED

COST OF EXCAVATING GRAVEL WITH A 65-TON STEAM SHOVEL IN A CANAL PRISM.

J. B. Brophy.*

This work was done in June 1908, in the heavy cutting south of the Grand Trunk Railway, near Trenton, Ontario—this cutting being a portion of Section No. 1 Ontario-Rice Lake Division of the Trent Canal. The material excavated



was a coarse gravel mixed with medium sized boulders, and the cutting, at that stage of the work, was a side cutting averaging about 10½ feet in depth. The material was loaded into cars as high as the crane would reach.

From June 1st to 13th the amount of excavation was 16,000 cubic yards, the average haul being 1,200 feet, and from June 15th to 30th 20,000 cubic yards were excavated, the haul averaging 1,400 feet, making a total of 36,000 cubic yards of excavation for the month, with an average haul of 1,311 feet. All the material excavated was put in a spoil bank, averaging from 10 to 18 feet deep.

The following is a list of the plant used on this work: A 65-ton steam shovel with a 2½ cubic yard dipper, made by the Bucyrus Steam Shovel Company, of South Milwaukee, Wisconsin. Two 12-ton Porter Dinkey Engines, 22 dump cars of four cubic yards capacity, and about half mile of track.

The value of this plant would be approximately as follows:—

65-ton shovel	$ 8,500
2 twelve-ton dinkey's	5,400
22 four yard dump cars at $220	4,480
17 tons rails at $30	510
1,100 ties at $0.10	110
Shovels, bars, etc., say	40
Total	$19,400

Allowing 2 per cent. for monthly interest, repairs and depreciation, gives a monthly charge of $388.

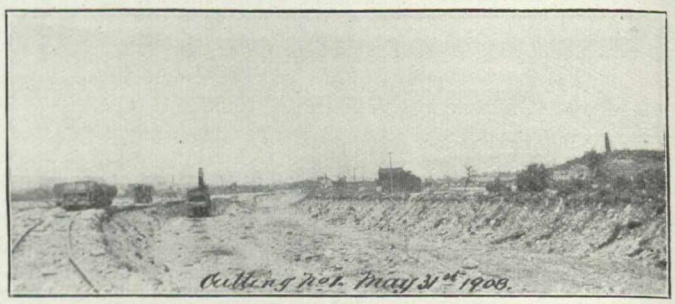
The shovel, hauling and dump gangs worked twelve hours per day. The track gang and water wagon only worked ten hours per day.

Assuming the standard rates of wages for this class of work, we get the following:—

Shovel runner	$125.00	per Mo. for 10 hour day
Craneman	90.00	" " "
Fireman	60.00	" " "
Watchman	45.00	"
Dinkey runners	3.00	per day of 10 hours
Brakemen	1.75	" " "
Foremen	3.50	" " "
Pitmen	1.75	" " "
Oiler	1.75	" " "
Laborers	1.50	" " "
Water boy	1.00	" " "
Teams	5.00	2 2 " "

As 26 days were worked during the month, the cost of the work and the organization of the forces, would therefore be:—

Loading—		
1 Shovel runner	$150.00	
1 Craneman	108.00	
1 Fireman	72.00	
4 Pitmen	218.00	
1 Team hauling water	130.00	
52 Tons coal at $5	260.00	
Oil, waste, etc., say	10.00	
		$ 948.00
Hauling—		
2 Dinkey runners	$187.00	
2 Brakemen	109.00	
1 Oiler	45.50	
1 Trackman	45.50	
48 Tons coal at $5	240.00	
Oil, waste, etc., say	14.00	
		$ 641.00



Dumping—		
1 Foreman	$109.20	
16 Laborers	748.80	
1 Water boy	31.00	
		889.00
Track Gang—		
1 Foreman	$ 78.00	
5 Laborers	195.00	
		$ 273.00
Miscellaneous—		
1 Superintendent	$150.00	
Proportion of timekeeper's wages	30.00	
1 Watchman	45.00	
		$ 225.00
Interest, repairs and depreciation, estimated		388.00
Grand total		$3,364.00

* Division Engineer, Ontario—Rice Lake Division of the Trent Valley Canal.

The cost per cubic yard of material excavated would therefore be:—

For Loading	$26
" Hauling	18
" Dumping	24
" Track gang	8
" Miscellaneous	6
" Interest, repairs, and depreciation, estimated	11
Total	$93 per cub. yd.

Under the circumstances, the quantity of material moved is very large for this size of shovel, being at the rate of 1,385 cubic yards per 12 hour shift, or something over 115 cubic yards per working hour, and when it is considered that only 4-yd. cars were being loaded, and the average depth of cutting was only 10½ feet, it will be seen that the record is a very good one.

The contractors on this work are Messrs. Larkin & Sangster, of St. Catharines, Ont., Mr. Wallace was the superintendent in charge for the contractors, and Mr. E. G. Cameron is the assistant engineer in charge of this section.

ASPHALT PAVEMENTS.

During 1908 the city of Hamilton laid by day labor five stretches of asphalt pavement, and through the kindness of the city engineer we are able to give the detail of costs and figures reduced to prices per square yard.

Labour:—		$	$ *	$ *	$	$
	On gutters and foundation	303.60	262.16			
	Grading	158.54	105.65	157.27	785.75	93.14
	Road rolling	23.50	13.00	37.20	104.70	121.40
	Chanigng gutters	29.88		22.00	31.50	14.00
	At asphalt plant	227.51	226.85		122.94	
	Laying asphalt	329.54	317.20	118.16	583.13	146.46
				157.89	686.18	264.90
Materials:—						
	For Foundation and Gutters.—	$	$	$	$	$
	Stone, loads	28— 38.70		12— 12.00		82.66
	Gravel, loads	70—105.40			80—129.20	
	Cement, bags	740—340.40			437—201.02	
	Stores	3.91	4.26			12.93
	Extras				170.32	
	Brick				5,200—139.62	
	At Asphalt Plant.—					
		$	$	$	$	$
	California asphalt	43,745—546.81	51,954—649.42	27,819—347.74	136,356—704.44	47,106—588.82
	Cuban asphalt	12,023—180.34	13,875—208.17	6,241— 93.61	27,786—416.79	13,314—199.71
	Stone, cu. yd.	51— 58.82	107—123.05		261—309.48	35— 40.25
	Oil, gallons	802— 83.18	483— 44.66	268— 24.78	1,803—167.39	582— 54.38
	Pitch, pounds	2,340— 24.30				
	Sand, loads	58— 96.52	169—279.67			
	Cement, lbs.	1,980— 9.90	7,400— 37.00	32— 53.62	183—316.38	50— 81.67
	Stone dust, lbs.	17,310— 73.08		5,082— 25.41	16,640— 83.20	4,185— 20 93
	Wood, coal, stores	11.50	11.40			
	Extras		74.45	25.84		18.90
	Removing old timber	12.27		14.38		
		$	$	$	$	$
	Total	2,657.70	2,356.94	1,115.65	5,885.01	1,740.15
	Total area, sq. yds.	1,398	1,501	787	4,220	1,214
	Cost per sq. yd.	1.80	1.57	1.42	1.40	1.41

*Includes material.

CONCRETE ENGINE FOUNDATION.*

A. H. Shaw.
Engineer Central Coke and Coal Company, Bevier, Mo.

The application of a reinforced concrete block for an engine foundation is something new and well worth considering by the man who is up against the proposition of having an unstable foundation under his engine and a limited time in which to do the work of making it solid. At the Central Coal and Coke Company's Mine No. 61, near Keota, Macon County, Mo., the following experiment was successfully accomplished.

This mine is equipped with electric haulage, and the generator is driven by an Erie 16-inch by 18-inch engine, making 500 revolutions per minute. This engine was installed about seven years ago on a foundation of sandstone, which, through some fault in its construction, began after six years of continued service to show signs of failing at a line three feet below the top of the foundation. The movement of the engine and foundation began to be so great that it was decided to brace it with 1½-inch iron tie-rods anchored to the solid part of the foundation, but this did not prove very successful, for while it gave temporary satisfaction, it was seen that in a very short time the foundation would be torn to pieces by the continual rocking back and forth of the engine at every revolution. The situation had reached a point where something had to be done, and quickly, but how to do it without shutting the mine down for a week or more was the question, as this would have meant a big loss to the company for they needed every ton of coal that could be hoisted.

The company's chief engineer, Mr. J. R. Stephens, proposed that a reinforced concrete block, of the same dimensions as the damaged part of the old foundation, be made. The block was 3 ft. 10 in. × 13 ft. 0 in. × 3 ft. 6 in. made of 1 : 1 : 2 concrete, reinforced, as shown in Fig. 1 (a) by placing three 12-pound steel rails 12 feet long about four inches from the top and three the same distance from the bottom of the block and three in the centre to serve as longitudinals; the cross reinforcement was made by placing 12-pound rails on top of longitudinals and spacing them six inches apart through the length of the block; vertical reinforcement was thought to be unnecessary.

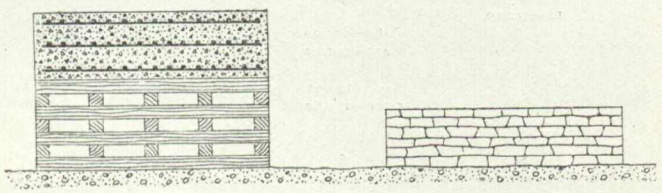
The forms for the concrete block were supported at the level shown in Fig. 1 (a), for with a block cast in this position it was not necessary to raise it when ready to be moved into place on the old foundation shown at (b). After the forms had been built and braced, wooden core boxes of sufficient size to leave ample room for the anchor bolts were set; care being taken in spacing these core boxes so that there would be no difficulty in setting the block over the

* In the "Mines and Minerals."

bolts. In casting, the concrete was well tamped into the corners and along the sides to insure absence of voids. The block was allowed to stand two weeks.

To put the block into position the engine was moved forward far enough for the fly-wheel to clear the end of the foundation and then off to one side. After the damaged portion of the foundation had been torn off and the newly exposed surface cleaned, the concrete block was rolled forward, let down over the anchor bolts and grouted into position. After this had set the engine was replaced. Enough of the old foundation was taken off so that there was fully an inch of clear space between the bottom of the engine bed and the top of the concrete block when the nuts on the anchor bolts had been screwed down the length of their own depth.

The cores in the concrete block were large enough to allow lateral motion for bringing the engine into alignment with the dynamo, and that was done by moving the engine so that the edges of the driving wheels and the driver pulley were all in the same straight line. The engine is supported on iron wedges and by shifting these wedges the engine was perfectly levelled both in direction of cylinder and crank-shaft. A form was then built around the foundation, the top being level and projecting an inch above it. The engine bed was then firmly grouted in by first filling the core boxes and then bringing the entire surface to the level of the top of the forms. The iron wedges were not removed but remain permanently. The spaces surrounding the bolts in the bedplate openings were filled with molten sulphur.



(a) (b)

FIG. 1

The mine was closed on Wednesday at 3 p.m. and the work of moving the engine off the foundation began, and at 12 p.m. the concrete block was rolled into place, grouted in and allowed to stand twenty-four hours. This was considered long enough for the grout to have gotten sufficiently hard to permit putting the engine back into position. The engine was moved into position on the block in four hours, grouted in and allowed to stand until Saturday noon, when a trial run was made. No apparent movement could be detected in the foundation. On Monday morning work began as usual and the block method of renewing this foundation was a success.

The calculated weight of this block was 7½ tons and the estimated cost of this renewal was as follows:—

Concrete 6.5 cubic yards at $8	$52.00
Forms (lumber and carpenter)	4.50
Blacksmith on reinforcements	3.00
Raising engine off foundation, tearing out old foundation and setting block and engine	12.00
	$71.50

The Soo Corporation's output of rails for the year compares as follows:—

	1907-8—Tons.	1908-9—Tons.
Pig iron	135,852	130,268
Rails (Bessemer)	117,697	126,733
Rails (open hearth)	25,321	31,732

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

8146—September 22—Recommending to the Governor-in-Council for sanction agreement between the Canadian Collieries, Ltd., and the United Coal Fields of British Columbia, re sale and transfer of the franchise, rights, powers, railway and undertakings.

8147—September 22—Approving location plan of the C.P.R. Company's station at Mowbray, Man.

8148—September 22—Authorizing the C.P.R. to open for the carriage of traffic portion of line from Bolton to Bolton Junction, Ont.

8149—September 21—Directing the C.N.R. to provide and construct certain highways in the City of Fort William, Ont.

8150—September 22—Authorizing the Municipal Electric Light System of Listowel, Ont., to cross with its wires the track of the G.T.R. at that town.

8151—September 22—Authorizing the C.P.R. to construct, maintain, and operate spur in the Parish of Kildonan, Man.

8152—September 22—Authorizing the C.P.R. to construct industrial spur for the Empire Elevator Company at Fort William, Ont.

8153—September 22—Approving plan of proposed new iron bridge to be constructed by G.T.R. to replace present bridge at M.P. 121.22 near Ailsa Craig, Ont.

8154—September 22—Authorizing the C.P.R. to construct spur for J. Brodie & Son, mileage 3.79 from Stayner-ville Junction, P.Q.

8155—September 22—Granting leave to the Listowel Municipal Electric Light System to place its wires across the track of the G.T.R. Company, where the same crosses Mill Street, Listowel, Ont.

8156—September 22—Granting leave to the Listowel Municipal Electric System to place its wires across the track of the G.T.R. at Mill Street in said town.

8157—September 23—Granting leave to the Walford Rural Telephone Company to place its wires across the track of the C.P.R. at Irish Creek, Ont.

8158—September 23—Granting leave to the Bell Telephone Company to place its wires across the track of the N.C.R.R. near Bridgeburg, Ont.

8159—September 21—Dismissing application of the C.P.R. for leave to cross with its tracks the track of the G.T.R. in the town of Ingersoll, Ont.

8160—September 22—Dismissing application of the C.P.R. to cross with its track the track of the G.T.R., County of Oxford, at mileage 5.03, Ont.

8161—September 24—Approving location and detail plans of the C.P.R. Company's station at Belle Plain, Sask.

8162—September 24—Authorizing the G.T.R. to operate branch line in the City of Brantford, Ont., to the premises of Schultz Bros., Ltd.

8163—September 24—Authorizing the C.P.R. to operate branch, or industrial spur, for the Redcliffe Realty Company, Limited, Redcliffe, Alta.

8164—September 24—Approving and sanctioning location of the G.T.P. Company, Prince Rupert easterly, between mileage 150 and 180.74, Coast District, B.C.

8165—September 23—Granting leave to the Bell Telephone Company to cross the track of the G.T.R. at Howick

(Continued on Page 440.)

ELECTRIC LOCOMOTIVES FOR THE BRITISH COLUMBIA ELECTRIC RAILWAY.

The British Columbia Electric Railway Company operate twenty miles of track in and around New Westminster, B.C., connecting this town with Vancouver, Stevest, Cloverdale, Huntingdon, Chilliwack, and several other Fraser Valley towns. They use a 4 ft. 8½ inch gauge and a 60 lb. T rail. Recently they have added to their equipment three electric locomotives.

These locomotives were built and supplied by Messrs. Dick, Kerr & Company, the electrical equipment being manufactured at their electrical works at Preston, and the trucks and mechanical portion at their general engineering works at Kilmarnock.

The locomotives are of the articulated truck four-axle type, with one motor mounted upon each axle. The maximum rated tractive effort is 16,000 lb. drawbar pull, and the maximum instantaneous effort is 25,000 lb. A feature of special interest in the truck arrangement is that the body of the locomotive rests upon two four-wheeled trucks coupled together by a massive hinge having lateral flexibility but vertical rigidity thereby enabling the rear trucks to resist any tendency to tilt under the action of the forward truck, and vice versa. The centre pins and cab platform framing are not subjected to any longitudinal stress, except that due to its own inertia when starting and stopping, the whole pull of the motors being transmitted direct from the motors through the trucks. Suitable arrangements are made to allow the trucks to radiate when passing round a curve. The spring suspension is of the locomotive type, the weight being carried by semi-elliptic springs resting on the journal box saddles.

Fig. 1 shows the general appearance of one of the locomotives, and Fig. 2 gives a view of the interior of the cab. Here can be seen the two master controllers one at each end of the cab, the contactor boxes, circuit-breakers, switches, etc. The control equipment is of the standard Dick-Kerr multiple-unit type, with series magnets operating the various contactors. The resistances are placed in the sloping ends of the superstructure.

The motor equipment consists of four Dick-Kerr 12a motors. When operating on a 600 volt circuit each motor will give a tractive effort of 4,040 lb. on the periphery of the 42-inch wheels, and a speed of 15 miles per hour at the one-hour rating. Each motor is fitted with reduction gear having a ratio of 3.64 to 1. The armature bearings of the motor are lubricated by oil rings, which are specially designed to prevent flooding when running at high speeds. The axle bearings are lubricated by a system of wicks which are immersed in oil wells. No grease is used as an emergency lubricator. The whole of the gearing of the motor is contained in a malleable iron oil-tight gear box, which is provided with suitable stiffening ribs. It is supported by the axle bearing at one end and by the pinion bearing and motor shell at the other end. The motors are designed and arranged for forced ventilation, the air being blown into the motor shell at the end farthest from the commutator, and passing out at suitable openings provided at the commutator end.

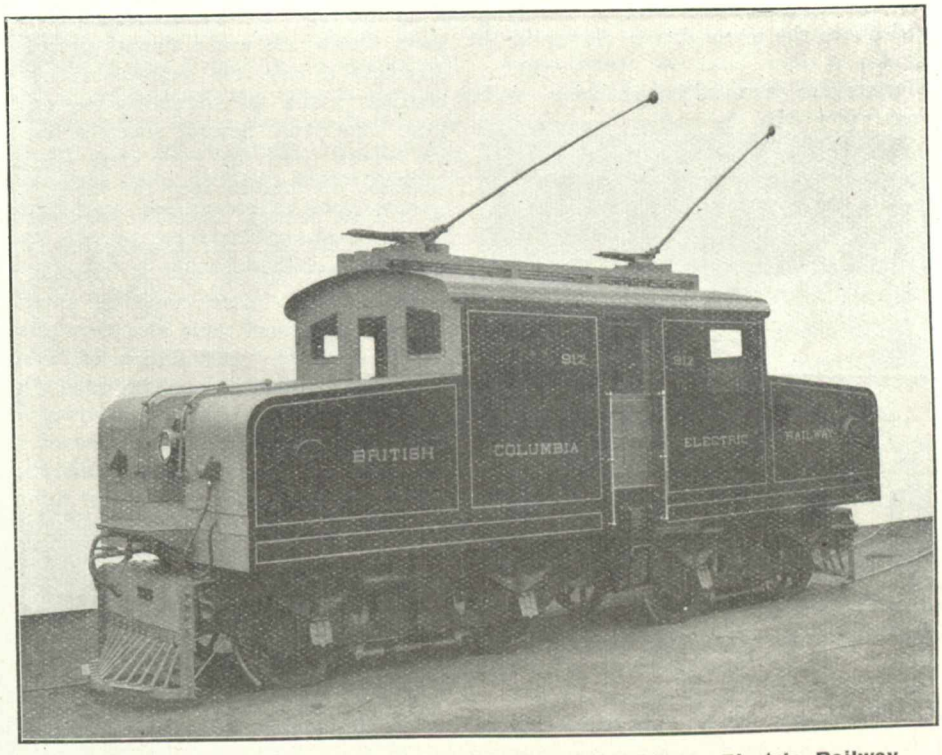


Fig. 1.—Electric Locomotive for the British Columbia Electric Railway.

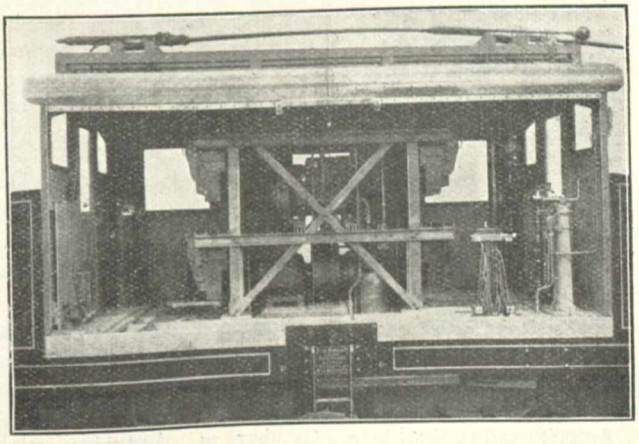
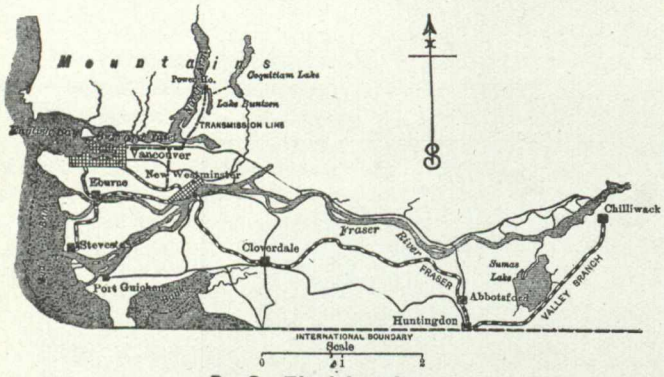


Fig. 2.—View Showing Interior of Cab of Locomotive

The air for the forced ventilation is obtained by means of a centrifugal blower situated in the centre of the cab (see Fig. 2) and driven by a Dick-Kerr motor. The controller for operating this motor is situated near the right-hand master controller, seen in Fig. 2. In addition to the blower for the motors, there is an electrically-driven air compressors with suitable air reservoirs for the air-brake equipment, the locomotive being fitted with combined straight and automatic air brake. The compressor for the brake equipment is mounted above the motor-driven blower in the cab.

Two current collectors are provided, these being of the straight under-running trolley type, the current being collect-



B. C. Electric Lines.

ed from an overhead trolley line. The trolleys are equipped with retrievers. The following details of the equipment are of interest:—

Number of motors	4
Gear ratio	3.64 to 1
Number of driving wheels	8
Diameter of driving wheels	42-inch
Total wheel base	24 ft. 6 inch
Wheel base of each truck	8 feet
Length overall	35 ft. 7 inch
Length of main cab	16 ft. 5 inch
Height of cab above rail level	14 ft. 1½ in.
Width of cab	9 ft. 8 inch
Total weight of locomotive	50 tons

The Canadian agents for Dick Kerr & Co., are Chapman & Walker, Toronto, Ont.

COMING MEETINGS.

American Railway Bridge and Building Association.—October 19-21. Nineteenth annual convention at Jacksonville, Florida. Secretary, S. F. Patterson, Boston & Maine Railway, Concord, N.H.

National Gas and Gasoline Engine Trades Association. Harry T. Wilson, treasurer, Middleton, Ohio; Albert Stritmatter, Cincinnati, Ohio. Next meeting November 30, December 1, 2, 1909, at Chicago, Ill.

American Gas Institute.—October 20. Annual meeting at Detroit, Mich. Secretary, A. B. Beadle, 29 W. 39th Street, New York City.

National Association of Railway Commissioners.—Nov. 16. Annual meeting at Washington, D.C. Secretary, Martin S. Decker, Albany, N.Y.

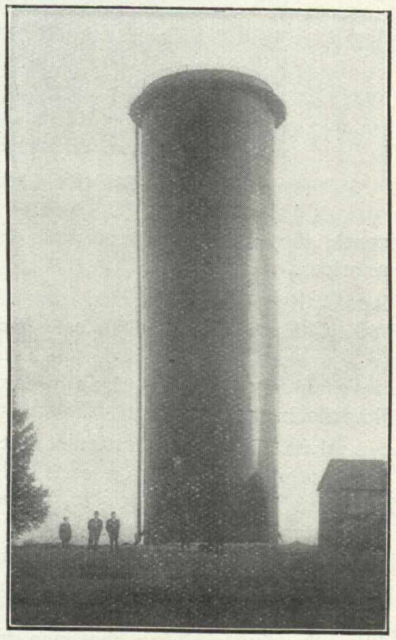
America Railway Association.—Nov. 17. Annual meeting at Chicago, Ill. Secy., W. F.Allen, 24 Park Place, N.Y.

American Society of Municipal Improvements.—Nov. 9-11. Annual convention at Little Rock, Ark. Secy., A. P. Folwell, 239 West 39th St., New York City.

GUELPH'S WATER SUPPLY.

A. E. Oakley, C.E.

The city of Guelph, with a population of 14,000, formally inaugurated its new system of water supply on the 23rd September, the Lieutenant-Governor of the Province, Hon. J. M. Gibson, being the guest of honor. Up till this time the city has derived its supply from the River Speed, from which the water flowed practically direct to pumps. Needless to say, the supply was not of a very wholesome character, due to contamination, and typhoid fever cases were numerous. Several schemes for filtering the water on its course from the river were tried, but with indifferent success; so that in 1907 the Water Commissioners decided to consult Messrs. Davis & Johnston, of Berlin, as to the practicability and cost of collecting springs at Arkell, a distance of four miles east of Guelph, where an abundant supply of pure water could be obtained. The report they received confirmed their idea that this was practicable, and also advised the installation of a storage reservoir, new pumps, and standpipe. The report was adopted, and the citizens voted $125,000 for carrying out the work as outlined. The engineers who reported on this scheme were engaged, and the writer as resident engineer. The satisfactory results following the operation of the system have fully justified the Commissioners in the course they have



Stand Pipe, 500,000 gallons.

taken, and Guelph has now an abundant supply of pure water, sufficient for many years to come.

The intention of the writer in the present article is to describe briefly some of the features of the work of construction in the hope that it will be of interest to engineers.

The springs at Arkell are situated in the valley of the River Speed, and those at present in use are six in number. They vary considerably in flow, that of the largest being 1¼ million, the smallest 56,000 imperial gallons in twenty-four hours. The springs rise on the side of the hill out of a coarse gravelly ground, underneath which is limestone rock. To protect the springs from contamination about 170 acres of land was bought by the city and has been carefully

fenced in. This land the Commissioners propose planting with trees.

The work of collecting springs consists of a concrete chamber, 4 ft. by 3 ft., built in the most suitable position. From this chamber open-jointed pipes are laid, following the springs into the side of the hill and in other directions where smaller springs could be obtained. These branches were laid to an average depth of 6 ft. and covered with 1 ft. of washed gravel, and trench refilled with the excavated material. A weir was built in the chamber, so that the flow can be measured periodically to see if the flow decreases or otherwise. From the weir chamber a cement jointed pipe is laid to main conduit, the connection being made by building a concrete chamber 3 ft. by 3 ft. All chambers are covered with reinforced concrete slabs, with manholes where necessary. It will be gathered from the preceding description that the springs are, as far as practicable, protected in every possible way from the risk of contamination, the water not being exposed until it reaches the valve-house at the reservoir.

The main conduit consists of a 24-inch diameter vitrified pipe, laid to a grade of 1 in 1,000, the average depth of pipe being 5 feet 6 inches.

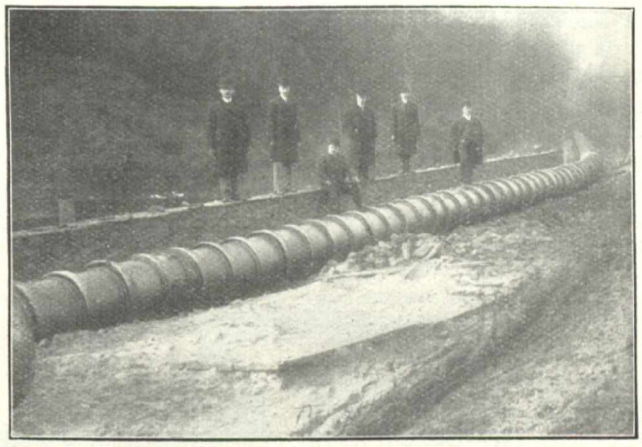
Nothing of especial interest occurred in the work. The usual methods of pipe-laying were employed as in sewer

Pipe Line during construction.

construction, with the exception, perhaps, of the manner of making joints, which was specified briefly as follows: Strands of yarn to be cut eight inches longer than circumference of the pipe, yarn to be well soaked in cement grout and thoroughly caulked into joints; no strands of yarn to overlap in same place. The joint to be filled in this manner and finished off with the usual fillet of cement. The fact that one section of this conduit is laid as an inverted syphon for a distance of 1,800 feet under a five-foot head, and is watertight, shows that this system of making joints is very satisfactory. Great care, however, should be exercised, and, in the opinion of the writer, an inspector should be on the ground to see each joint made, as it is almost impossible to get the work done properly without constant supervision, especially where water is met with in the excavation, as was the case in places where the conduit was laid.

The conduit in its course cityward crosses under the C.P.R., and also under the river. No difficulty was experienced at either place. In the latter the water in the river was about four feet deep, and the customary way of daming off half the river, pumping, excavating and laying pipe for that distance, then turning the flow of water over the pipe already laid and laying the next part was followed successfully.

Pipes under the river were of cast-iron, owing to the greater head that they were subjected to. They were laid

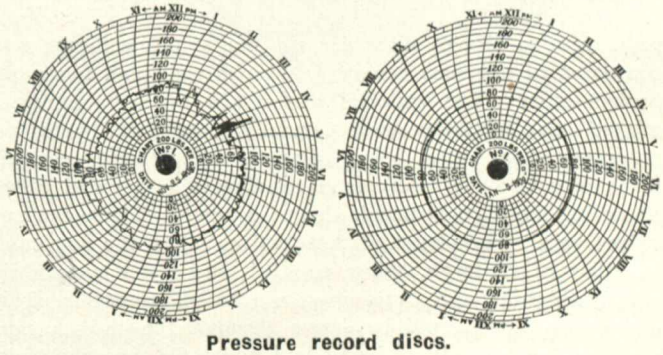


Pipe Line and Retaining Wall.

as an inverted syphon, a concrete chamber with air vent being built at either end.

The construction of the concrete storage reservoir presented some rather unusual difficulties, owing to the fact that the site was in part of the open reservoir then used by the city, and that the supply could not be interfered with whilst work was in progress.

To overcome this difficulty the engineers decided to lay a 14-inch cast-iron pipe, with lead joints, in the bottom of the old reservoir, the level of which was three feet lower than the floor level of the new reservoir. Pipes were jointed together on trestle work and lowered eight feet into place



Pressure record discs.

by means of chain blocks, the blocks being spaced about twelve feet apart. In this manner 200 feet of pipe were successfully laid. Dams were then built, water pumped out, and excavation and grading done. Several springs or leakages from the old reservoir were met with, and diverted to pumps by means of open-jointed tile. In adopting this method no difficulty was encountered in the laying of concrete. One pulsometer pump and one duplex pump was sufficient to keep excavation dry during the progress of work. The dimensions of the reservoir and details of same are shown on the accompanying plan. The capacity is about 500,000 imperial gallons. Depth of water is usually eight feet, but can be

increased to a depth of ten feet for reasons dealt with in the description of the valve-house.

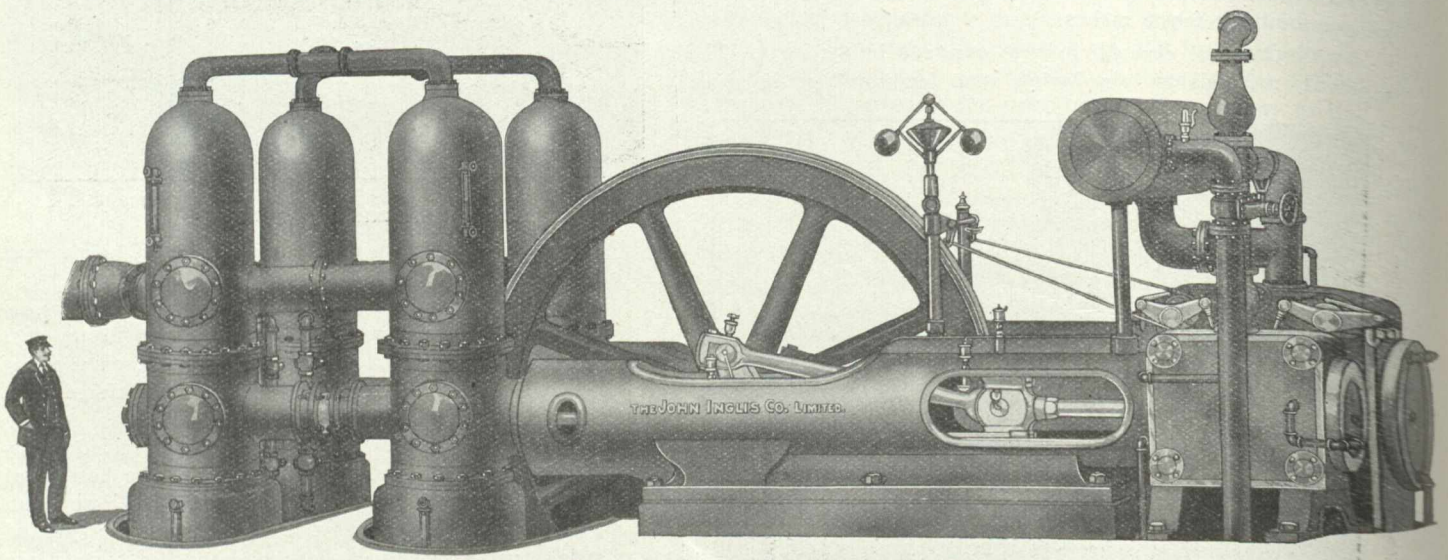
The floor of reservoir consists of concrete, 8 inches thick, reinforced with ½-inch steel rods, spaced 5½ inches, centre to centre, and also with ¾-inch rods, laid longitudinally between columns. This reinforcing was calculated to resist the static pressure from beneath when at any time the reservoir should be emptied, the level of water outside being four feet higher than floor level.

The walls are of plain concrete, 2 ft. 6 in. thick at base, and sloping on the inside to 1 ft. 6 in. at the top. Columns for supporting roof are also plain concrete, 1 ft. 6 in. square. Beams are of reinforced concrete, the reinforcing consisting of three 1⅜-inch. rods, the centre rods being bent up at ends. In addition to this, two ½-inch rods, bent as shown, are placed to anchor the ends of beams to walls, and over piers two ½-inch rods 8 feet long are placed for shear. The roof consisted of concrete 4 in. thick, reinforced with ½-inch steel rods, spaced 5½ in., centre to centre; longitudinal rods are also placed as shown. The roof slab is continuous from end to end of reservoir. The concrete for floor and roof was composed of one part cement, two of sand and four parts broken stone. That for the walls and columns was composed of one part cement, 2½ parts sand and five parts broken stone. The concrete was mixed by a "continuous mixer," but materials were carefully gauged in boxes, no automatic appliances being allowed. Where the conduit discharges into the reservoir an overflow chamber and valve-house has been constructed, also of concrete. There are two valves here. The object of these valves is, in the one case, to allow of reservoir being emptied, the water meanwhile discharging through overflow pipe into old reservoir, from which the water could be drawn through the 14-inch pipe mentioned previously as being laid under the new reservoir, a valve being placed on this pipe for this purpose. The second valve in the valve-house is an overflow. This can be operated so that the overflow level will be considerably higher than any high water mark of the river ever recorded or remembered by the inhabitants.

The valve-house is built partly over a section of the reservoir. An opening in the roof, railed off, provides an opportunity for visitors to view the water as it discharges from the conduit into the reservoir, this being the only place it is visible until it reaches the consumers. From the reservoir the water flows to the pump well, from which it is pumped by a 3,000,000 imperial gallon horizontal, cross-compound engine, designed to work against a head of 240 feet, including suction, when supplied with 125 pounds steam pressure per square inch at throttle. Discharge from pumps enters a 14-inch and 12-inch main to city and standpipe.

The standpipe is situated on a hill adjacent to the city, the dimensions being 100 feet in height and 30 feet diameter. Foundation consists of concrete 7 feet 6 inches thick, and is hexagonal in shape. The standpipe pressure at the centre of the city records 80 pounds per square inch. However, in case the necessity arises, owing to fire, to increase this pressure, an electrically operated valve is to be placed on the force main at the base of the standpipe, and water can then be pumped direct to the main. This valve is to be operated from the pump-house.

Fig. 3 is a reproduction of two records taken from the pressure gauge in the city hall. The first one shows the pressure on November 25th, 1908, before the stand pipe connections were made, and when the pumps were pumping direct into the city mains without the standpipe for overflow. The second record was made January 5th, 1909, and clearly indicates the uniform pressure now secured.



Cross Compound Pumping Engine, built by The John Inglis Company, Limited.

The following analysis, which is a good average result, shows the water to be very pure:—

Total solids	336 parts per million
Chlorine	9 parts per million
Free ammonium	merest trace
Albuminoid ammonium	.038 parts per million

Contract.	Contractor.	Price.
Supplying 24-inch tile	Lytle Tile Co., Buffalo, N.Y.	$24,000 00
Laying same	J. Conn & Co., Windsor	24,978 00
Iron pipe	Gartshore, T., Hamilton	
Laying force main	J. Conn & Co., Windsor	2,825 00
Concrete reservoir	C. H. Conery, Guelph	8,993 00
Pumps	J. Inglis & Co., Toronto	14,400 00
Standpipe	Toronto Iron Works, Ltd.	9,250 00

The Guelph Waterworks system is managed by a commission consisting of G. B. Ryan, chairman; R. L. Torrance, secretary, and the mayor. Mr. J. J. Hackney is the manager of the whole system, the Commissioners dealing only with matters of policy.

THE ACTION OF FROST ON CEMENT AND CEMENT MORTAR, TOGETHER WITH OTHER EXPERIMENTS ON THESE MATERIALS.*

By Ernest R. Matthews, Esq.,† and James Watson, Esq.

This paper describes in detail a series of experiments, extending over the past two years, made by the writers, in order to ascertain:—

The effects of frost, and alternate frost and thaw, on the tensile strength of cement and cement mortar when mixed with—

(a) fresh water, cold or warm;

(b) sea-water;

The temperature below which it is detrimental to mix Portland cement concrete;

The effects produced by immersing concrete in—

(a) fresh water, hard or soft,

(b) sea-water;

Absorption of water by (dry) cement;

Quantity of water required to be added to cement to produce complete hardening.

The results of these experiments are not only interesting, but should prove of value to engineers generally.

The Hull Cold Storage Company, of Hull, England, kindly allowed the writers to use its refrigerating rooms in order to obtain the degrees of frost necessary for these experiments. The cement used was that manufactured by Robson's Cement Company, of Hull, and all the experiments were carried out at the laboratories of that firm, in Hull, these being kindly placed at the disposal of the writers.

Cement Used in Experiments.

The particulars of the cement used are as follows: Made on January 28th, 1907. Residues on a 5 776-sieve (that is, having 76 meshes per linear inch) = 0.5%; residues on a 10,000-sieve (having 100 meshes per linear inch) = 2.0%; residues on a 32 400-sieve (having 180 meshes per linear inch) = 11.5% (showing that the cement was ground extremely fine). Specific gravity = 3.112; flour = 54.5%; Le Châtelier tests, expansion = 2.7 mm.; Faija bath test, cement pat sound and hard; time of set of neat cement with 25% water: Initial set = 35 min.; permanent set = 6 hours, in a room kept at a temperature of 60° Fahr.

Tensile Strains. Neat Cement.

7 days = 685 lb. per sq. in. British Standard Test, 400 lb. per sq. in.

14 days = 787 lb. per sq. in.

28 days = 875 lb. per sq. in. British Standard Test, 500 lb. per sq. in.

It will be seen that these results are well above the British Standard Tests.

Tensile Strains. One Part Cement and Three Parts Sand.

Mixed with three parts by measure of sand, and with no hammering of briquettes into moulds, its mean strength was:—

7 days = 200 lb. per sq. in. British Standard Test, 120 lb. per sq. in.

14 days = 277 lb. per sq. in.

28 days = 333 lb. per sq. in. British Standard Test, 225 lb. per sq. in.

* Read before the American Society of Civil Engineers and published in Vol. XXXV., No. 1, Page 1.

†Borough Engineer of Bridlington, England.

Chemical Analysis.

	Percentage
Insoluble Residue	0.82
Silica	20.43
Alumina	9.10
Oxide of iron	1.95
Lime	62.65
Magnesia	1.25
Sulphuric anhydride	1.38
Loss on ignition	1.66
Alkalies and loss	0.76
	100.00

The sea-water used in these experiments was taken from the North Sea; the fresh water was drawn from the Hull Corporation mains. To obtain the soft water, the temporary hardness of this water was removed, the permanent hardness being from 3 to 4 degrees.

The experiments herein will be compared with the tests just given, which will be referred to as the "Normal Test."

Effects of Frost.

The effects of frost, and alternate frosts and thaw, on the tensile strength of cement and cement mortar when mixed with (a) fresh water—cold or warm, (b) sea-water; and the temperature below which it is detrimental to mix Portland cement concrete, were determined by the following experiments:

Experiment A.—In this experiment the writer set out to discover the weakening effect, upon freshly mixed cement, of continuous light frost, temperature 29° Fahr., and of heavy frost, 15° Fahr. Nine briquettes were made with neat cement, 20 per cent. water, in the laboratory, the temperature of the air being 60° Fahr. These were taken from the moulds 24 hours after gauging and placed in cold stores, temperature 29° Fahr., and were broken at seven and twenty-eight days, respectively, the average tensile strength being:

At 7 days = 610 lb. per square inch.

At 28 days = 905 lb. per square inch.

These results are compared with the normal tests as follows:

Tensile strength in pounds per square inch.

	Normal tests, 24 hours in air at 60° Fahr., in water remainder of time.	In air at 60° Fahr. for 24 hours then 29° Fahr. for remainder of time.
7 days	685	610
28 days	875	905

In the 7 days' test it will be observed that there is a decrease of 10.9 per cent. in tensile strength, and an increase of 3.4 per cent. in the 28 days' test.

Experiment B.—Nine briquettes, made in the same manner as in Experiment A, were placed at 60° Fahr. Three were taken out at the end of 2 days, and placed in cold storage for 25 days; three more, at 7 days, for 21 days, and the other three, at 14 days, for 14 days. All were broken at 28 days, the result being as follows:

Tensile strength in pounds per square inch.

	Normal test in air, 60° Fahr. for 24 hours, then in water.	In water at 60° Fahr. for 2 days, then in air at 29° Fahr.	In water at 60° Fahr. for 7 days, then in air at 29° Fahr.	In water at 60° Fahr for 14 days then in air at 29° Fahr.
28 days	875	912	977	942

Experiment C.—Nine briquettes, made as before, were allowed to harden in air for 7 and 28 days at 60° Fahr., the result being:

Average tensile strength at 7 days = 443 lb. per sq. in.

Average tensile strength at 14 days = 525 " "

Average tensile strength at 28 days = 775 " "

Days.	7, 14 and 28 days in air at 60° Fahr.	24 hours in air at 60° Fahr., then in water.
7	443	685
14	525	787
28	775	875

Experiment C1.—

Sand and Cement Tests (3 to 1): Same as Experiments A, B, and C.

Days	Normal test	A	B	C
7	200	163	.....	220
14	277	270	.....	250
28	353	342	B2. 317; B7. 305; B14. 243	322

Experiment D.—Effect of Alternate Frost and Thaw.—The briquettes were allowed to remain for 24 hours under damp flannel, then in water for three days (60° Fahr.), then in water at the cold stores (temperature varying from 29° to 60° Fahr.). The briquettes were changed every three days.

Days	Neat	3 to 1	Normal Neat	3 to 1
14	787	252	787	277
28	813	322	875	353

Experiment E.—This test was the same as A or D, but the briquettes were gauged with warm water; temperature, 100° Fahr.

Days	Neat	3 to 1	A Test Neat	3 to 1
7	352	133	610	163
14	705	205	...	270
28	728	230	905	342

Experiment F.—(Salt-Water Immersion).—Nine briquettes were mixed with fresh water, and, after 24 hours, were immersed in sea-water, and broken at 7, 14 and 28 days.

Days	Neat (20% water)	3 to 1 (10% water)	Normal Neat	3 to 1
7	770	242	685	200
14	742	278	787	277
28	812	360	875	353

Experiment G.—Nine briquettes were mixed with sea-water (same test as before).

Days	Neat	3 to 1	Normal Neat	3 to 1	Mixed with fresh water and immersed in sea-water Neat	3 to 1
7	693	180	685	200	770	242
14	775	287	787	277	742	278
28	773	293	875	353	812	360

Initial set, 9 minutes; final set, 6 hours.

Experiment H.—Nine briquettes were mixed with sea-water, and, after 24 hours under damp flannel, were immersed in fresh water for the remainder of the time.

Days	Neat	3 to 1	Normal Neat	3 to 1
7	628	150	685	200
14	733	255	787	277
28	713	297	875	353

Experiment K.—Same test as A, but the briquettes were kept in a temperature of 15° Fahr. in cold storage.

Days	K.—Heavy Frost Neat	3 to 1	A.—Light Frost Neat	3 to 1	Normal Neat	3 to 1
7	405	57	610	163	685	200
28	595	145	905	342	875	353

The briquettes were taken from the cold stores to the laboratory, two miles away, and were broken in a temperature of 60° Fahr., 45 minutes after leaving the cold stores.

Experiment L.—The briquettes, 24 hours after gauging, were put into water at 60° Fahr. for 6 days, then placed in the cold stores at a temperature of 15° Fahr. for the remainder of the time.

Days	Briquettes placed in air at 60° Fahr. for a day or two after having been in cold stores at 15° Fahr. for 28 days. Neat	3 to 1	Neat	3 to 1	Neat	3 to 1
28	700	217	875	315	905	342

Experiment M.—The briquettes were put directly into the cold stores at 29° Fahr. for 7 days.

Days	Neat	Normal—Neat
7	480	685
28	595	875

Experiment N.—The briquettes were made with neat cement, and placed, some in the air at a temperature of 60° Fahr., and others in air at a temperature of 29.3° Fahr. (2.7° of frost). In 15 minutes those in air at 60° Fahr. were still soft, while those subjected to frost had just frozen hard at the expiration of that time. Briquettes mixed with sand and cement (3 to 1) were subjected to a similar test. At the expiration of 15 minutes those in a temperature of 60° Fahr. were still soft, while those in a temperature of 29.3° Fahr. had just frozen hard; and at a temperature of 27° Fahr. (5° below freezing point, Fahr.) were frozen very hard, indeed, at the expiration of that time.

Conclusions from the Foregoing Experiments.—These investigations have led the writers to the following conclusions:

(1) That light frost occurring 24 hours after the cement has been gauged, as indicated in Experiment A (3° of frost, or thereabouts), is detrimental to freshly mixed Portland cement, but only for a short time, and that at the end of 28 days it has quite regained its normal strength. If the frost occurs immediately after the cement has been gauged, the effect is more detrimental, and would appear to be permanent (see Experiment M). A minimum quantity of water should be added in frosty weather.

(2) That heavy frost (17° of frost, or thereabouts) has a most injurious effect (permanent) upon freshly mixed cement (neat), and cement mortar, as shown in Experiment K.

(3) That a light frost (3° of frost, or thereabouts), as indicated in Experiment A, does not affect cement or cement mortar if it has attained 2 days' set previous to the occurrence of the frost (Experiments B, C, and D).

(4) That the detrimental effect of light frost upon cement mortar (3 to 1) occurs more immediately than upon neat cement, but that cement mortar recovers from the ill effects of frost more rapidly than neat cement. At the end of 14 days it has quite recovered (Experiment C).

(5) That the mixing of cement or cement mortar with warm water (temperature, say, 100° Fahr.), which is sometimes done in frosty weather, and has been recommended by some engineers,* has a permanently injurious effect upon

* Minutes of Proceedings, Inst. C.E., London, Vol. CXXXIV, p. 384.

cement and cement mortar. This will be seen by reference to Experiment E.

(6) That neat cement immersed in fresh water immediately after becoming set, and remaining in water, has a much greater tensile strength than when remaining in air (Experiment C), the former being 55 per cent. stronger than the latter at the end of 7 days, 50 per cent. stronger at 14 days, and 11.3 per cent. stronger at 28 days. In 3 to 1 cement mortar, however, the result is different, the tensile strength being practically the same under both conditions.

(7) That it increases temporarily the tensile strength of cement and cement mortar to immerse them in sea-water 24 hours after gauging, instead of immersing them in fresh water; but the increased strength is only temporary (Experiment F).

(8) That there is an immediate reduction in the tensile strength of briquettes mixed with sea-water and immersed in sea-water (Experiment G) over those mixed with fresh water and immersed in sea-water (Experiment F). At the end of 14 days the strength of the former equals that of the latter, but after that period a depreciation again sets in, so that at 28 days there is a deficiency of 5 per cent. in the tensile strength.

(9) That the initial set of briquettes mixed with sea water is 9 minutes; permanent set, 6 hours. When mixed with fresh water, the former is 35 minutes; the latter, 6 hours (Experiment G).

(10) That cement and cement mortar mixed with sea-water, and immersed in fresh water 24 hours afterwards, have less tensile strength than when mixed with fresh water and immersed in fresh water (Experiment H).

(11) Experiment L shows that 17° of frost for 28 days does not kill the process of hardening in the briquette, but only delays it.

(12) It would appear from Experiment N that it is detrimental to concrete to mix it when the temperature is below 29.3° Fahr. (2.7° of frost), that being the freezing point of cement and concrete.

The Effects Produced by Immersing Concrete in Fresh Water (Hard or Soft), and in Sea-Water.

Neat Cement.—Neat-cement briquettes (mixed with 20 per cent. of fresh water) were immersed in fresh water (both hard and soft) and in sea-water after being in the moulds for 24 hours. In each case the absorption finished at the end of the seventh day: (1) The water absorbed by the briquettes in hard water at the end of the seventh day = 3.46 per cent.; (2) by the briquettes in soft water = 2.92 per cent.; (3) by the briquettes in sea-water = 3.92 per cent.

Sand and Cement, 3 to 1.—As in the case of neat cement, just described, no absorption took place after the seventh day. (1) The briquettes in hard water absorbed at the end of the seventh day 3.4 per cent. of water; (2) in soft water, 3.4 per cent.; (3) in sea-water, 4.5 per cent. In the case of the neat cement, and sand and cement briquettes, similar to the foregoing, but exposed to air for 7 days previous to immersion in water, the following results were obtained:

With neat cement during 7 days' exposure to air, the loss in weight, was 1.7 per cent.; then, after 24 hours' immersion in (1) hard, (2) soft, and (3) sea-water, the increased absorption = 1.7 per cent., just counterbalancing the previous loss. On continued immersion a further gain of only 0.3 per cent. in weight was obtained. The results of tensile tests at 28 days were: (1) = 875 lb.; (2) = 760 lb.; and (3) = 835 lb. per square inch. The lower absorptions were most probably due to the partial set of the cement in the centre of the briquettes during the 7 days' drying in the air, and the prevention of the free percolation of the water through it.

With sand and cement, during 7 days in air, the loss of moisture was 2.2 per cent.; then, after 24 hours' immersion, the gain was: (1) in hard water = 3.4 per cent.; (2) in soft water = 2.0 per cent.; and (3) in sea-water = 2.8 per cent. The results of tensile tests at 28 days were: (1) = 360 lb., (2) = 360 lb., and (3) = 330 lb. per square inch.

Conclusions from the foregoing Experiments.—(1) That no absorption takes place in neat cement, cement mortar, or concrete after immersion in water for 7 days.

(2) That neat cement immersed in hard fresh water for 7 days absorbs 0.54 per cent. more than when immersed in soft fresh water for the same period.

(3) That if immersed in sea-water for 7 days it absorbs 0.46 per cent. more than when immersed in hard fresh water, and 1.0 per cent. more than when immersed in soft fresh water.

(4) That cement mortar (3 to 1) absorbs the same quantity when immersed in either hard or soft fresh water, but when immersed in sea-water it absorbs 1.1 per cent. more.

(5) That neat cement and cement mortar, when immersed in hard fresh water, have practically the same absorption in both cases. That neat cement immersed in soft fresh water absorbs 0.48 per cent. less than cement mortar (3 to 1), and that cement immersed in sea-water absorbs 0.58 per cent. less than cement mortar.

(6) That when neat cement is exposed to air for 7 days after gauging it loses 1.7 per cent. of its weight, but when immersed for 24 hours in water, either hard or soft fresh water, or sea-water, it absorbs 1.7 per cent., which just counterbalances the previous loss.

(7) That after this loss has been made good, and the immersion of the briquettes is continued, there is a further gain of 0.3 per cent., which averages 1.43 per cent. less than the absorption which takes place when cement is immersed in water 24 hours after gauging.

(8) That cement mortar (3 to 1) exposed to air for 7 days after gauging loses 2.2 per cent. of its weight; but after 24 hours' immersion in hard fresh water the absorption is increased to 3.4 per cent.; in soft water it is 2.0 per cent., and in sea-water it is 2.8 per cent., showing that soft water is absorbed more slowly than hard water, and that sea-water is also more slowly absorbed than hard fresh water.

Absorption of Water by (Dry) Cement.

Experiment 1.—Dry cement was compressed into moulds with a press, the same amount in each mould. The moulds were then allowed to stand in water for 24 hours. The result was an average increase in weight of 14.9 per cent.

Experiment 2.—The cement in the moulds was then changed so that there would be a variation in thickness of ⅛-inch. The result was that the absorption varied correspondingly from 13.2 to 17.1 per cent. The writers then took a larger quantity of cement and compressed it into the same bulk as at first, and found that the absorption after 12 hours = 12.3 per cent.; after 24 hours = 14.4 per cent; after 48 hours = 14.8 per cent.; after 4 days = 15.1 per cent.; after 8 days = 15.4 per cent.; after 31 days = 16.8 per cent. (constant).

Conclusions from the foregoing Experiments.—(a) That when neat cement is immersed in water for 24 hours it absorbs from 14.4 to 14.9 per cent., according to the thickness of the cement;

(b) That the absorption increases to 16.8 per cent. at the end of 31 days' immersion;

(c) That no absorption takes place after 31 days' immersion.

Quantity of Water Required to be Added to Cement to Produce Complete Hardening.

According to the formula laid down by Le Châtelier,* $3CaO\ SiO_2 + water = CaO\ SiO_2\ 2\frac{1}{2}\ H_2O + 2Ca\ (Oh)_2$ 35.4 per cent. of water would be required to be added to cement for complete hardening, and the hardened cement, therefore, would contain 26.2 per cent. of water in a combined state. From the figures the writers now give, this is found to be by no means the case. Possibly the re-action is not so complete, as Le Châtelier works it out by theory, and, although more water is combined by using an excess in gauging, yet the test becomes less and the strength is impaired, for Dr. Michaelis† found that, by sealing up some very finely ground cement with 150 per cent. of water for four weeks and then drying it over sulphuric acid, a loss on ignition was shown which equalled 27.5 per cent. of water absorbed. The results of the writers' experiments are as follows:

Experiment A.—Neat-cement test pieces gauged with 20 per cent. water, after 14 days' immersion in water, gave free moisture = 11.75 per cent., combined = 9.7 per cent.,; after 28 days' immersion they gave free moisture = 12.14 per cent.; combined = 10.9 per cent.

Experiment B.—Mortar briquettes, with 3 sand to 1 cement, gauged with 10 per cent. of water, after 24 hours were immersed in water and kept there for 7, 14 and 28 days:

	Free water at 105° cent. Percentage.	Combined water. Percentage.
At 7 days	9.44	9.20
" 14 "	8.49	10.58
" 28 "	8.68	10.29

Experiment C.—Neat cement test pieces were gauged with 20 per cent. of water, and, after 24 hours under damp flannel, were immersed in fresh water for periods up to 18 months.

	Free water at 105° cent. Percentage.	Combined water. Percentage.
After 3 days	8.0	6.4
" 7 "	8.9	7.9
" 28 "	9.0	12.38
" 3 months	9.25	13.05
" 6 "	9.55	12.95
" 12 "	9.40	12.90
" 18 "	9.82	12.20

Experiment D.—Other test pieces, made of different cement, were also tried, 20 per cent. of water being used for gauging, with the following results.

	Free water. Percentage.	Combined water Percentage.
After 24 hours	8.5	3.3
" 48 "	7.45	11.5
" 72 "	7.10	7.7

Experiment E.—Frozen Test Pieces.—The cement was gauged with 20 per cent. of water, and, after 24 hours under damp flannel, was placed in cold storage at 15° Fahr. (17° of frost) for 6 days. The free water = 10.29 per cent.; combined water = 5.92 per cent. There was no active hardening of the cement.

Conclusions from the foregoing Experiments.—That from the quantity of water absorbed by cement and cement concrete the writers are unable to determine precisely its ultimate effect upon the hardening of the concrete. It depends entirely upon physical conditions, such as the porosity of the concrete. When an excess of water is added, there seems to be a loss due to evaporation during the few hours after gauging; then, although immersed in water, the percentage of uncombined water remains constant, while the percentage of combined water increases until it attains a maximum of approximately 12 per cent. This occurs also with gauged cement exposed to open air, the only difference being that the quantity of free moisture gradually diminishes, owing to evaporation. In the case of sand and cement mortar, more water is absorbed in proportion to the quantity of cement used; this, most probably, is due to the greater porosity of the mass. The same result, it will be noted, occurs in the case of cement compressed into moulds, less water being absorbed in the same period when the mass is denser in bulk; so that, in the case of fireproof floors and reinforced work, the denser the concrete, and with no more than the maximum quantity of water used to obtain a perfect gauging, the more fireproof will be the mass, and less subject to dilation through the expansion of unnecessary water. In the case of the test pieces subjected to hard frost, the process of hardening has been stayed, and, although the proportion of water used was the same as in Experiment C, yet in the same period of time 20 per cent. less of the water had gone into combination, preventing the cement from attaining its normal strength.

* Annales des Mines, 1887.

† Thonindustrie-Zeitung, 1899.

RAILWAY ORDERS.

(Continued from Page 432.)

Junction, P.Q., and the M.C.R.R. at P.C. ½ mile w. Charing Cross Station, between Lots 18 and 19, Con. 10, Raleigh, Ont.

8167 to 8171—September 23—Granting leave to the Manitoba Government Telephone System, to place its wires across the tracks of the C.N.R. and C.P.R. at various points in the Province of Manitoba.

8172—September 24—Authorizing the Corporation of the City of Toronto, Ont., to lay and thereafter maintain a section of high level intercepting sewer on the Don Esplanade, across the land and under the track of the G.T.R. in said city.

8173—September 24—Authorizing the Corporation of the town of Walkerville, Ont., to lay sewer under track of the G.T.R., Walkerville, Ont.

8174—September 25—Authorizing the C.P.R. to construct, maintain, and operate a line connecting the Pembina branch of its line with main line of the G.T.P. in the City of Winnipeg, Man.

8175—September 24—Amending Order of the Board No. 8087, dated September 15th, 1909, authorizing the Mt. McKay & Kakabeka Falls Railway to cross the track of the C.N.R. at Yonge Street, Fort William, Ont., by striking out the words " Applicant Company's " in the 3rd and 4th line of par. 3 and substitute the words " The Canadian Northern Railway Company's "; and the words " the Applicant Company's " in line 5 of said paragraph and substitute the words " the Canadian Northern Railway Company."

8176—September 24—Granting leave to the C.N.R. Company to cross with its line the tracks of the C.P.R., Wetaskiwin branch, at Camrose, Alta.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Oct. 7		STOCK QUOTATIONS TORONTO				MONTREAL			
				1909	1908	Price Oct. 7 '08	Price Sept. 30 '09	Price Oct. 7 '09	Sales Week End'd Oct. 7	Price Oct. 8 08	Price Sept. 30 '09	Price Oct. 7 '09	Sale Week End'd Oct. 7
Canadian Pacific Railway	8,920.6	$150,000	$100	$2,175 000	1,599.000	175	186¾ 186⅝	187½	1227	174	173¾	186¼ 187	186 186¾ 6772
Canadian Northern Railway	2,986.9			298 200	246,400								
*Grand Trunk Railway	3,536	226,000	100	902,777	817,362		*1st. pref. 108½, 3rd pref. 57½, ordinary 23½						
T. & N. O.	334	(Gov. Road)		35,966	19,530								
Montreal Street Railway	138.3	18,000	100	78,416	70,070					188	187	214½ 214	214⅛ 214½ 1123
Toronto Street Railway	114	8,000	100	75,515	68,657		126½ 126	124½	80	103½	101¼	126½ 126	124¼ 123⅝ 191
Winnipeg Electric	70	6,000	100			162 161	187½	187½	53		162¾	187½	187½ 187¼ 120

* G.T.R. Stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

CANADIAN RAILWAY EARNINGS FOR SEPTEMBER.

Over and over again the big railways of Canada have broken their records of gross earnings. In nine months of 1909, the Canadian Pacific has made as much as it did during the whole of 1906, while its gross earnings from January 1st to September 30th, this year, show an increase of eight and a half millions when compared with returns for the same period last year. If present conditions continue, the gross earnings of Canada's biggest road will total over eighty millions when the end of December is reached. Thirty millions were earned by this road in 1901. In 1906 the figures had increased a hundred per cent.

Perhaps there is no other country in the world that can show a record so wonderful; and the gain is practically certain to continue.

Returns for the past two months are given below:—

	Sept., 1909	Aug., 1909	Increase or Decrease
C. P. R.	$8,148,000	$7,152,000	+ $996,000
G. T. R.	3,959,004	3,789,948	+ 169,056
C. N. R.	1,076,000	807,100	+ 268,900
T. & N. O.	153,217	147,983	+ 5,234
Montreal Street	307,489	312,678	— 5,189
Toronto Street	379,581	300,887	+ 78,694
London Street	24,645	21,806	+ 2,839

In the accompanying table are given figures for September, as well as returns from January 1st to September 30th, dwith comparisons. It will be noticed that increases are general. The figures which relate to the Grand Trunk and Canadian Northern systems are encouraging, while those for the electric street railways tell a most interesting story.

Company	Sept. 1909	Sept. 1908	Increase	January 1 to Sept. 30,'09	January 1 to Sept. 30,'08	Increase
Canadian Pacific Railway	$8,148,000	$6,317,000	$1,831,000	$57,272,860	$48,781,000	$8,491,860
Grand Trunk Railway	3,959,004	3,534,830	424,174	29,480,080	28,163,784	1,316,296
Canadian Northern Railway	1,076,000	911,700	164,300	6,770,460	6,100,100	670,360
Toronto & Northern Ontario	153,217	81,684	71,533	1,082,856	597,966	484,890
Montreal Street	307,489	292,218	15,271	2,641,927	2,496,554	145,373
Toronto Street	379,581	353,695	25,886	2,729,536	2,520,874	208,662
London Street	24,645	23,377	1,267	179,109	175,165	3,943

ONTARIO ELECTRIC RAILWAYS.

From week to week we propose to give, on our page devoted to transportation interests, particulars of the equipment, mileage, and other information regarding the railways of Canada, together with a list of the officials. This series of articles commenced in our issue of October 1st.

Previously Given:—

Brantford and Hamilton Railway.
Chatham, Wallaceburg and Erie Railway.
Cornwall Street Railway.
Guelph Radial Railway.
Galt, Preston and Hespeler Railway.

LONDON STREET RAILWAY.

President, H. A. Everett.
Manager, C. B. King.
Chief Engineer, H. Welburn.
Purchasing Agent, Geo. H. Bentson, Sec.Treas.

Kind of Road: Urban Street Railway.

Length of Road:

Double track, miles, 6.79.
Single track, miles, 26.46.
Total in single miles, 33.25.

Character of Service:

Car equipment No., 34 single truck closed cars; 5 double truck closed cars; 5 double truck open cars; 4 single truck open cars.
Number of motors, 116; power of motors, approx. 40 h.p.
Method of controlling, series-parallel.
Method of braking, hand.
Gauge of tracks, 4 ft. 8½ in.
Weight of rails, 60 lbs. to 73 lbs.

Power:

Direct current, D.C.
Voltage of transmission, 550 volts.
Trolley voltage, 550 volts.
Current collecting devices, trolley.

CALGARY STREET RAILWAY.

Earnings for September.

Returns received from Calgary's municipally owned street railway are much greater than was expected by even the most optimistic. Receipts for September amounted to $10,179, and for Wednesday, September 29th, the receipts amounted to $419. At this rate Calgary will receive a very large return from its street railway.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS.

Quebec.

QUEBEC.—Tenders will be received until Friday, October 22nd, for the construction of an Ice Breaker at St. Liguori, Montcalm County, Que. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

MONTREAL.—Tenders will be received until Monday, October 18th, for a site and the erection thereon of a public bath. Asselon and Perron, architects. L. O. David, city clerk.

MONTREAL.—Tenders for heating apparatus, Postal Station "D," Point St. Charles, Montreal, will be received until Wednesday, October 20th. Mr. C. Desjardins, Clerk of Works, P.O., Montreal. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

MONTREAL.—Tenders are being called by the Saraguay Electric & Water Company for turbo-generators of 2,000 K.W. capacity. Proportionate increase of power-house boilers and other equipment will be made likewise. Charles Brandeis, consulting engineer, 4 Phillips Place.

RIMOUSKI.—Tenders will be received until Monday, October 25th, for the construction of an Armoury at Rimouski. Plans, specifications, etc., can be seen at the office of the District Engineer, Mr. A. R. Decary, Quebec. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

Ontario.

ALLISTON.—Tenders will be received up to Monday, October 18, for boring for water at Alliston. Tenderers to state separate price for each hundred feet up to 1,000 feet, and separate price to be quoted for 5-inch and 6-inch pipe. J. H. Mitchell, chairman.

BERLIN.—Tenders will be received until Thursday, October 28th, for paving King Street. A. H. Millar, town clerk; Wm. Mahlon Davis, C. E., town engineer. (Advertisement in the Canadian Engineer.)

LONDON.—Tenders will be received until Monday, October 18th, for 18-inch cast iron water mains. John M. Moore, Engineer and Superintendent Waterworks. (Advertised in the Canadian Engineer.)

OTTAWA.—Tenders will be received until noon on Tuesday, the 19th October, for timber which the Indians of Cape Croker intend to take out during the ensuing winter, and deliver on the shore of Lake Huron, at convenient points for shipment, viz.:—500,000 feet B.M., comprising maple, basswood, elm, beech, hemlock, cedar. Further information can be obtained from Mr. John McIver, Indian Agent, McIver P.O., Ont., or from J. D. McLean, Secretary. Department of Indian affairs, Ottawa.

OTTAWA.—Tenders will be received until Thursday, November 25th, for the packing of material and supplies for points along the Yukon Telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911, and 1912. Forms of tender and specification may be obtained and form of contract seen on application to Mr. J. T. Phelan, Superintendent of Government Telegraphs, Vancouver, B.C.; Mr. William Henderson, District Superintendent Government Telegraphs, Victoria, B.C.; and from the Government Telegraph Agents at Ashcroft, B.C.; Quesnelle, B.C.; Hazelton, B.C.; and Telegraph Creek, B.C. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

TORONTO.—Tenders will be received until Thursday, October 28, for turbine pumps. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Thursday, October 28, for electric motors. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until October 20th, for grading, etc., in connection with a spur line, 3,400 feet long. A. J. McGee, Secretary-Treasurer, Toronto and Northern Ontario, 25 Toronto Street, Toronto. (Advertised in the Canadian Engineer.)

LATCHFORD.—Tenders will be received until Thursday, October 28, for the construction of a Dam and Sluiceways across the Montreal River at Latchford. Plans and specifications can be seen at the office of J. G. Sing, district engineer, Confederation Life Building, Toronto, and on application to the Postmaster at Latchford. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

Manitoba.

WINNIPEG.—Tenders will shortly be invited for the new 26-foot Louise bridge which is to be erected at an estimated cost of $120,000, including additions to piers. Col. Ruttan, city engineer.

WINNIPEG.—Tenders for supply of five only 18 inch valves for the domestic waterworks system, will be received up to Wednesday, October 20th. M. Peterson, Secretary, Board of Control.

British Columbia.

VICTORIA. — Tenders will be received up to 4 p.m., Monday, 15th November, for supplying 20 tons of best blue pig lead. W. W. Northcott, purchasing agent.

VANCOUVER.—Tenders will be received until October 25th for building a large bridge over False Creek, this city. sulting engineers, Kansas City, Mo. (Details advertised in the Canadian Engineer.)

CONTRACTS AWARDED.

Quebec.

VERDUN.—This municipality awarded the following contracts last week:—Sewer pump; The Gould Pump Company, of Montreal, $2,830, the lowest tender. Two engines for electric installation, Belliss & Morcom, Birmingham, Eng., whose agents are Messrs Laurie and Lamb, Montreal, $9,500. Two 235 K.V.A., 3-phase engine type generators with direct connected exciters and complete switch-boards, the Canadian Westinghouse Company, $7,532. Mr. Charles Brandeis, of Montreal, was consulting engineer.

Ontario.

HAMILTON.—Amongst many others, the Smart-Turner Machine Company recently received the following orders:—The Fowlers Canadian Company, Hamilton, a duplex pump. The Adams Wagon Company, a duplex pump. The Temiscaming and Northern Ontario Railway, North Bay, a duplex boiler feed pump. The Burlington Canning Company, Burlington, a duplex pump.

TORONTO.—The tender of the Jenks' Dresser Company, of Sarnia, Ont., for the steel work of the new Parkdale School, $2,880, was accepted.

TORONTO.—In response to a recent invitation the City of Toronto received the following tenders for the superstructure of the Wilton Ave. bridge, whose dimensions were given on page 42 of the Canadian Engineer for September 10th: $35,809, $45,645, $48,200, $51,725, $54,500, £9,375, £13,330. The two latter were sent from Darlington, England, and Glasgow, Scotland.

TORONTO.—The following tenders were received by Mr. Frank Barber, York County Engineer, for the construction of a sewer on Parlwood Avenue:—

Canadian Contracts	$4,996.68
John Maguire	4,998.00
Excelsior Constructing & Paving Co.	4,337.00
J. H. McKnight Construction Co.	4,010.00
John F. Connolly	3,978.00

The work was let to John F. Connolly.

Manitoba.

WINNIPEG.—The Board of Control have recommended the tender of W. Beverly Robinson, of Montreal, agent for the Stanton Iron Works, Nottingham, Eng., for the supply of cast iron pipes for water mains aggregating 1,128 tons. The figures are about $39,000, being considerably lower than any of the others received.

WINNIPEG.—Among many large contracts for structural material for buildings and bridges in the Western Canadian Provinces secured during September by the Manitoba Bridge and Iron Works, Limited, of Winnipeg, are the following:—Y.M.C.A. new building at Nelson, B.C.; new brewery for Lethbridge Brewing and Malting Company, Lethbridge, Alta.; Victoria Avenue Methodist Church, Brandon, Man.; public school, Watrous, Sask.; warehouse for Gordon, Ironsides & Fares, Saskatoon, Sask.; King Edward Hotel, Fernie, B.C., ornamental iron work; Burns building, Lethbridge, ornamental iron work; warehouse, Calgary, J. McNeil, contractor; highway bridge, Indian Head, Sask.; transmission installations for forty-two elevators, (line).

Saskatchewan.

LASHBURN.—The Canadian General Electric Company have secured contract for one Chloride Accumulator of 60 E-9 cells from Canadian Fairbanks, Limited, Winnipeg, together with controlling apparatus for operating one hundred 25 Watt Tungsten Lamps for five hours.

Alberta

CALGARY.—The contract for the general work at the Calgary Power and Transmission station, has been awarded to the Walker-Fyshe Company, of Montreal. Smith, Kerry & Chace, Engineers.

British Columbia.

VANCOUVER.—The contract for 55 D-7 cells of chloride accumulator with charging and controlling apparatus has been awarded to the Canadian General Electric Company. The battery will have a momentary discharge of 120 amperes, and will be used for operating and controlling high tension switches at the power-house of the British Columbia Electric Railway.

VICTORIA.—The new road roller recently purchased from the Waterous Engine Works of Brantford, Ontario, for $3,300 arrived a few days ago, and is giving satisfaction.

RAILWAYS—STEAM AND ELECTRIC.

New Brunswick

ST. JOHN.—The accounts of the Transcontinental Railway show that there has been expended in the New Brunswick section a sum of $7,655,045.01. This was divided among the six sections of the work as shown in the table below. Returns for the work done during the month of Sept. were just completed recently. Ninety per cent. of all the ballasting to be done in the province has already been completed. The foundation has been about completed for the huge bridge at Upper Salmon River, which is to be the largest structure of its kind on the entire system, but no steel will be put up until spring.

During the month of September there was expended:

Contract No. 1	$ 91,112.92
" " 2	17,311.24
" " 3	68,050.06
" " 4	—6,879.81
" " 5	112,895.79
" " 6	69,834.84
Total	$476,084.66

Total Expenditure—

Contract No. 1	$1,376,792.66
" " 2	301,623.02
" " 3	712,154.97
" " 4	1,419,708.47
" " 5	2,103,414.02
" " 6	1,739,351.87
Total	$7,653,045.01

Ontario.

PORT ARTHUR.—That more cars are required for the street railway here is recognized by the railway board of the city council, and the question of ordering more cars in now being considered.

OTTAWA.—The Erie, London & Tillsonburg Railway Company has given notice of application to Parliament for a bill extending the time within which it may construct its authorized lines of railway. The Richelieu & Ontario Navigation Company is applying for amendments to its charter to allow an increase in capital stock, to construct terminals, and to secure the control of other similar companies..

PORT COLBORNE.—Everything has been arranged for the extension of the N. S. & T. R. trolley line from Welland to Port Colborne, and work was virtually started on October 5th. Six carloads of rails are on the way from Sydney. The contract has practically been let for the construction of a lift bridge over the feeder, and unless there is some delay at that point, the line will be completed by the first of the year.

Manitoba.

BRANDON.—The C.N.R. is to spend $10,000 improving the yards at this point, and has nearly completed the new freight sheds at a cost of $10,000.

HUDSON BAY JUNCTION.—The C.N.R. have a gang of men here erecting a large water tank, and immediately it is completed they will begin the erection of a roundhouse with stalls for eight engines; also a gang is putting in the necessary sidings for a railway yard.

WINNIPEG.—The Railway Commission in session here on Monday, October 11th, decided to order the C.N.R. to build a railway on Pembina Street. The work is to commence on November 1st, and proceed continuously.

WINNIPEG.—The Soo line will meet the new route of the C.N.R. to Duluth by a cut off via Thief River Falls, and is rushing work upon that branch. This week it was announced that ninety miles of steel will be laid this fall between Moose and Leech Lakes, Minn., and completion may be expected early next summer.

WINNIPEG.—The new main line of the C.P.R. to Northern Alberta, which will connect Winnipeg with Edmonton, will be completed this week. It will tap the C. & E. road at Wetaskiwin and is generally known as the Wetaskiwin branch. There remains but sixteen miles of steel to lay, and the last spike will be driven before Saturday night next. It will give practically another main line through to the Alberta capital via Portage la Prairie, Saskatoon and Yorkton.

WINNIPEG.—Tuesday, October 12, saw the last spike driven in the Winnipeg-Fort William section of the National Transcontinental Railway, which now stretches from Fort William to Edmonton, about 1,500 miles. The contract price, exclusive of station houses, was about thirteen million dollars. Since May 1906, when the work was started on what is known as section "F," the construction of the road has been carried out speedily. Difficulties of building the line through a rocky country, intersected by lakes and other obstacles have been surmounted in a masterful fashion. Several surveys had to be run in order to determine the best route, and parties worked their way through the wilderness both summer and winter. Then the right-of-way was cut out, after which followed the tremendous undertaking of removing the 5,000,000 to 6,000,000 cubic yards of solid rock, not to mention other material. The 244 miles of line from Winnipeg to Superior Junction was one of the most difficult sections on the whole line from coast to coast. Since the inception of the work there have been from 6,000 to 8,000 men employed continuously. The distance completed of the line to Lake Superior is 449 miles, and of this 200 miles compose the G.T.P. branch from Superior Junction to the lake. This was started in 1905, and finished in January last. Grades on the completed line are lower than those of any other line to the head of the lakes. These are four-tenth of one per cent.

for the grain haul, and five-tenths against it. Along the line are thirteen bridges, and of these eight are of steel construction.

Saskatchewan.

CARLYLE.—Steel laying on the Maryfield-Lethbridge C.N.R. is progressing favorably, and is expected to be as far as here within ten days.

LIGHT, HEAT, AND POWER

Quebec.

MONTREAL.—The Parish of Pointe aux Trembles have awarded to the Saraguay Electric & Water Company an exclusive franchise for electric light and power. The territory covers about 35 square miles on the Island of Montreal, stretching from Boute de Isle to Longue Pointe.

Ontario.

TORONTO.—A considerable amount of practical work towards deciding upon the standardisation of the equipment of the various municipalities in connection with the hydro-electric power scheme was accomplished at a conference of municipal engineers held at the City Hall, Toronto, October 13th. Mr. R. A. Ross, presided, and the municipalities represented were Stratford, Guelph, Berlin, Hepner, Woodstock, St. Mary's, London and Galt. It was decided that no motor exceeding ten horse-power should be supplied with power from lighting lines.

OWEN SOUND.—A proposition made by The Georgian Bay Power Company for the town's power supply is being considered by the council. The company offers to sell 1,500 h. p. at $20, at Eugenia Falls, where it is developed, or $24 per h. p. delivered in town.

KINGSTON.—Mr. E. B. Merrill of Toronto, Ont., has completed in a most satisfactory manner his contract here in connection with the leaky gas tank. The work was very difficult and under the first test the work showed up 200 per cent. better than the contract called for.

SEWERAGE AND WATERWORKS.

Quebec.

MONTREAL.—Dr. Henri St. George, City Bacteriologist, has completed his report in regard to the condition of the city's water, showing it to be unfit for drinking.

VERDUN.—Verdun's bill of health has been appreciably cleaner since a water filtration plant was operated by the town, and the latest official returns state that not one single case of infectious disease has been notified during the past month. This fact has been referred to the City Health Committee as an argument in support of a filtration plant for Montreal.

Ontario.

ST. THOMAS.—The construction of a new sewer on several streets and the enlargement of the 8-inch mains on other streets have been recommended by the city engineer, Mr. Jas. A. Bell.

LONDON.—The council of the Village of Exeter have adopted the report and plans prepared by Mr. F. W. Farncomb, C. E., of London, for a system of waterworks which for the present will be for fire service only. The estimated cost, including concrete dam now under construction, is $25,000. This will include a pumping plant with a capacity of half a million gallons a day, a main along Main Street, with provision for future extensions, and an elevated storage tank, 125 feet high, with sufficient capacity for two days' supply for the town. The pumping plant will be so situated that an ample supply of spring water can be collected by gravity, if required, and pumped into the mains. The present supply will be drawn from the river.

Saskatchewan.

REGINA.—The city council have decided to make a big cut in the water rates to manufacturers. Hitherto the rate charged to large consumers has been 12½ cents per thousand gallons. The proposed new rate is 6 cents.

CARLYLE.—The installation of a waterworks system at a cost of $17,500 is being considered by this municipality. J. L. White & Company, of Sioux Falls, S.D., have outlined plans.

TELEPHONY.

Quebec.

MONTREAL.—On Monday next, the C. P. R. will have in operation a telephone wire from Cartier, in Ontario, to Brandon, in Manitoba, a distance of 1,045 miles. This is the necleus of a system which will stretch from the Atlantic to the Pacific with telephones along the company's branches. For the time being this wire from Cartier to Brandon will be used for emergency purposes only, but it is possible the company will utilize it for despatching trains before long. Every station and section house between Cartier and Brandon is a telephone exchange, and, in addition, each train will be fitted with apparatus which will enable the conductor to obtain connection with the nearest town from any point along the line in the event of an accident. This system will prove invaluable in calling assistance. The company is also installing a similar wire between Swift Current and Medicine Hat, and it is expected this section will be linked up with the line now completed before the end of the year.

Saskatchewan.

REGINA.—In the latest issue of the government Gazette, notice is given of the incorporation of the Glen Ewen Rural Phone Company, Glen Ewen, Saskatchewan.

FINANCING PUBLIC WORKS.

Ontario.

BRIDGEBURG.—The ratepayers of this village passed a sewerage by-law on October 11th by a majority of twenty-nine. The plan is to provide two trunk sewers and a sub-main trunk sewer along three of the most available streets into which various other sewers can be emptied.

Quebec.

MONTREAL.—Voting on the Montreal & Southern Counties Railway by-law on Saturday, at Montreal South, resulted in the by-law being carried by an overwhelming majority. The expected opposition did not materialize. Work on the new electric line will be started at once.

CURRENT NEWS.

Quebec.

MONTREAL.—Notice is given in the Canada Gazette, for October 9th, of the incorporation of The Duckworth Boyer Engineering and Inspection Co., to inspect all kinds of material and machinery in connection with railways, bridges, piers and other structures and to act as experts generally in all matters requiring special knowledge and skill in the line of civil or any other branch of engineering. Walter Duckworth, engineer, of Lachine, Aurélien Boyer, engineer, and Stephen Newton, civil engineer, of Montreal, are interested.

MONTREAL.—A meeting of the purchasing agents of eight railway companies was held at the Place Viger Hotel last week. The gathering was entirely informal, it was stated and its object was to talk over the prices of ties, telegraph poles and other railway supplies. Among those attending the meeting were Messrs. Thomas Walklate of the Canadian Pacific and W. Cuthbert of the Grand Trunk.

Ontario.

OTTAWA.—The Board of Railway Commissioners recently left for the West. They will sit at the following places:—Prince Albert, October 18; Edmonton, October 20; Calgary, October 22; Vancouver, October 27, and Victoria, October 29. Sittings in Nelson will be arranged later.

Saskatchewan

PRINCE ALBERT.—George E. Parkinson, who has been prospecting about a year, recently discovered within the limits of the city an oil belt from which streams continually flow. G. A. Charlton, analyst, Regina, states that the sample, taken from outcroppings containing considerable water includes one per cent. of thick, brown, crude oil.

Foreign

SCRANTON, PA.—Mr. F. W. Dean, mill engineer and architect, Boston, is regularly inspecting two large pumping engines now being built at the Scranton works of the Allis-Chalmers Co. Each engine is to have a capacity of 100,000,000 gallons each 24 hours and is of the triple expansion type with three horizontal cylinders with a vertical shaft. The centrifugal pump is below the engine.

BUFFALO, N. Y.—The Pierce Arrow Motor Car Co., having sold its output for the year 1910, is using every endeavor to increase its manufacturing facilities. For this purpose it has placed with The Aberthaw Construction Co., Boston, Mass., a rush order for a storage building, 300 feet long by 60 feet wide, four stories, along with a sawtooth addition to their manufacturing building and a covered passageway connecting the storage building with the body building. The builders are under contract to deliver this building in short order and are accordingly sending a large equipment of plant to Buffalo.

PERSONAL NOTES.

MR. WILLIAM CARTER, of the Canadian Rand Co., has just returned to Toronto after a successful business trip through Western Canada.

MR. W. W. WALLACE, of Kemptville, Ont., has been appointed resident engineer on the third residency east of Toronto on the C.N.R. Toronto-Ottawa line.

MR. HERBERT W. KENT, of Vancouver, B.C., has been appointed sales agent for British Columbia, for Jens Orten-Böving & Company, hydraulic engineers, of London, England.

MR. J. S. WILLIS, of London, Ont., who has accepted the position of assistant engineer, under Mr. J. A. Bell, St. Thomas, Ontario, has taken charge of work at the sewage disposal plant.

MR. ALLAN PURVIS, superintendent of the Canadian Pacific Railway in Kootenay, has been appointed superintendent of the Chilliwack branch of the British Columbia Electric Railway.

MR. G. G. GRUNDY, general superintendent of the Temiscouata Railway, at Sherbrooke, Que., will shortly succeed Mr. D. B. Lindsay, who retires his position as general manager, retaining the office of secretary.

STEPHEN E. BASTOW of Bruce Peebles & Co., Ltd., Edinburgh, Scotland, passed through Toronto this week on his way to Vancouver, whence he will sail for Australia and South Africa. Mr. Bastow is on a business trip and reports a most satisfactory demand for the electrical machinery manufactured by his company.

MR. W. N. DIETRICH, who for several years had charge of the installation, maintenance and operation of electrical equipment and mechanical apparatus on the Canadian Pacific Railway, has opened offices at 16 St. Sacrament Street, Montreal, Que., where he will undertake any kind of electrical or mechanical work.

MR. LOUIS LAVOIE, formerly of Rimouski, and for the past few years a most efficient member of the Intercolonial staff, has been appointed purchasing agent of the Intercolonial Railway, with headquarters at Ottawa. He was for a time chief clerk in the General Superintendent's office, and later was on the personal staff of Gen. Man. Pottinger. Although only about thirty years of age, he has worked his way up through the various departments of the road, and is considered by the board of management to be the very best available man for the position.

MISCELLANEOUS.

Debentures have been sold by the following municipalities. **Preston, Ont.**—$32,000. **Brussels, Ont.**—$15,000, for telephone construction. **Hull, Que.**—$115,000, for civic improvements. **Cartierville, Que.**—$5,000.

Nova Scotia.

HALIFAX.—City Engineer Doane recently prepared a report on the possibility of an underground system for the fire alarm wires, together with an estimate of the cost of installation, which was in the neighbourhood of $900.

Ontario

OTTAWA.—Two by-laws—one for improvements to the city hall, $60,000, and one for a new incinerator—may be submitted to the ratepayers of Ottawa in November.

GUELPH.—The ratepayers will vote on a by-law to raise $25,000 for the building of a new school.

WELLAND.—The ratepayers defeated the paving by-law. The issue will come up again in January.

GALT.—The ratepayers will vote on a by-law to raise $5,000 by the issuance of 4½% waterworks debentures,

PORT ARTHUR.—The ratepayers passed the 8 by-laws for local improvements and the giving of a site to the Port Arthur Steel and Wagon Works was also sanctioned. The granting of the franchise to the gas company was voted down.

TORONTO.—A survey is being made for a new road from Elk Lake to Charlton. About 11 miles of the road from Elk Lake to Gow Ganda have been completed, and 250 men are constructing the remaining 16 miles.

Manitoba.

BRANDON—The ratepayers will vote on a by-law to raise $13,000, for the purpose of extending the Winter Fair Building.

British Columbia.

TRAIL.—A by-law authorizing the city to raise the sum of $25,000 to install a municipally-owned water system, has been passed.

REVELSTOKE.—A by-law for electric-light plant and extensions, will be submitted to the ratepayers here at an early date.

NANAIMO.—The by-laws for the waterworks loan and the Boston St. bridge carried. The sewerage by-law was defeated by four votes.

EBURNE.—The ratepayers of the municipality of Richmond, will shortly vote on a by-law to raise $275,000 for waterworks purposes.

VICTORIA.—Civic improvements of many kinds are being made by this city before the cold weather comes. Considerable new work, which includes pavements, roads, sewers, etc., involving many thousands of dollars, was ordered at a recent meeting of the council.

MARKET CONDITIONS.

Montreal, October 14th, 1909.

There is a lull in the market for foundry iron, in the United States, but in steel making iron, both Bessemer and basic, the turn-over has been very heavy and prices are still on the up-grade. Nineteen dollars, per gross ton, Valley furnaces, is now being asked for standard grades of Bessemer, for delivery in 1910, and it is reported that two or three of the principal furnace interests have withdrawn from the market entirely, holding their product at $20 for next year. A liberal tonnage, however, is being turned over at about $18.50 for prompt shipment and $19 for next year. One cargo, at least, of Middlesboro iron has now reached the Atlantic Coast, and it is reported that three or four others are under contract and are expected to arrive shortly. This will have the effect of preventing any considerable advance in foundry iron at Atlantic Coast points, unless English iron shows a further upward tendency.

English prices are somewhat easier as a result of heavy selling on the part of speculative interests. Home demand continues to improve, and stocks in quantity going into store are less than at any time during the past eighteen months. Notwithstanding this, prices have eased off about 6d. from the high point. It is felt, however, that this is a healthy condition and will probably be a starting point for an advance which will carry prices higher than previously. This is more probable in view of the fact that Continental prices, especially German, are now tending upwards and a fair enquiry is being received by makers, for export trade.

Local business continues good, both for domestic and import iron. A heavy tonnage is being turned over and some of the largest consumers are covering for their requirements for fully nine months ahead, thus evidencing their belief that the market will show a further advance during the next year. Supplies, in the case of small foundries, are comparatively light, and such users will be compelled to purchase liberally from stock to keep their works operating during the winter months.

The market for finished and semi-finished products shows almost no change, although pig-iron shows further advances in some lines, this week, as will be seen from the following list:

Antimony.—The market is steady at 8 to 8¼c.

Bar Iron and Steel.—The market promises to advance shortly. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild

steel, $1.85; sleigh shoe steel, $1.85 for 1 x ⅜-base; tire steel, $1.00 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; imported, $2.20.

Boiler Tubes.—The market is steady, quotations being as follows:—1½ and 2-inch tubes, 8¼c.; 2½-inch, 10c.; 3-inch, 11¼c.; 3½-inch, 14 1-2c.; 4-inch, 18 1-2c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—Prices are as follows:—¼-inch, $5.10; 5-16-inch, $3.95; ⅜-inch, $3.55; 7-16-inch, $3.35; ½-inch, $3.20; 9-16-inch, $3.05; ⅝-inch, $2.95; ¾-inch, $2.90; ⅞-inch, $2.85; 1-inch, $2.85.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal.

Copper.—Prices are strong at 14½ to 14¾c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5. Double strength fuses, 4-ft., $3.75; 6-ft., $4.29; 8-ft., $4.83; 10-ft., $5.37. Fuses, time, double-tape, $6 per 1,000 feet; explohmeters, fuse and circuit, $7.50 each.

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.40; Comet, $4.25; Gorbal's Best, $4.25; Apollo, 10¾ oz., $4.35. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—The outlook is strong. The following prices are for carload quantities and over, free on dock, Montreal, prompt delivery; No. 1 Summerlee, $20.50 to $21; selected Summerlee, $20 to $20.50; soft Summerlee, $19.50 to $20; Clarence, $18.25 to $18.50; Midland or Hamilton pig is quoted at $20 to $20.50 per ton for No. 1 f.o.b., cars at point of production, No. 2 being $19.50 to $20, and No. 3 $19 to $19.50 for delivery during the next six months. It is said Dominion and Scotia companies are not quoting prompt delivery. Carron No. 1, $20.50 to $21; Carron special, $20 to $20.50.

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.50 to $3.60.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carring $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X, $1.50; XX, $2.50; XXX, $3.

Nails.—Demand for nails is better, but prices are steady at $2.30 per keg for cut, and $2.25 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—$1.20 per gallon, in barrels; liquid red lead in gallon cans, $1.75 per gallon.

Pipe.—Cast Iron.—The market is unsettled and uncertain, as dealers are compelled to meet competition from all sources. Prices are easy and approximately as follows:—$31 for 6 and 8-inch pipe and larger; $32 for 5-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 24-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. (See Building Paper; Tar and Pitch; Nails, Roofing).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are steady at $2.35 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pounds. (See building paper; also roofing).

Tin.—Prices are unchanged, at 33¼ to 34c.

Zinc.—The tone is steady, at 5¾ to 6c.

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Toronto, October 14th, 1909.

The tone of the hardware and metals trade is better, and demand shows a distinct increase, shelf goods being perhaps most active. Iron pipe prices were advanced on 8th instant as per our list, both black and galvanized. This is a consequence of the advance of American prices previously. Sheets, whether galvanized or plain, are as yet unchanged, but an advance is likely, prices being below those of corresponding date in either 1907 or 1906, and makers are said to be months behind in orders.

Lumber is fairly active at steady prices, the demand being greatest from city buyers. Bricks move freely at former prices. The cement market is in a state of flux; retail dealers in Toronto are selling at $1.35 to $1.40 without bags in load lots delivered, while wholesale dealers hesitate to quote less than $1.35. Camp supplies, so far as meats and dairy produce go, are higher.

The following are wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:—

Antimony.—Demand active and price higher at $9.25 per 100 lbs.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.

Bar Iron.—$1.95 to $2, base, per 100 lbs., from stock to wholesale dealer. Market well supplied.

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¾-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $18.50 to $19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. Demand is fairly active.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick move also freely. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 60c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. The supply is excessive; hence the lowered price. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—Manufacturers' prices for Portland cement are $1.35 without bags, or $1.65 including cotton bags for car lots on board car, Fort William or Port Arthur. This has been the case since September 16th. There is a good deal moving and the likelihood felt that the merger is unlikely to boost prices beyond a living point, will probably cause the free movement to continue. Smaller dealers get $1.35 to $1.40 per barrel without bags, in load lots, delivered in town.

Coal.—Retail price for Pennsylvania hard, $6.75 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.75. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is laregly used here, quotes at from $5.25 to $5.50; Reynoldsville, $4.50 to $4.75; Connellsville, 72-hour coke, $5.25 to $5.50.

Copper Ingot.—The market continues as before stated, price being $13.85 to $14.05, and the demand normal.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1.

Dynamite, per pound, 21 to 25c., as to quantity.

Roofing Felt.—An improvement in demand of late, no change in price, which is $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. The demand is steadv.

Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet.

Galvanized Sheets.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, 3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—gauge, $4.50; 20-gauge, $4.25; per 100 lbs. Demand very active.

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ¾-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—The expected advance has come; we now quote, black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, $27.08; 4-inch, $30.76; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

Lead.—Prices steady outside. This market is steadier, and demand quiet, at $3.75 to $3.85 per 100 lbs.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car. Demand is good.

Lumber.—Prices continue steady, and city demand still active. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to 45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $20; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.60, and very few to be had.

Nails.—Wire, $2.25 base; cut, $2.70; spikes, $3 per keg of 100 lbs.

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar fairly active at $3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20 per ton. Producing plants are everywhere busy, and there is considerable business in prospect for 1910.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $2; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—An improved request is noted lately, at catalogue prices before quoted.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Pennsylvania slate 10x16 may be quoted at $7.25 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. The demand continues active; competent roofers are scarce.

Rope.—Sisal, 9½c. per lb.; pure Manila, 12½c. per lb., Base.

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Business steady; price, 73 per cent. off list at factory for car-load lots; 65 per cent. of list retail. Small lots subject to advance.

Steel Beams and Channels.—Quiet.—We quote:—$2.50 to $2.75 per 100 lbs., according to size and quantity; if cut, $2.75 to $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over; Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43.

Sheet Steel.—Market steady at the former prices; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a quantity of light sheets moving.

Tank Plate.—3-16-inch, $2.40 per 100 lbs.

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c.

Tin.—The feeling in tin is firm, and the price 32 to 33c. per lb.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each.

Zinc Spelter.—A very active movement continues, and a large business is being done. Price very firm at $5.75 to $6 per 100 lbs.

CAMP SUPPLIES.

Beans.—Hand picked, $2.50 to $2.60; prime, $2.30 to $2.40; Rangoon, hand-picked, $1.80 to $1.90.

Butter.—Dairy prints, 21 to 22c.; creamery rolls, 25 to 26c.

Canned Goods.—Peas, 77½ to $1.12½; tomatoes, 2s, 85 to 90c.; tomatoes, 3s, 95c. to $1; pumpkins, 3s, 80 to 85c.; corn, 85 to 95c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.90 to $1.95; raspberries, 2s, $1.90 to $1.95.

Cheese.—No old cheese on hand; new cheese, large, 12¾c.; twins, 13c.

Coffee.—Rio, green, 10 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, Valencia, 6 to 6¾c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 12 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 8c.

Eggs.—New laid, 25 to 26c. per dozen, in case lots.

Lard.—Scarce and higher. Tierces, 15½c.; tub, 15¾c.; pails, 16c. per lb.

Molasses.—Barbadoes, barrels, 37 to 45c.; Porto Rico, 45 to 60c.; New Orleans, 30 to 33c. for medium.

Onions.—$1.25 a bag.

Potatoes.—Best, 75c. a bag.

Pork.—Market uncertain. Short cut, $27.50 per barrel; mess, $26, nominal; no stock here.

Rice.—B grade, 3½c. per lb.; Patna, 5½ to 5¾c.; Japan, 5¼ to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75.

Smoked and Dry Salt Meats.—Long clear bacon, 15c.; firm, tons and cases; hams, large, 14 to 14½c.; small, 15½ to 16c.; rolls, 14½ to 14¾c.; breakfast bacon, 17c.; backs (plain), 18 to 19c.; backs (peameal), 18c. to 18½c.; shoulder hams, 12c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 16 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c

Sugar.—Granulated, $4.85 per 100 lbs. in barrels; Acadia, $4.75; yellow, $4.45; bags, 5c. lower; bright coffee, $4.65; bags, 5c. less.

Syrup.—Corn syrup, special bright, 3½c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

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Winnipeg, October 12th, 1909.

The volume of business in all lines of trade throughout Western Canada has increased very materially within the last few weeks. The crop movement is heavy, and money is coming back to the farmers in large quantities and consequently to the different dealers in all lines of trade.

The local market in all lines of builders' supplies, is still active, as the splendid weather that has prevailed in the West this season has enabled all contracts this season to be completed in record time, and much new work undertaken, that would not otherwise have been started. The builders and contractors have had an exceptionally good year. Prices remain steady in all the lines quoted; but there seems to be an uneasiness in the cement situation, as few of the dealers know where they are at in regard to prices. Cement conditions in the past year or two have been very unsatisfactory, and if the big mergers that have taken place will do anything to regulate the output and the prices, it will be welcomed by contractors and dealers, and also by manufacturers.

All the local iron works have had a splendid season, and have been worked to their full capacity to keep pace with the demand.

Winnipeg quotations are as follows:

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50.

Axes.—Chopping axes, per dozen, $6 to $9; double bits, $12.10 per dozen.

Barbed Wire.—4 point and 2 point, common, $3.15 per cwt.; Baker, $3.20; Waukegan, $3.30.

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch.

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 2 White Pine, 6 in., $55; cull red or white pine or spruce, $24; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6 in., $55; No. 3, $45.

Bricks.—$10, $11, $12 per M, three grades.

Building Paper.—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain, 60c.; No 2 tarred, 62½c.; plain, 56c.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $9.75 large lots to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $2 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots, special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $10 a ton.

Copper Wire.—Coopered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12, $4.20; No. 14, $4.40; No. 16, $4.70.

Copper.—Tinned, boiler, 26½c.; planished, 29¼c.; boiler and T. K. pits, plain, tinned, 45 per cent. discount.

Cement.—$2.25 to $2.50 per barrel, in cotton bags.

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 7-16-inch, $4.75; ½-inch, $4.40; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ¼-inch, $8.50; jack iron, single, per dozen yards, 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 80 to 90c. per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¼c. per lb.; 12 inches up, per lb., 4¼c.

Galvanized Iron.—Apollo, 10¾, $4.90; 28, $4.70; 26, $4.30; 22, $4.10; 24, $4.10; 20, $4; 18, $3.95; 16, $3.90; Queen's Head, 28, $4.90; 26, $4.70; 24, $4.30; 22, $4.30; 20, $4.10 per cwt.

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., Toronto.

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—2x4, 2x6, 2x8, 8 to 16 feet, $26.00; 2x20 up to 32 feet, $36.50.

Nails.—$4 to $4.25 per 100. Wire base, $2.85; cut base, $2.90.

Picks.—Clay, $5 per dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb.

Pipe.—Iron, black, per 100 feet, ¼-inch, $2.50; ⅜-inch, $2.80; ½-inch, $3.40; ¾-inch, $4.60; 1-inch, $6.60; 1¼-inch, $9; 1½-inch, $10.75; 2-inch, $14.40; galvanized, ½-inch, $4.25; ¾-inch, $5.75; 1-inch, $8.35; 1¼-inch, $11.35; 1½-inch, $13.60; 2-inch, $18.10. Lead, 6½c. per lb.

Pitch.—Pine, $6.50 per barrel; in less than barrel lots, 4c. per lb.; roofing pitch, $1 per cwt.

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Rope.—Cotton, ¼ to ½-in. and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c.; sisal, 10½c.

Spikes.—Basis as follows:—1¼ 5 and 6, $4.75; 5-16 x 5 and 6, $4.40; ⅜ x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sizes.

Steel Plates, Rolled.—3-16-in., $3.35 base; machinery, $3 base; share, $4.50 base; share crucible, $5.50; cast share steel, $7.50; toe calk, $4.50 base; tire steel, $3 abse; cast tool steel, lb., 9 to 12½c.

Staples.—Fence, $3.40 per 190 lbs.

Timber.—Rough, 8 x 2 to 14 x 16 up to 32 feet, $34; 6 x 20, 8 x 20, up to 32 feet, $38; dressed, $37.50 to $48.25.

Tool Steel.—8½ to 15c. per pound.

Wire.—Oiled and annealed, 8 and 9 gauge, $3 per cwt.; 10 gauge, $3.06; 11 gauge, $3.12; 12 and 13 aguge, $3.20; 14 to 16 gauge, $3.25 to $3.70; 10c. extra for oiling.

TENDERS CALLED FOR

TURBINE PUMPS.

EXTENSION OF TIME.

Tenders will be received by the City of Toronto, Canada, up till noon of Thursday, October 28th (changed from October 14th), for the following Turbine Pumps:—

4—	13½	million	gallon	pumps.	100	pounds pressure.
2—	5	"	"	"	300	" "
2—	10	"	"	"	65	" "
2—	10	"	"	"	110	" "
2—	6½	"	"	"	90	" "
2—	6½	"	"	"	100	" "
2—	1½	"	"	"	65	" "
2—	1½	"	"	"	110	" "

With valves, piping, bed plates, couplings, etc.

The lowest or any tender not necessarily accepted.

For specifications and form of tender apply to the City Engineer.

ELECTRIC MOTORS.

EXTENSION OF TIME.

Tenders will be received by the City of Toronto, Canada, up till noon of Thursday, October 28th (changed from October 14th), for the following Electric Motors:—

4—1500 H.P. Synchronous Motors.
2—1500 H.P. Induction Motors.
4— 500 H.P. Synchronous Motors.
4— 500 H.P. Induction Motors.
2— 225 H.P. Synchronous Motors.

With exciters, switchboards, connecting material, etc.

The lowest or any tender not necessarily accepted.

For specifications and form of tender apply to the City Engineer.

The city of Toronto, Canada, will shortly call for tenders for pole line supplies, including poles, cross-arms, pins, braces, etc., etc.

For information apply Electrical Department, City Hall.

SUPPLY OF PIPE.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 16th, 1909,** for the supply of three thousand feet of rivetted steel pipe 60 inches in diameter, and five hundred feet of rivetted tapered steel pipe, also one thousand seven hundred and eighty-two lineal feet of 60-inch reinforced concrete pipe for the outfall sewer.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the City Engineer, Toronto.

The usual conditions relating to tendering as prescribed by city by-law must be strictly complied with, or the tenders will not be entertained.

The lowest or any tender not necessarily accepted.

JOSEPH OLIVER (Mayor),
Chairman, Board of Control.

City Hall, Toronto, Oct. 1, 1909.

CITY OF VANCOUVER

Tenders for Bridge.

Bids addressed to the Mayor and Council of the City of Vancouver, British Columbia, Canada, for the building of a bridge over False Creek, in that city, between Bridge Street and Beatty Street, will be received up to 4 p.m., of October 25th, 1909.

The structure is to be about 3,375 feet long between abutments and is composed of a 264 ft. centre bearing, electrically operated, swing span, carried on concrete piers, which are to be sunk by the pneumatic process, and sixty-six deck plate girder spans varying from 35 to 80 ft. in length, and supported on steel bents resting on concrete pedestals of which sixty are to be placed on piles and fifty on earth. Approaches, each about 150 feet long, consist of concrete retaining walls and abutments with earth fill. The bridge carries two wooden sidewalks, each 6 feet wide, and a roadway 44 feet wide, paved with creosoted wood blocks on creosoted planks and ties. Two electric railway lines are at the centre of the roadway and the bridge will be lighted electrically.

Tenders will be received on the following basis:

1st.—For metal work and all other superstructure materials erected.

2nd.—For substructure complete.

Plans, specifications, and bidding papers will be on file in the City Engineer's office, at Vancouver, or may be obtained from Waddell & Harrington, Consulting Engineers, Kansas City, Missouri, by sending with request a guaranteed deposit check of twenty-five dollars ($25.00), which amount will be refunded if papers be returned in good order.

All tenders are to be sealed and marked on the outside, "Tenders for Cambie Street Bridge."

Each bidder must deposit with his tender, cash or a properly certified check for a sum equal to ten per cent (10%) of the aggregate amount of said tender, made payable to the Mayor of the City of Vancouver, as a guarantee that he will enter into contract if the work be awarded him. The city does not bind itself to accept the lowest or any tender.

Newspapers inserting this advertisement without authority, will not be paid for same.

THE LONDON WATERWORKS.

Sealed, whole or separate, tenders will be received at the waterworks office, addressed to O. Ellwood, secretary, up to 4 p.m., Monday, October 18th, for the furnishing of material and laying of eighteen-inch cast iron water mains.

Plans and specifications may be seen at the office of Moore, Henry, & Munro, Carling Block, London, Ont.

Lowest, or any tender not necessarily accepted.

WM. JONES, Chairman.
JOHN M. MOORE, Engineer and Supt.

TOWN OF BERLIN

To Contractors.

Sealed tenders addressed to the undersigned will be received up to noon, Thursday, 28th October, 1909, for the construction of a paved roadway on King Street, between Water and Scott Streets. Tenders for vitrified brick, sheet asphalt, bitulithic and asphalt block will be considered. Plans and specifications may be seen and forms of tender obtained at the office of the Town Engineer.

The lowest or any tender not necessarily accepted.

A. H. MILLAR, Town Clerk.