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The Canadian Engineer

ESTABLISHED 1893

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TORONTO, CANADA, DECEMBER 25, 1908.

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INDEX FOR 1908.

Special care has been taken with the index of the Canadian Engineer for 1908. It has been cross-indexed, and many of the articles are classed under four heads. This index should make a valuable addition to bound volumes of the Engineer for 1908. It will be ready about January 6th 1909, and will only be sent to those applying for a copy.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

On January 28th, 29th and 30th the Canadian Society of Civil Engineers will meet in Toronto. Mr. Henry Holgate says:—

"The Society is national in its character, and must set itself as a body against any local feeling or prejudice which may exist.

"Attending the meeting in Toronto will promote harmony; without a good understanding amongst its members the Society will not be as forceful as it should be.

"Harmony, co-operation success."

Mr. J. G. G. Kerry's reply next week.

ENGINEERS' CLUB, TORONTO.

The Engineers' Club, Toronto, are to be congratulated on the success of their annual gathering, and upon the large part this club has played in the life of the engineers resident in Toronto during 1908. It is not an easy matter for an executive to arrange all the meetings so that they will appeal to all the members, but they have shown excellent judgment in securing speakers who were specialists in their own field and could speak authoritatively. The variety in subjects treated was large, yet in every discussion the good of the engineering profession was always kept in mind. The political and sociological side of public questions was left to other organizations.

It is true that more than once the addresses given caused some mild excitement outside of the engineering profession, but this was not because the members of the Club attempted to interfere in foreign affairs, but because they discussed earnestly and freely the engineering side of the problems that affect the community. That is its field, and an organization which covers well and carefully its own field will soon come to its own.

That the Engineers' Club is coming to its own is manifest. From a membership of twenty in 1890 it has grown, until to-day its list includes some three hundred engineers. Of these, over seventy were added during 1908. Toronto is becoming a greater centre for engineers—this club must meet new demands. It is not well to be too visionary, but more faith in the future of this club would bring greater results.

AMERICAN BRIDGE DESIGN.

The failure of the Quebec Bridge has done a great deal to awaken a serious study of the methods of American bridge design and American bridge erection. Designed by a leading engineer and undertaken by one of the best bridge construction companies, we had a right to expect that it would represent the best design and the most ingenious methods. The failure of this exceptionally large structure forced home the conviction that too much had been taken for granted, that some of our methods were at fault, and that other structures designed along similar lines were in danger of collapse.

The Blackwell's Island Bridge over the East River at New York was at that time well on to completion, and one of the New York daily papers led in a campaign, which resulted in an investigation and subsequent report, which go to show refinement in calculations has been carried too far, and that mathematical calculations, necessary and valuable as they are, must be checked by the lessons learned by the field man.

The Blackwell Island Bridge is a double-decked cantilever structure, 3,724½ feet long. There are two river spans, the longer 1,182 feet, the shorter 984 feet; compared with the 1,800 feet river span of the Quebec Bridge it will be seen to be much less. The bridge was designed for pedestrian traffic of 75 pounds per square foot; carriage traffic, 100 pounds per square foot; trolley cars, 4,000 pounds per lineal foot, and two overhead railway tracks, 3,400 pounds per lineal foot making an estimated live load of 12,600 pounds per lineal foot. The possibility of the maximum loading occurring was considered so remote that high unite stresses were used. For the tension members 3.25 per cent. nickel steel eye-bars were used designed for stresses of 17.4 tons per square inch. Mild steel tension bars for stresses of 29.5 tons, and compression members were of extra soft steel having tensile strength of 26.8 tons per square inch.

The original estimated weight of the structure was 37,600 tons, but when four railway tracks were added, increasing the intended live load to 16,000 pounds per lineal foot, the estimate weight was increased to 47,000 tons of steel, or 12.5 tons per lineal foot. To this was added the dead load for railings, etc., of 3.26 tons, or a total dead load of 15.76 tons and a live load of 7.15 tons per lineal foot.

Now comes the report of the commission of engineers that the bridge will not carry with safety the intended load. In fact, it appears to be able for only one-third of its designed load.

So it would appear that the American method of design and American criterions of safety have again failed. To Canadians these facts are of great interest. The Canadian Government have undertaken to rebuild the Quebec Bridge. Three engineers of prominence have been selected for the work—men capable and experienced. There is this great danger, though, that the new commission may not be broad enough. It would appear that the first danger the new commission would encounter would be unanimity. It would be a great misfortune if the new design were adopted without thorough investigation. As has been shown, men working along similar lines are apt to fall into the same errors.

One of the strongest claims that can be urged for increased representation on the commission is that the new members would bring a different school of thought to bear upon the question.

TORONTO SEWAGE DISPOSAL QUESTION.

The result of the publication of a review of the recent "Royal Commission on Sewage Disposal" in this journal and of a large deputation of citizens from East Toronto complaining of the site chosen for the works has resulted in the Board of Control resolving to give the whole matter fresh and further consideration. This in spite of the fact that the plans have been completed and negotiations effected for the purchase of the land now objected to.

The plans and scheme had even been presented and received the sanction of the Provincial Board of Health.

The proposals of the corporation were, in short, to concentrate the greater part of the sewage of Toronto by means of an intercepting or trunk sewer at a point in the east end of the city called Morley Avenue, and there to pass the sewage through sedimentation tanks of the septic character, discharging the tank liquor effluent direct into Lake Ontario without any filtration or bacteriological treatment.

The objections raised by citizens in the locality were two fold. First. That the site chosen was calculated to depreciate the value of adjoining property to a large extent, and prove a nuisance to the neighborhood. Second. That the tank effluent was not being purified by filtration, and was calculated to produce a nuisance at the lake front.

In view of the recent findings of the Royal Commission, and that such findings were not available at the time when the scheme was prepared, we consider that the Board of Control have taken a wise action in this matter.

There can be little doubt, judging from the Royal Commission report, that many of the chief claims of the septic tank have not stood the test of experience, and that the tank effluent presents no special features as far as any degree of purification is concerned, other than those presented by the effluents from ordinary sedimentation tanks. Apart from this, however, there is no doubt that the amount of sludge to be eventually dealt with is diminished by the use of septic sludge treatment.

It would appear, therefore, as far as Toronto is concerned that the point at issue as far as preliminary treatment is concerned, is centred in the question of sludge disposal.

The Commission hold that the results of their extensive experiments at Exeter and elsewhere point to not more than 25 per cent. of the sludge being diminished by digestive, or septic putrefaction, and for this reason it may be advisable and economical to adopt septic treatment under certain conditions.

Just what these conditions are appear to depend on the locality of the site of the works as to the means of disposing of the sludge and any nuisance created by the disposal in the vicinity.

It appears to us that septic preliminary treatment may be usefully installed where sewage works are located at considerable distance from dwellings, but, on the other hand, that such treatment may prove a greater nuisance than the ordinary sedimentation treatment when the works are situated in crowded localities.

The handling of the sludge after removal from the tanks is a matter of considerable difficulty.

In open country the difficulty, however, almost disappears, as there is generally sufficient land on which it can be lagooned or dried without the nuisance being appreciated.

In confined localities it, however appears to be almost essential to artificially treat the sludge by some drying or pressing process before it can be successfully handled.

The Commissioners give a large amount of information as to the comparative costs of drying and so treating sludge, both from ordinary sedimentation tanks and septic tanks, and conclude that it costs just about double the amount to heat septic sludge.

These various points are certainly worthy of consideration, apart from the proposal of the corporation to allow the tank liquor to empty direct into the lake. With reference to the latter proposal, however, we feel certain that the city will give the matter further consideration in the light of the newer knowledge, that such tank liquors are really no better than crude sewage minus the major part of the grosser solids.

There is some talk of sending someone abroad to obtain full information on the subject or of obtaining information by calling in some outside expert. But we think that the Board of Control would do well to first thoroughly digest the Royal Commission's report before taking any action, as it would be impossible for any one person in a lifetime to obtain so great an amount of accumulative and unprejudiced information as is presented in the fifth report of the Commission.

GROUNDED TRANSMISSION MEDIUMS.—III.

By J. Stanley Richmond, Consulting Engineer, Toronto.

Track Drops—Comparative Simultaneous Voltages of Different Points.

It is very necessary, not only to assist in making surveys, but also to keep check on the condition of the tracks from a conductivity point of view after they have once been placed in good order, that some arrangement should be made whereby the voltages of different points of the low-voltage side of a system can be simultaneously taken at least once a month.

For this purpose, the writer once designed a rather complete set of apparatus, consisting, in the main, of one special switchboard for the telephone central office and subsidiary apparatus for each point of the system chosen as suitable to know the voltage of.

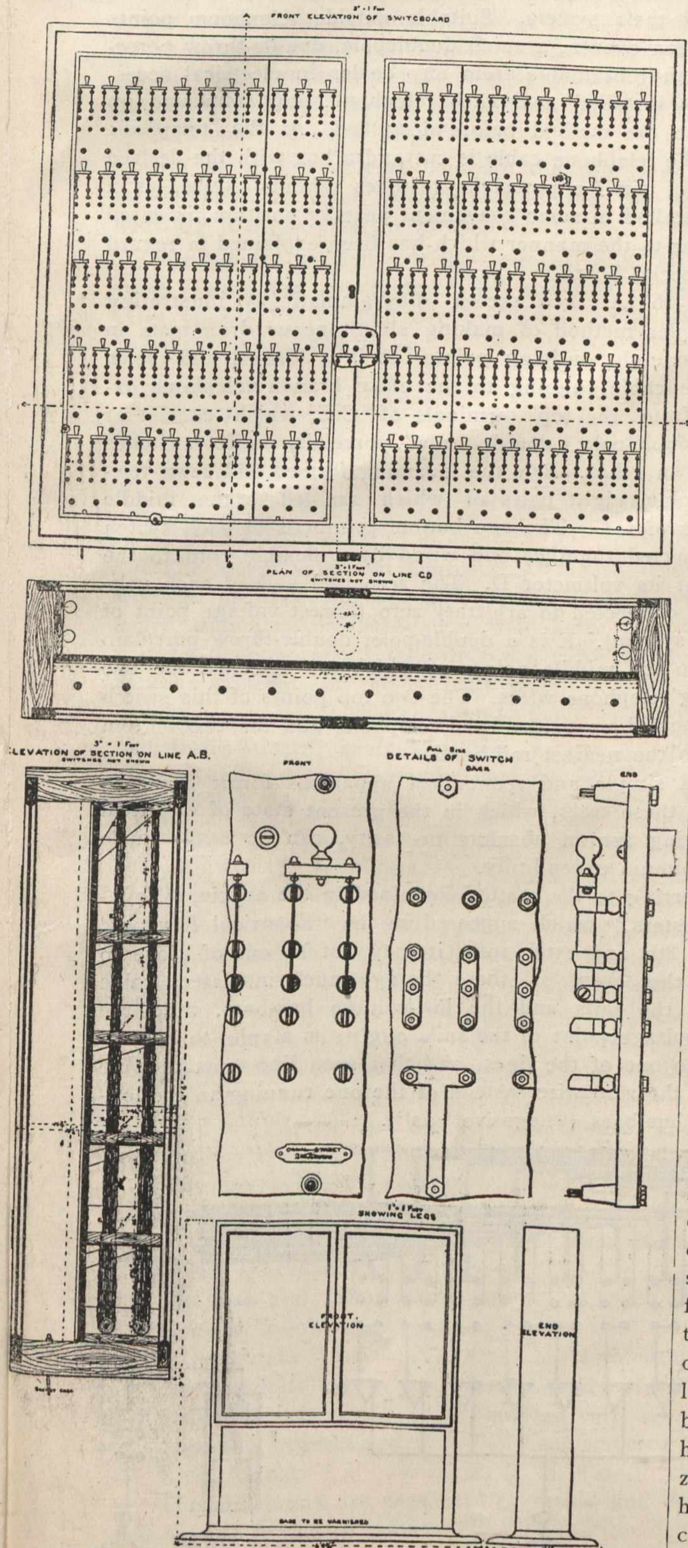


Fig. 15.—Central Switchboard Testing System.

Fig. 15 is the reproduction on a reduced scale of a drawing such special board, which consists of a substantially made frame box, with the back removable, and two glass doors so hinged in front that they can be locked in the centre. The switchboard proper is built of three sheets of hard rubber fastened down around the edges, by countersunk flat-head brass screws, to an inner-projecting portion of the frame. On these sheets are mounted five rows of twenty-four double-pole, double-throw switches with one plug below each switch. Through the bottom of the frame run twelve flexible cords, to the inner end of each of which is attached a small socket made to fit the plugs under each switch, and to the outer end of each of which is connected a suitable meter terminal. The wiring is on the back of the board (between the rubber sheets and the removable back), and consists of small rubber-covered wires, formed and stitched on the principle similar to that adopted in telephone practice. One bunch of formed wires constitutes the incoming cable and the other bunch the outgoing cable.

To connect this special board up, the required telephone wires are cut between the distributing rack and the switchboard of the telephone exchange; and the ends from the distributing rack are connected to the incoming cable of the special board, while the ends from the telephone switchboard are connected to the outgoing cable of the special board. The two wires of each pair of the incoming cable are connected to the middle points of their particular switch, to the upper points of which switch are connected the two wires of the corresponding pair in the outgoing cable. Each switch has its bottom points connected in multiple to the plug mounted below it. The details of the wiring and the other parts will be understood after examining the detail drawings in Fig. 15. Thus, when all the switches are up, the telephone wires are in regular service; while, when down, each pair of wires will be in multiple with one of the small plugs and the telephone service cut out.

Fig. 16 is a drawing showing the subsidiary apparatus. This consists of a small box, the upper part of which contains a sheet of hard rubber on which is mounted one double-pole, double-throw switch. One of these is placed alongside of each telephone located nearest to the point of the track of which a reading of the voltage is required. To connect up this subsidiary apparatus, the line wires are cut at each point near the telephone and the line ends are then connected to the middle points of the switches, the upper points of which switches are connected to the line posts of the telephones. Each box has a lower compartment lined with asbestos and divided in the centre with a piece of leatheroid (fibre); and in each of the divisions so formed is mounted a binding-post with a fuse wire between them. In practice, the writer has found that this fuse is not necessary but it is provided to allay the fears of telephone officials. The first binding-post in each box is connected by a wire or strip to the lower points of the switch, and the second one to the nearest track bond. If two connections (two points to take readings of) are required at any one of the stations, the second binding-post is connected to the middle point of a single-pole double-throw switch mounted alongside of the double-throw one, the top point of which is connected to the nearest track bond and the lower point to the other point desired. To use the apparatus which has been described, the modus operandi is as follows: Eleven below-and-above-zero-reading potential-meters (Richmond pattern) are placed on a table near to the special board, and all the zero posts connected to one of the flexible cords at the bottom of the special board. The plug on the other end of this cord is forced on to the socket below the switch, which is connected to the wires from the power-house telephone, and the switch of the subsidiary apparatus alongside this telephone has its lower points connected to the low-voltage bus-bars (negative bus) instead of to the nearest track bond. This power-house line, when the readings are being taken, becomes the zero wire. The other eleven cords, after their socket ends have been forced on the plugs belonging to the switches controlling the points at which voltage readings are desired, are connected one to each of the other binding-posts of the meters. The operator at central is then requested by the head reader to call up the twelve points (power-house first) and request them to throw their double-throw switches down, to stay by them for fifteen minutes and then throw them up again. When he has received favorable answers, he so notifies the head reader, who immediately throws down the corresponding twelve switches on the special board. Then, calling his eleven assistant readers to order and with watch in hand, he waits until the second hand reaches the minute, when in a clear, loud voice he says "Now," repeating the word every ten seconds for two or three minutes. Every time he says "Now," each assistant notes the deflection of his meter needle and jots such down consecutively on the sheet provided, which is ruled with spaced columns, ten spaces to each column. At each minute, the head reader says immediately after the word "Now" the word "Minute," by which the assistants know that the reading which they are entering must come in a space at the head of one of the columns. This, in case an assistant has skipped the entering of one reading; and so that all his readings thereby may not become valueless.

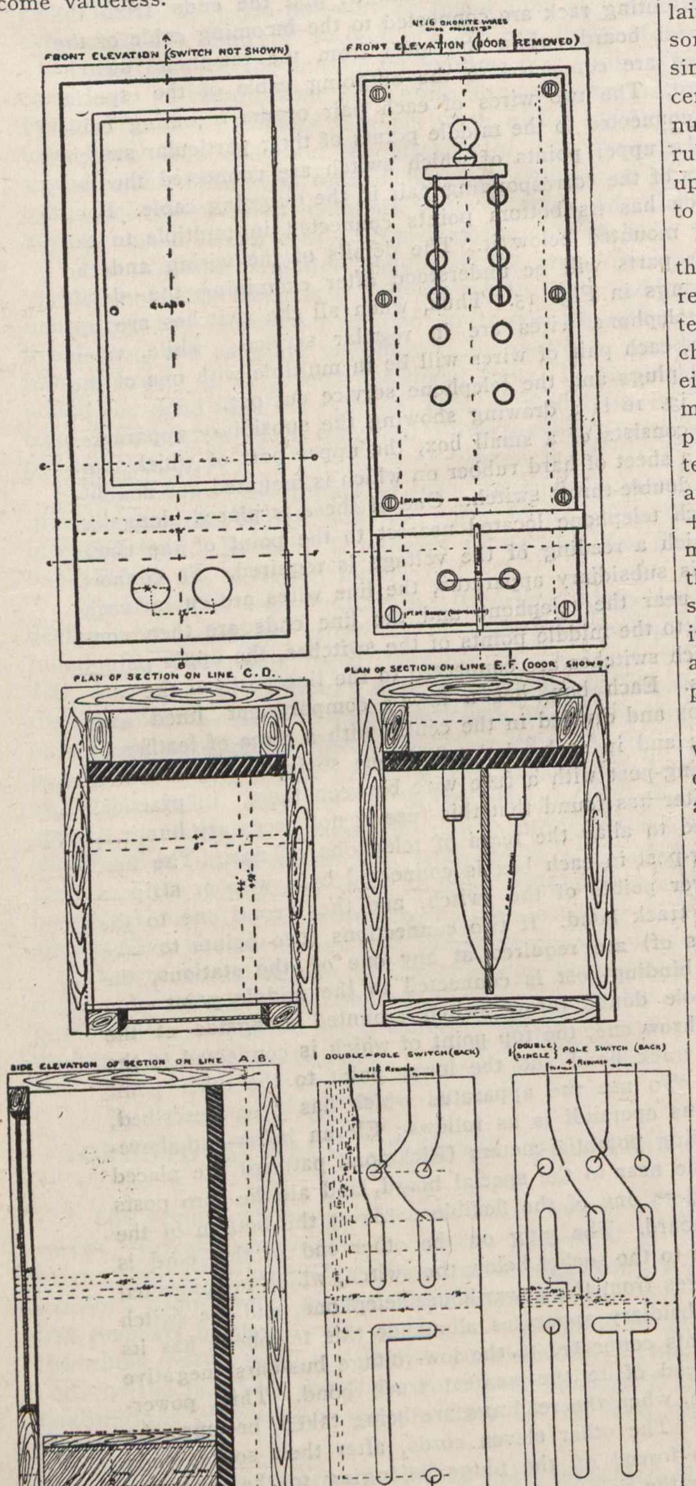


Fig. 16.—Station Switch and Fuse Boxes, Testing System.

After the readings have been all taken, the head reader immediately throws up the twelve switches on the special board and notifies the operator at central that he has finished. The operator at central, after the fifteen minutes have elapsed, takes the trouble to call up the twelve points and find out whether the attendants at these points have or have not thrown up their switches as requested. In case of any special emergency, any one of the attendants at any one of the twelve points can obtain telephonic communication while the readings are being taken by throwing up his switch. This stops the deflection of the needle of the potential meter on his line, the assistant reader in charge of which instrument immediately throws up his switch, whereby central is called in the regular manner.

This class of testing can be easily carried out by any company having a central exchange either of their own or rented from some local telephone company, provided that the instruments operated from it are located at suitable points of their system. Suitable outside telephone points having been chosen, a small doublepole, double-throw porcelain switch (obtainable from any dealer in electrical accessories) is installed near each telephone, and connected up similar to the method before described. At the telephone central the telephone cable is cut and a box with the desired number of similar porcelain switches (about twelve, as a rule), installed in some convenient near-by position, is wired up similar to the manner which has been explained in regard to the special board.

Fig. 16 (A) is a sketch diagrammatically illustrating this simpler method of making simultaneous drop tests in regard to eight outlying points. A is a formed and sewn telephone cable running to the office branch telephone exchange from the top terminals of C C, which consist of eight double-pole, double-throw porcelain knife switches mounted in a box. B is the incoming formed and sewn telephone cable, eight pairs of which are led to the middle terminals of C C. The two bottom terminals of each switch are connected together and wired by a flexible cord to the + side of its voltmeter D. The zero (—) side of each voltmeter is connected to arbitrary zero (lowest voltage point of the rail system). E is a double-pole, double-throw porcelain switch to the middle points of which are attached the two incoming telephone wires. The two top points of this switch are connected up to the local telephone and the two bottom points to the nearest rail-bond.

Such simple and economical apparatus forms a means whereby these tests, which in the present state of electrical engineering are an absolute necessity, can be easily made at a minimum expenditure.

Referring to the matter contained in the article, "Negative Boosters," which appeared in the "Electrical Review," October 8th and 15th, 1904, it may not be out of place to say, in the event of there being much insulated cable between the rails and the low-voltage bus-bars, that the lowest voltage point of the rails ought, as a rule, to be connected to one of the lines, and that such line must then be used as the zero wire instead of the one running to the low-voltage bus-bars ("negative bus").

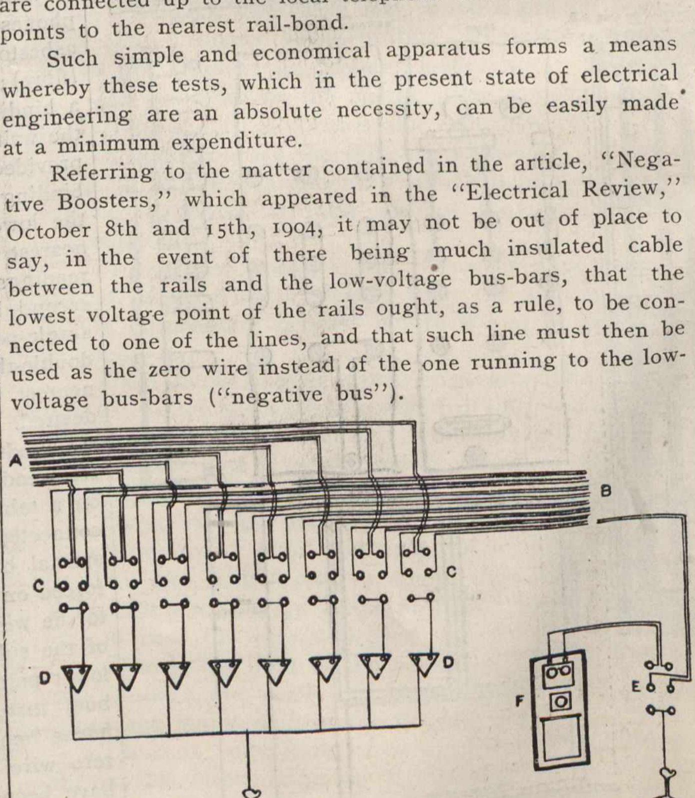


Fig. 16 (A).—Diagrammatic Illustration of Arrangement for making Eight or Less Simultaneous "Drop" Tests.

Once the apparatus is installed, tests should be made at frequent intervals, care being taken that the readings are made at similar times of the day (approximately equal load conditions) on each occasion; and if the duties connected with such are controlled by some other department than the one in charge of the bond testing the general manager will find that the information obtained from the readings serve as a very effective check on the bond-test sheets turned in.

ENGINE TESTS.*

A thesis, which consists of a written report of some technical investigation is required of each member of the senior class before graduation. In view of this fact, we decided on making a test to secure the correct data for comparison of the two types of engines.

The plant where the data were obtained gives light and power to the town of Amherst, Nova Scotia, Canada. The power house contains two tandem compound engines and a simple Corliss engine, each driving by belt two direct current generators. These engines are non-condensing and exhaust through one feed water heater.

As we wished only to compare the two large engines, we excluded the small tandem engine from the test by exhausting it directly to the atmosphere.

For brevity we will call the unit composed of the slide valve engine and generators "S" and that of the Corliss valve engine "C." The size and rating of engines "S" and "C" are as follows.—

Engine "S."	Engine "C."
Bore 14 and 22-inch.	Bore 15-inch.
Stroke 20-inch.	Stroke 24-inch.
R. P. M. 170.	R. P. M. 165.
Rated horse-power 220.	Rated horse-power 225.
Boiler pressure 120.	Boiler pressure 120.

The steam valves of engine "S" are of the sweet or straight line type balanced against the steam pressure by a heavy stationary pressure plate, held away from the valve seat by distance strips, allowing the valve to move freely between the seat and the pressure plate.

The automatic cut-off is obtained by means of the "Robb-Armstrong-Sweet" shaft governor, located in the driving wheel of the engine, so arranged that the cut-off of the valves is controlled directly by the action of the governor.

Engine "C" is fitted with the Armstrong-Corliss valve gear, constructed as follows:—

The steam valves are caused to open and close quickly and remain stationary during the remainder of the stroke by the introduction of two small links between the wrist plate and each of the bell cranks, the action being almost precisely the same as with the releasing gear ordinarily used on a Corliss engine. The steam valves are driven positively by shaft gear which controls the cut-off, in a similar manner to all shaft governed engines; the time of admission of steam is varied slightly so that the lead is negative, and the admission line lowered for light loads, and early cut-off, which probably gives higher economy of steam consumption as explained in the Transactions of A.S.M.E., vol. 18, page 1063. The exhaust valves are driven by fixed eccentrics and wrist plate geared in the ordinary way.

The size and rating of generators of units "S" and "C" are as follows:—

Generators "S."	Generators "C."
No load volts 115.	No load volts 115.
Full load volts 125.	Full load volts 125.
Full load amperes 440.	Full load amperes 600.
R. P. M. 925.	R. P. M. 850.

The generators are connected in series, and deliver current on the three wire system.

The electrical power was absorbed by a water rheostat improvised for the occasion; it consisted of the end of an old boiler drum, three feet in diameter, and five feet high. The neutral wire was connected to the shell of the drum, while the outside terminals were connected, each to a sheet of boiler plate arranged so as to slide vertically in wooden guides. Each plate was tapered to a point at the lower edge, so it was possible to draw just the current required for the various loads. The rheostat was placed out of doors, and the severe cold weather aided in keeping the water from evaporating too rapidly.

The condensers used in this test consisted of feed water heaters. Each heater is composed of a vertical cast iron shell. The exhaust steam enters one side near the bottom, passes up to the top, over a baffle plate, down and out the other side. In passing it surrounds a number of brass tubes containing in the ordinary use, feed water, but in our case, the water ran through, and to waste. We used two five hundred horse-power heaters in conjunction with the old heater, and piped them up in such a way that the condensed steam could be drained to tube placed on scales, and weighed. The final exhaust outlet of this line of condensers was left open, so the engines would be exhausting at atmospheric pressure. The switchboard instruments were then calibrated by comparing them with standard instruments borrowed from Stevens Institute.

The indicators were cleaned, tested, oiled, and lined up. The pressure plates and valves scraped true, also pistons examined, and the tandem was ready for the test.

We carried loads on the engine, commencing with full load, then three-quarters, one-half, one-quarter and zero, as near as we could approximate from the electrical readings. We found it impossible to carry an over-load on the engine as the generators were too light, and we would also run off the scale of the switchboard instruments. Each load was carried for one hour, indicator cards, and readings being taken every ten minutes. The total weight of water for each load was recorded.

In the test of the Corliss engine the same general mode of procedure was followed.

The results of these tests are shown in tabulated form on blue prints attached, which show a comparison of the efficiencies, steam consumption, and the general economical workings of the two engines.

A comparison of the two tables, shows better results for the Corliss engine. The steam consumption per hour per horse-power for engine "S" runs from 60 lbs. at zero load to 27.85 lbs. at full load, this evidently being the load for highest economy. The table of steam consumption of engine "C" shows a decrease from 44.7 lbs. per hour per horse-power for zero load to 26.1 lbs. per hour per horse-power for three-quarters load, and then a slight increase to 26.8 for quarter over load.

The efficiency of the Corliss engine in per cent. varies from 85.97 at full load to 83.72 at quarter over load and 54.6 at quarter load.

The slide valve efficiencies run from 78.6 at full load to 48.9 at one-quarter load.

We are indebted to the Canada Electric Company for the use of their plant, and also to the Robb Engineering Company, Ltd., for apparatus used and necessary help.

* A comparative test of slide valve tandem compound engine and simple Corliss valve engine, made by students of Steven's Institute of Technology, Hoboken, N.J.

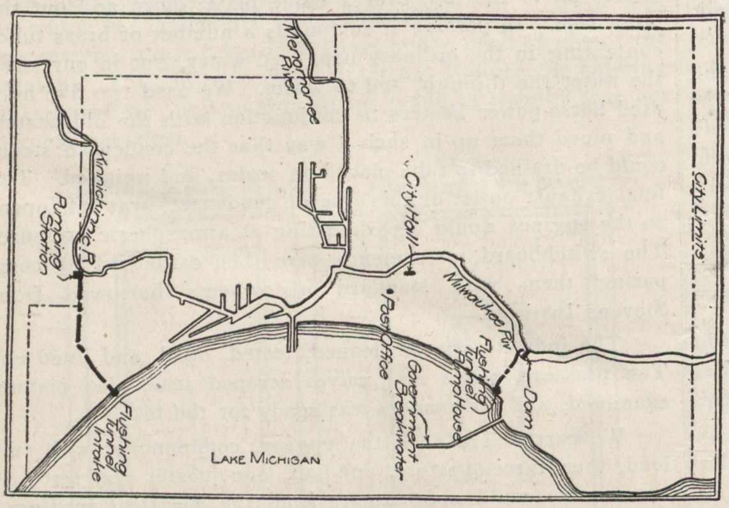
An official summary of the traffic through the Sault Ste. Marie canals during September is as follows:—

	U.S. Canal	Can. Canal	Total
Vessel passages No..	1,677	711	2,234
Registered tonnage,			
Net	3,494,588	1,456,076	4,950,664
	Net tons	Net tons	Net tons
Freight:			
East bound	3,297,969	1,807,672	5,105,641
West bound	1,032,486	315,231	1,347,717
Total freight	4,330,455	2,122,903	6,453,358

THE KINNICKINNIC PUMPING STATION.

By Frank C. Perkins.

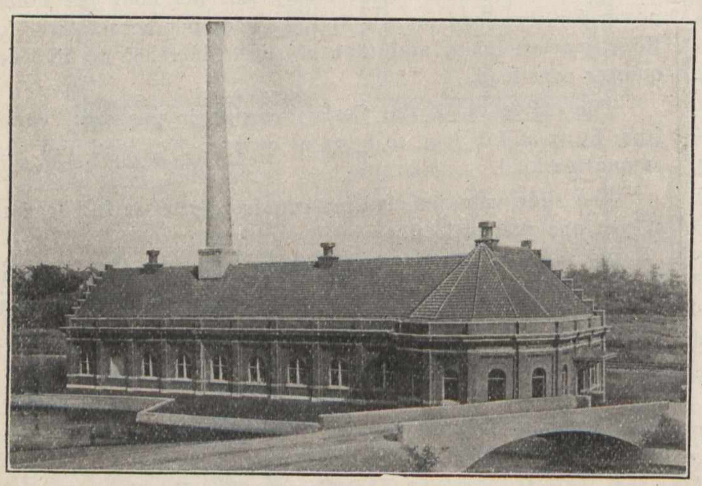
One of the most remarkable and interesting pumping engines in the world has recently been installed at the Kinnickinnic Pumping Station at Milwaukee, Wisconsin, as shown in the accompanying illustration and drawings, the photograph showing the power-house **and the cylinder and valve** gear of this wonderful engine.



It was constructed for a capacity of three hundred and twenty-three million gallons of water per day of twenty-four hours operating against a head of 3½ feet. This engine of Allis-Chalmers construction is of the tandem compound type of Reynolds-Corliss system operating a screw pump of enormous proportion.

The screw of 12½ feet in diameter has six blades mounted on a large shaft one foot in diameter. It is driven by a vertical tandem compound engine operating at a speed of 52 revolutions per minute. This Reynolds-Corliss engine has two cylinders, one measuring 18 in. in diameter receiving the high pressure steam while the low pressure cylinder arranged below and in tandem with the one just mentioned has a diameter of 38 inches, the stroke measuring 42 inches in length.

It is stated that the city and government are expected to widen the Kinnickinnic River soon, and it is held that the largest vessels on the lake can then be accommodated in the

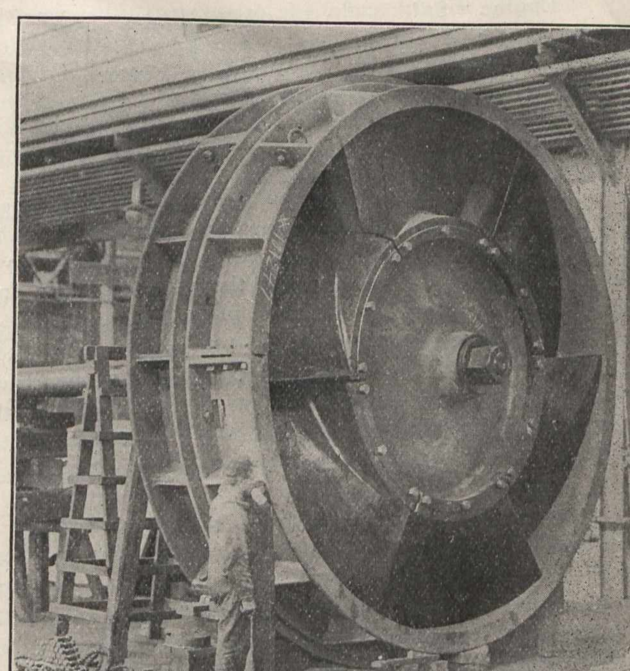


Kinnickinnic Pumping Station.

turning basin to be provided. It will be noted that the engines is of the vertical tandem-compound condensing type with Corliss liberating valve gear, and it has sufficient capacity, when supplied with steam at 140 pounds pressure and running at 55 revolutions per minute to drive the pump, so the latter will raise 30,000 cubic feet of water per minute against the head above mentioned. The air pump for the jet condenser, which is supplied with water from the tunnel, and all other auxiliaries are driven by rocker arms attached to the cross-head of the engine.

It may be stated that steam is generated in two 72-inch by 18 feet return tubular boilers equipped with Hawley down-draft furnaces and Forest superheaters. The furnaces are connected to a Costodis radial brick stack 135 feet high. The superheaters supply steam to the engine at a temperature of 100° Fahr. above that of saturated steam. The pump has a sheel made up with six impeller blades attached to a 12-inch shaft which revolves in a casing set in the tunnel lining. A cone 6 feet in diameter at the base, is placed concentric with the wheels on the side from which the water approaches the latter and directs the flow on the blades. A second casing placed just beyond the wheels contains stationary deflector blades which reduce the swirling motion given to the water by the wheel. The 12-inch shaft on which the wheel is mounted is carried by an outboard bearing in the centre of the second casing, where it is supported by the reflector blades. The pull on the shaft is taken **by the thrust** bearing of special design, of the marine type **which is placed** inside the engine pit. The shaft is 32 feet **long, extends** through a stuffing box on the side of the engine pit and is direct-connected to the crank disc of the engine.

The station is shown in the accompanying illustration and measures 34 x 165 feet in plan in the clear, the front end being made wider to accommodate the engine which drives the pump in the tunnel.



Engine Cylinder.

It is of interest to note that the intake at the lake, from which the tunnel starts, consists of two parallel, rock-filled pile piers which are 60 feet apart and extend 385 feet into the lake from the shore line, the channel between the piers having been dredged to a depth of 16 feet. As practically all heavy storms on the lake and most of the floating ice come from the north-east, the intake has been built to provide against any difficulties which may arise from this condition. The pier on the south side extends 300 feet from the shore line, an opening 75 feet wide being left between it and the end of the intake; the pier on the north side is carried 75 feet farther out, and has a section 80 feet long, at right angles to it at the end, which section is across the end of the intake channel, and protects the opening along the south side of the intake.

It is of interest to note that the corner between the end and north side piers is reinforced with a diagonal pier on the inside and is riprapped on the outside with heavy stones for a width of 32 feet along the end and for 50 feet from the corner along the side. The two parallel side piers converge at the inshore end, and in a distance of 85 feet from the shore line the space between them is reduced to a width of 12 feet. A short length of concrete conduit connects the end of the intake with the tunnel proper, the cross section of this concrete conduit being changed from square to circular from the outer to the inner end of it.

The tunnel has been built under city streets for almost its entire length. The invert of the tunnel is 16 feet below Milwaukee city datum, which is approximately the average water level in Lake Michigan at the inlet end, and 20 feet below that level at the outlet end in the river. The excavation was all carried on in tunnel, with the exception of a short length of about 450 feet where an old creek valley was crossed in open trench. The cover over the top of the tunnel varied from 5 to 80 feet. The tunneling was handled from six shafts and on the whole no difficulties were encountered while it was in progress, as the work was practically all through clay, or sandy clay, which for the most part could be shored with light timbering. Quicksand was encountered for a short stretch, however, and some trouble was occasioned in building this section of the tunnel.

It is aid that the tunnel is lined with four rings of Milwaukee sewer brick laid on Milwaukee Portland cement mortar. Manholes for entering the tunnel are provided at each end of the latter. A 12-feet cast iron sluice gate is placed in the tunnel at the inlet end. A gate of the same size and type is also placed in the tunnel on each side of the pump at the river.

The pumping station was located at the river end of the tunnel instead of at the lake end, as is the pumping station for the Milwaukee River tunnel, because a better site could be had at the river.

It may be stated that the Kinnickinnic River rises about 10 miles south-west of the central part of the city and empties into the Milwaukee River at a point half a mile north from the mouth of the stream in Lake Michigan. The mouth of the Milwaukee River is a little to the south of the central business district of the city, the river running north-westerly for nearly half a mile from its mouth, and then turning to the north, which general direction it follows to beyond the outskirts of the city. The original portion of the city, and what is now its most congested section lies between the lake and the Milwaukee River, and to the west of the latter. The area along the Kinnickinnic River, just south of the central business district, is largely covered with factories, while farther out are residence sections, which are comparatively new. The Menominne River flows east and west through the city and also joins the Milwaukee River at the point where the latter turns to the north. The land on both sides of the Menominne River is fully occupied from its junction with the Milwaukee River to the city limits, a distance of about two miles, with factories and coal and steamship docks.

In refernece to the sewerage system of Milwaukee it is on the combined plan, practically all the sewers having their outlets in one of the three rivers. All three streams have comparatively small watersheds, which are of such nature that during dry weather the flow in them is slight. The Milwaukee River has an average width of 200 feet and a depth of 20 feet for about three miles from its mouth, the Kinnickinnic River is also 200 feet wide and 20 feet deep for nearly two miles from its mouth, and its channel is being dredged to that cross-section for one-half mile farther. The large cross-section of the Milwaukee River, the small volume of water flowing in it during eight to ten months of the year and the great amount of sewage tributary to it, long ago rendered the stream very offensive for all but two or three months in the year. In order to relieve the situation, a 12-feet tunnel 2,500 feet long, was built in 1888 from an intake on the shore of Lake Michigan to the river at a point down stream from a dam which is about half a mile south of the northern limits of the city. All of the sewage above the dam is intercepted and carried below the mouth of the tunnel. A 14 feet screw pump, placed in this tunnel near the lake, gives a head of three feet to the water in the tunnel, which is sufficient to cause a large enough flow through the tunnel from the lake to flush the river. This pump is driven by a vertical tandem-compound steam engine in the pumping station near the lake. The water supplied through this flushing tunnel has kept the river in good condition at all times since it was placed in service over nineteen years ago.

When the Milwaukee River flushing tunnel and pumping station were built, the areas along the Kinnickinnic River were sparsely covered with buildings, and the old channel of the latter river had not been dredged to its present cross-section. Since then these areas have become quite congested and the river has been widened with the result that the pollution of the stream has been greatly increased and the nuisance caused by this pollution has been correspondingly aggravated, until in the last few years some means of relieving the situation became an imperative necessity. A flushing tunnel 12 feet in diameter and 7,182 feet long has accordingly been built from Lake Michigan to a point on the river, 2½ miles from the mouth of the latter. A pump similar to the one in the Milwaukee River tunnel was placed in this tunnel at the river and is driven by an Allis-Chalmers engine in a pumping station built over the outlet end of the tunnel, as described above. The river will be dredged to the standard width of 200 feet and depth of 20 feet from the lake to this pumping station, and as it is only 20 to 30 feet wide above the station no trouble from pollution in this portion of it is anticipated.

AMERICAN BRIDGE FAILURES.

An Engineering Correspondent in The London Times.

Almost within a year the two greatest cantilever bridges on the American continent have failed, namely, that over the St. Lawrence River, near Quebec, and that over the East River of New York City, two piers of which stand on Blackwell's Island. The word failure is used advisedly, for the Quebec Bridge actually collapsed as regards one completed but not fully loaded cantilever during construction, while the New York or Queenboro' Bridge has failed to pass the rigor of a recalculation of its stresses at a time when it is nearly complete, and would soon have been thrown open to the public. Failure, therefore, very properly applies, even though collapse has not supervened as at Quebec. But collapse would have occurred. Public opinion, or rather fear, was raised by the Quebec collapse. The two designs were very similar. The danger members—those subject to the indefinable stresses of compression—were of the same unsatisfactory order: mere latticed aggregations of merchant sizes impressed to serve as bridge members without the justification of experience to warrant such trust. American bridge engineers have a well-deserved reputation for their bridges, long or short. They have ever sought to fit their structures to the needs of a limited finance. But they have advanced step by step. There has always been opportunity for the development of defects or the insufficiency of design to meet the unknown effects of wind and of impact. There has always been the endeavor to make sure of every step by the testing of full-size bridge members, and the rolling mills have ever striven to enlarge their sections so that these should continue to bear a reasonable proportionality with the general dimensions of the members of which they formed a part. In order to avoid the risks incidental to large bridges Americans have clung to the suspension bridge long after it has been eliminated from the thoughts of European engineers in respect of railway bridges. The suspension bridge has the supreme virtue that the stress in its main members is very closely and positively determinate, for they are simple tension members. This type of bridge marks the fact that ordinary commercial American bridge engineering is a matter of rolling mill capacity. Great cantilever bridges can be built safely. The Forth Bridge stands as a proof of this. Its spans are but 90 feet less than the Quebec span, or about 500 feet longer than the Queenboro' spans. Its loading, however, is but a double-track railway, whereas both the other bridges were to carry railways, roads, and trolley tracks. Still, this is only a question of due provision in the design. The Forth Bridge is an example of a design that went beyond precedent, and, according to established English custom, its construction was carried out on equally exceptional and unprecedented lines. The was followed by Stephenson in the Britannia and Conway Bridges and by Brunel in those really magnificent structures at Saltash and Chepstow, structures, all of them, that would to-day, far more cheaply and with perfect safety, be built on the American system, because for spans of 400 feet the ground has been trampled hard by experience. Both at Quebec and at New York there was no consolidation of the mental approaches or of the material methods. Suspicion attaches to Quebec that, perhaps, unconsciously, paucity of funds induced undue optimism in design. But at New York this did not apply. The bridge was devised at a period of unprecedented prosperity and abundance of cash and credit. But the ingrained habit of close calculation of stresses and the apportionment of liberal stresses led to the "tuning up" of its parts to use the words of a well-known American bridge designer.

The immediate result of the Quebec disaster was a demand by the public, voiced by the "Tribune," for investigation into the design of the Blackwell Island Bridge, and a strong denial of any need for this by the Bridge Department responsible for the design. This department would have gone steadily forward and opened the bridge as designed and with full loading. It was perfectly safe, in their judgment. However, in deference to the public outcry an inquiry was accepted. Two experts were appointed, Mr. Hodge, of Boller & Hodge, and Professor W. H. Burr. The first finds that with the four trolley car lines and the roadway and footway traffic, but without the elevated railway load, the bridge can even then only be made safe by taking off 1,000 pounds of dead load per linear foot of each truss. The second expert, who, perhaps, belongs to the tuning-up school, contrives to find safety even with the elevated railway load by the very doubtful expedient of a greater headway to the trolley cars and a still greater reduction of dead load. The "Engineering News" sums up the situation as an ability safely to carry not more than a third of the intended live load, or by removing dead weight somewhat over half the intended load.

There may be thousands of people on the bridge. Can it be contended that any real safety can be secured by so precarious a thing at a minimum headway of trolley cars? This will not bear a moment's consideration.

Both experts find that the bridge is unsafe for the designed original load, yet this designed load was increased by doubling the original two elevated railway tracks and by much extra dead weight; and no provision of extra strength was made for these additions, though already the stresses were largely in excess of the original specification, itself sufficiently liberal for high-unit stresses. The bridge is 8,600 feet long, the important cantilever spans being 1,182 feet, 630 feet, and 984 feet, with anchor arms of 469.5 feet and 459 feet. There are two piers on the island, forming the 630 foot span. This total length of 3,724.5 feet alone was investigated, the approaches being normal. The original design weighed 84,300,000 pounds, of which 13,300,000 pounds were in the form of nickel steel tension bars and pins. The loading—"congested live load"—was 12,600 pounds per linear foot, made up as follows: Two elevated railways, per foot, 3,400 pounds; four trolley lines, per foot, 4,000 pounds; 35½-foot road at 100 pounds, per foot, 3,550 pounds; two 11-foot footways at 75 pounds, per foot, 1,650 pounds, making a total of 12,600 pounds. The regular live load was estimated at half this, or 6,300 pounds per linear foot. The subsequent additions brought these figures up to 16,000 pounds and 8,000 pounds, respectively. The dead load had no allowance for snow! Wind was assumed at 2,000 pounds per linear foot, one-half fixed and one-half moving. The structural steel specification was excellent. The nickel steel was to have an elastic limit of 48,000 pounds, an ultimate strength of 85,000 pounds, and an elongation in 8 inches of 1,600,000 ÷ ultimate strength, while full-size members were to show the same figures, but an elongation of 9 per cent. in 18 feet. The other steel was to show 30,000 pounds elastic limit, shapes were to show 60,000 pounds ultimate, and eye bars 66,000 pounds ultimate, with an elongation in 8 inches of 1,500,000 ÷ ultimate strength.

The congested load and dead load combined stress allowances for nickel steel were 39,000 pounds in tension and 24,000 pounds in shear of pins and 48,000 pounds on pin bearing. Structural steel was allowed 24,000 pounds in tension and $24{,}000 - 100\,\frac{l}{r}$ in compression, r being the radius of gyration and l the length.

To deal with the reports fully would require much space. It is sufficient to point out that a nominal safety is only secured by severe thinning out of the loads. This cannot be held safe, for the cut-down loading might, any holiday, be exceeded under pressure. Both reports are made to the Bridge Commissioner of the city, and are very cleverly worded so that the public will be reassured, but they can only add to the misgivings of the expert. Professor Burr practically says: "You possess a very fine ¾-inch chain fit to hold a tiger. It has only a few links so small as ½-inch, so let this reassure you." But the expert knows the value of even one ½-inch link in a ¾-inch chain, and will interpret Professor Burr exactly as Professor Burr intends the Bridge Department to interpret him, and, looking through his telescope, the tiger must only be a very fine cat.

He does not agree that the very worst combination of loading should ever produce a stress "just under the elastic limit." He would limit stress at its worst to three-fourths of this.

While it is satisfactory to find the work good, it is very disturbing to find stresses exceeding by 15, 25, and even 47 per cent. in vital members the already high specified allowance. It is unexpected, too, to find that so much dead load can be eliminated. This helps somewhat. But surplus dead load seems unusual in American practice, embodying as it does much concrete.

To any engineer who knows New York and has seen the traffic on the existing bridges the present reports will not be at all reassuring, for they do but point to a constant future risk of the worst type. Messrs. Hodge & Burr are the mildest-mannered men we have ever read, but were this great bridge in England they would have effectually "scuttled the ship," for their reports, carefully worded as they are, are absolutely condemnatory. How comes it that the stresses are so much in excess of specifications already too liberal? So far there is no answer. Evidently a repetition of the Quebec inquiry is wanted to elucidate facts, for the early recurrence of serious discrepancy between estimate and fact in weights and stresses throws a very grave doubt on the thoroughness of the methods of quantity calculation in these huge structures. And is it not time that the whole subject of latticing of bridge members was investigated? A lattice bar adds weight to a bridge. It carries no load itself; it merely helps two separate bars to help each the other's stability. A solid plate does this better, as well as itself bearing a full share of stress. Lattices add an enormous load to a bridge, and count for so much working material, thus giving a fictitious value to the dead weight of a bridge. Lattices give a light appearance to a bridge; actually they add weight which does no primary work of load sustentation.

ENGINEERING SOCIETIES.

ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.; Secretary, Alcide Chaussé, P.O. Box 259, Montreal, Que.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, J. E. Hutcheson, Ottawa; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, J. F. Demers, M.D., Levis, Que.; Secretary, F. Page Wilson, Toronto.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, J. Galbraith; Secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1908. Annual meeting at Toronto Jan. 28, 29 and 30, 1909.

QUEBEC BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, E. A. Hoare; Secretary, P. E. Parent, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—96 King Street West, Toronto. Chairman, C. H. Mitchell; Secretary, T. C. Irving, Jr., Traders Bank Building.

MANITOBA BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, J. G. Sing; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

CANADIAN ELECTRICAL ASSOCIATION.—President, N. W. Ryerson, Niagara Falls; Secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN MINING INSTITUTE.—413 Dorchester Street West, Montreal. President, W. G. Miller, Toronto; Secretary, H. Mortimer-Lamb, Montreal.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, C. T. Pulfer, London, Ont.; Secretary-Treasurer, Alfred E. Uren, 62 Church Street, Toronto.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. H. Winfield; Secretary, S. Fenn, Bedford Row, Halifax, N.S.

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, H. L. Holman; Secretary, Calvin W. Rice.

SOCIETY NOTES.

American Waterworks Association.

The twenty-ninth annual convention of the American Waterworks Association will be held at Milwaukee, Wis., June 8th to 12th, 1909. The headquarters' hotel and other local arrangements will be announced later. A good programme for this convention is already well assured, good papers being already promised. Mr. J. M. Diven, secretary, 14 George Street, Charleston, S.C.

Manitoba Branch of the Canadian Society of Civil Engineers.

The Manitoba branch of the Canadian Society of Civil Engineers recently held their first annual banquet. About fifty members of the Society were present. The banquet was held in the Royal Alexandra Hotel, and proved a great success. Prior to the banquet the annual meeting of the society and election of officers for the coming year took place. Mr. J. E. Schwitzer, of the Canadian Pacific Railway, presided at the meeting in the absence of the president of the Manitoba branch, Col. H. N. Ruttan. The annual meeting was a formal affair, no questions coming up for discussion, so that the only item of importance was the election of officers, which resulted as follows: Chairman, Col. H. N. Ruttan; Executive Committee, J. E. Schwitzer, J. A. Resketh, C. H. Dancer; auditors, H. A. Bowman, Frank Lake; secretary-treasurer, Prof. E. Brydon Jack.

At the conclusion of the banquet a number of speeches were made by the various members of the society, all of which would indicate that the Manitoba branch of Canadian Society of Civil Engineers is entering upon a successful year with greater enthusiasm than has been heretofore shown.

The toast list was as follows: "The King," "Canada," A. L. Ford; "Manitoba," C. H. Dancer; "Winnipeg," Capt. S. Frank Peters; "Sister Societies," S. Hooper and Percy Over, for the architects, George McPhilips and C. C. Chataway for the M.L.S.; "The University," Prof. R. R. Cochrane; "The Railways," M. H. McLeod, J. E. Schwitzer, S. R. Poulin and L. B. Merriman; "Power Construction Department," W. G. Chace. Among those at the banquet were: S. Hooper, president of the Architects' Association; Percy Over, secretary; Geo. McPhillips, president of the Manitoba Land Surveyors, C. C. Chataway, secretary; Prof. R. R. Cochrane, of the university; E. V. Johnson, Dominion

Colonel H. N. Ruttan, Chairman Manitoba Branch Canadian Society of Civil Engineers.

Inspector of Railways; S. Frank Peters, Prof. E. E. Brydone Jack, Charles H. Dancer, J. A. Hesketh, Frank Lee, W. L. Mackenzie, L. B. Merriman, S. R. Poulin, J. E. Schwitzer, John Woodman, M. P. Blair, H. A. Bowman, W. G. Chace, C. W. Chivers, F. Crossley, H. A. Dixon, J. A. Douglas, W. A. Duff, E. P. Featherstonhaugh, E. H. Harrison, J. C. Holden, T. C. MacNabb, A. McGillivray, C. A. Millican, H. Patterson, P. C. B. Schioler, H. H. Boyd.

American Society of Civil Engineers.

The next monthly meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building on Tuesday evening, January 12th. The paper will be by Carl G. Barth, of Philadelphia, upon "The Transmission of Power by Leather Belting," illustrated by lantern slides. It will be a comprehensive summing up of the theory and practice of belting, in which conclusions are drawn from the work of Lewis, Bancroft, Bird and others, who have made experiments upon the transmission of power by belting. Valuable charts have been prepared by the author for the solution of belting problems.

Mr. Barth's long experience in the scientific running of machine tools, in connection with the introduction of improved shop methods, has shown the need of definite data for the application of belting to machinery, and led to the development of the results contained in his paper. His data have been applied to belting in different plants for many years, giving an unusual opportunity to study the problem in great detail.

Engineers' Club, Toronto.

On December the 17th the Engineers' Club, Toronto, held their annual banquet. The attendance was large, and a very pleasant time was spent. The chair was occupied by Mr. J. G. Sing, president of the club, and the vice-chair by Mr. A. B. Barry, the president-elect for 1909.

The toast of "Our Country" was replied to by Prof. J. Mackenzie and Dean Galbraith. Mr. C. M. Canniff at this stage read a very amusing and clever paper on "India Ink."

Mr. Isham Randolph, of Chicago, was the guest of the club, and in an interesting address described some of the features of the Chicago Sanitary Canal, with the construction of which he was connected, and spoke of the developments which are looked for in the United States from the extension of waterways. It was hoped that shortly after the Panama Canal was finished it would be possible to ship from Chicago to the Gulf of Mexico, and from there to all parts of the world. An interesting fact which he mentioned in connection with the Panama Canal was that at first President Roosevelt wanted a sea-level canal. When the Commission of Engineers, of whom five were foreigners, met there were some warm discussions. The five foreigners were unanimously in favor of a sea-level canal, and with them were three American engineers. The remaining five American engineers stood out for a lock canal, and the minority report was adopted. "The work at Panama," said Mr. Randolph, "is making remarkable progress. Indeed, never in the history of the world has so much work been done within the same period."

"Our City" furnished a text for Controllers F. S. Spence and Dr. Harrison.

"Sister Institutions" was responded to by the president of the Ontario Architects, the chairman of the Toronto Branch of Civil Engineers, Mr. C. H. Mitchell, and the president of the Engineering Society, Mr. R. J. Marshall.

Society of Arts, England.

At a meeting held on December 7th, Mr. Oscar Guttmann delivered the third of his series of four Cantor lectures on "Twenty Years' Progress in Explosives."

The lecturer said that the investigation of the history of the subject showed that while the merits of making the first powder-like material from a nitro compound belonged to Hartig, and while Schultze made the first commercial powder, yet the invention of a gelatinized powder in the modern sense must be attributed to Friedrick Volkmann, although, quite independently, Reid discovered, twelve years later, a superficially gelatinized sporting powder, and Vieille, sixteen years later, a thoroughly gelatinized military powder. It would appear, therefore, that the Austrians were not only the first to experiment with gun-cotton in guns, but actually had the present-day rifle powder for years, only to crush it out of existence by their monopoly, and then to forget it. The course of industrial progress was thereby virtually put back fifteen years. Nitro-glycerine and nitro-cellulose powder was invented by Alfred Nobel in 1888, and he gave it the name of Ballistite. The British Government adopted the powder, which contained insoluble gun-cotton with nitro-glycerine and vaseline, the whole being dissolved in acetone. Ballistite was the service powder for Italy, and was much used for large guns. A conviction had grown up that, in addition to being smokeless, a powder should also be flameless, and the problem in this connection was somewhat similar to that presented by explosives in coal mines. One of the first patents in this connection was for the addition of sodium bicarbonate to the powder, a substance which had the effect of cooling the flame, by losing its water of crystallization and carbon dioxide. Other substances, like oils and soap, were employed, but the matter was not yet in a sufficiently advanced state to permit of an opinion being expressed. Various circumstances underlying the manufacture of smokeless powders combined to affect their quality. The manufacture of fulminate of mercury was performed in almost the same way as that adopted fifty years ago, but the increasing demand for ammonium nitrate safety explosives had resulted in the use of greater quantities of powerful detonators. Great progress had been made with electric detonators, the tendency being to employ low-tension fuses and magneto firing apparatus, thus greatly reducing the risk of firing the pit gases. Bickford's invention still held the field as regarded safety fuses, and it was curious that all attempts to make a safety fuse with a core of smokeless powder or some other nitro compound had so far proved unsatisfactory. The British Government had played a prominent part in the investigation of the causes of mine explosions. It had been known for a long time past that coal dust, as well as pit gas, was highly explosive, and it had been ascertained that two zones of stone dust on either side of a zone of coal dust arrested the path of a flame. In this connection he ventured to make a suggestion. It appeared to him quite feasible to utilize certain lengths of tunnel in a mine for the construction of inverted absorption towers, and in that way to permeate an air zone with fine water mist. He believed that the existence of a number of such zones would absolutely prevent the ever-present danger of transmitting an isolated explosion to the whole of a mine.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

5587—November 12—Authorizing the Toronto Electric Light Company, Limited, to erect, place, and maintain twelve underground tile conduit ducts under the tracks of the C.P.R. at Christie Street, North Toronto, Ont.

5588—November 11—Authorizing the Manitoba Government Telephones to erect, place, and maintain its wires across the tracks of the C.N.R. at 1½ miles east of Lavenham, Man.

5589 — November 11—5590—November 11 — Authorizing the Bell Telephone Co. to erect, place, and maintain its wires across the tracks of the C.P.R. at The Main Road, Megantic, P.Q., and one half mile north of Labelle, P.Q.

5591—November 11—Authorizing the C.P.R. to open for traffic that portion of its Wolseley-Reston Branch from mileage 98.2 to Wolseley, Sask., a distance of 24 miles.

5592—November 11—Approving and sanctioning of the C.N.R. location through the Townships of Gurd and Patterson, Dist., of Parry Sound, Ont. Mileage 228.75 to 242.75, west from Ottawa, Ont.

5593—November 11—Authorizing the Water Commissioners of the City of Guelph, Ont., to lay and thereafter maintain a water main under the tracks of the G.T.R. where the same crosses under the East Leg of Long "Y" at Crimea Street, Guelph, Ont.

5594—November 11—Authorizing the New Brunswick Telephone Company, Ltd., to erect, place, and maintain its wires across the tracks of the C.P.R. at Perth, N.B.

5595—November 11—Approving the revised location of the Esquimalt & Nanaimo Railway Company's Wellington-Alberni extension from mileage 125 to a point south of Old Alberni, mileage 133.21, B.C.

5596—November 11—Authorizing the G.T.P. Ry. to cross road allowances in the Province of Saskatchewan, between mileage 100.298 and 153.60.

5597—November 7—Authorizing the G.T.R. to construct, maintain, and operate a branch line, or siding, and a spur therefrom, to the premises of Hiram Walker & Sons, Walkerville, Ont.

5598—November 12—Authorizing the Edmonton Railway Company, through application of the corporation of the City of Edmonton, to cross, at level, with its lines and the necessary poles to transmit power, the lines of the G.T.P. Ry. and the C.N.R. at the intersection of First Street and Namayo Avenue, Edmonton, Alta.

5599 to 5604—November 13—Authorizing the Bell Telephone Company to erect, place, and maintain its wires across the tracks of the W. E. & L. S. R. Railway Company, at 1½ miles east of Kingsville; cor. Division and Water Streets, Kingsville; one mile east of Kingsville; two miles south of Cottam; four miles south of Windsor; and cor. Howard Avenue and Tecumseh Road, Windsor, Ont.

5605—November 14—Authorizing the C.P.R. as lessees of the Ontario & Quebec Railway to change the location of its spur to the premises of the Sherwin-Williams Paint Company, Ltd., approved by Order 4857, dated 2nd June, 1908.

5606—September 14—Ordering the G.T.P. Ry. to treat the John Arbuthnot Company, Ltd., of Winnipeg, with respect to certain property in the City of Winnipeg, owned by the applicants, included in the location of the railway company's line approved by Order No. 3507, dated the 15th August, 1907.

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.

Nova Scotia.

TENNYCAPE.—Tenders for Tennycape breakwater extension will be received at this office until 4 p.m. on Monday, January 4, 1909, for the construction of an extension to the breakwater at Tennycape, Hants County, N.S., according to a plan and specification to be seen at the offices of C. E. W. Dodwell, Esq., resident engineer, Halifax, N.S.; E. G. Millidge, Esq., resident engineer, Antigonish, N.S. Napoleon Tessier, Secretary, Department of Public Works.

Ontario.

MARKDALE.—Tenders will be received by A. Macpherson, clerk, Markdale, Ont., until December 28,1908, for the construction of the several portions of a municipal waterworks system as follows: 15,600 feet of cast-iron pipe and hauling and laying the foregoing complete. Plans and specifications may be seen at the office of C. H. Mitchell, Traders Bank Building, Toronto, or the clerk's office, Markdale. (Advertised in The Canadian Engineer.)

OAKVILLE.—Sealed tenders will be received by A. S. Chisholm, Esq., chairman Board of Water and Light Commissioners, Oakville, Ont., for the laying of approximately one thousand lineal feet of eight-inch cast-iron intake pipe in Lake Ontario at Oakville for the waterworks system. Pipe and necessary flexible joints will be furnished by the Commission; lead, etc., by the contractor. Plans and profile may be seen and form of tender obtained at the office of Willis Chipman, Esq., 103 Bay Street, Toronto, or at Oakville. (Signed), A. S. Chisholm, Chairman.

Manitoba.

PORTAGE LA PRAIRIE.—Tenders addressed to W. R. Grieve, Secretary Parks Board, Portage la Prairie, Manitoba, will be received up to noon of Monday, December 28, 1908, for the various works to be done in connection with the improvements of Crescent Lake at Portage la Prairie, Man. Plans and specifications can be seen at the office of the Secretary of the Parks Board, Portage la Prairie, Man., or at the office of Messrs. Smith, Kerry & Chace, Carnegie Library Building, Winnipeg. Dated at Portage la Prairie, December 14, 1908.

WINNIPEG.—Tenders addressed to the chairman of the Board of Control for the privilege of removing all broken glass from the city nuisance ground will be received at the office of the undersigned up to 11 a.m. on Monday, December 28, 1908. M Peterson, Secretary, Board of Control Office.

WINNIPEG.—Tenders will be received by the undersigned at their offices in the city of Winnipeg up to twelve o'clock noon on Saturday, the 26th day of December, 1908, for the following parcels, together or separately, belonging to the estate of the Portable Elevator and Excavator Co., of Winnipeg, Man.: Lot 1—One London 8-foot lathe, 18-inch swing, and equipment therewith, cost $1,000. Lot 2—One London 10-foot lathe, 30-inch swing, and equipment therewith, cost $1,250. Lot 3—One 2½ horse-power Gilson gasoline engine, cost $120; one 1½ horse-power Gilson gasoline engine, cost $65, $185. Lot 4—One lot of tools, shaftings, pulleys, etc., amounting to $250. Lot 5—One Cary safe, practically new, 33 inches high, 28 inches wide, outside; 20½ inches high, 15½ inches wide, inside; cost $125. Newton, Davidson & Cherry. Winnipeg, Dec. 15, 1908.

CONTRACTS AWARDED.

Ontario.

HAMILTON.—Samuel Cheeseman was given the contract of constructing a sewer on Breadalbane Street at 98 cents a foot and on Ardvolich Street at 75 cents a foot. E. New asked $2,500 for constructing these sewers last summer, and now the job will be done for less than $2,000.

PETERBORO'.—The contract for Section No. 7 of the Trent Valley Canal has been let, and the contractor is Mr. Randolph McDonald, of Toronto, who also has the Rosedale section. Section No. 7 extends from Rice Lake to Healy Falls, a distance of about twenty miles, and includes the construction of a dam and lock at Hastings, new guide piers at the G.T.R. bridge at the same village, and also at the Narrows at Trent Bridge, the dredging of the river from Hastings to Healy Falls to produce a 9-foot draught.

SARNIA.—The council accepted the tender of Mr. Gutteridge for a 20-pound creosote block for street paving. Contract price, $27,100.

Saskatchewan.

INDIAN HEAD.—The contract for rebuilding the Massey-Harris warehouse, which was destroyed by fire three months ago, was let yesterday to Contractor Fleming, of Moosomin. Mr. Fleming will commence work on the building next week.

LIGHT, HEAT, AND POWER.

Ontario.

STRATFORD.—Stratford has decided to put the power by-law to the people and the chances are that it will carry. "That the city solicitor be instructed to prepare a by-law to contract for 1,000 horse-power at $27.10 for submission to the ratepayers in January."

TORONTO.—The Hydro-Electric Power Commission's agreement with Toronto promises to deliver power to this city by December 19, 1909, and Mr. K. L. Aitkin, engineer in charge of the city's distribution plant, says the transmission line should be completed by that time. He says the city will be prepared to take power then.

TORONTO.—It is expected that about seventeen more municipalities in Western Ontario will vote on power by-laws at the coming municipal elections. A. F. Lobb, solicitor, for the Hydro-Electric Power Commission, stated that from what he had learned in these towns he thought the by-laws would carry in the majority of them. At present it looked as if about 5,000 horse-power would be utilized, and it was likely that the option with the McGuigan Company for an additional length of transmission line would be taken up. Many of the municipalities where the voting was to take place were using natural gas, which might be a factor in the fight for cheap power. The leading places to vote will be Windsor, Walkerville, Chatham, Kingsville, and Leamington.

RAILWAYS—STEAM AND ELECTRIC.

Nova Scotia.

AMHERST.—There is under construction at the car works a box car for the Grand Trunk Pacific. It is a sample car of the 500 which Rhodes & Curry are under contract to build for the G.T.P. during the coming year. When this contract is finished work will be commenced on the C.N.R.

cars for which Mr. Curry recently secured the contract. Good progress is being made in rebuilding the car shop which was recently burned.

SYDNEY.—Mr. N. J. McLean, of Fourchu, has commenced the survey for an electric road to East Bay.

Quebec.

MONTREAL.—The Smart-Turner Machine Co., Ltd., are installing a ten-ton electric crane in the I.C.R. shops at River du Loup, Que.

Ontario.

BROCKVILLE.—On the site of the property on William Street, where the transfer shed stood for years, and which was torn down in 1907, the C.P.R. intend to do considerable building in the spring, which the company expects will greatly facilitate the handling of its business in Brockville. The intention is to build a roundhouse and turn-table and close up the present shop in the yards north-west of the fair grounds, known to employees on the road as "the field."

FREELTON.—Mr. Malcolm McPherson, of Freelton, has been appointed by Mr. John Patterson, of Hamilton, to buy the right-of-way from Freelton to Guelph for the projected electric road, the Hamilton and Guelph Railway, of which Mr. Patterson is the promoter.

WELLAND.—Mr. Geo. H. Burgar is endeavoring to secure a franchise for an electric railway. The aim is to provide a local service from the county town to the lake front. The first part of the line will be built from the Grand Trunk to the Michigan Central, the second section from the Michigan Central to the Air Line, and the third from Air Line to Port Colborne. The aim of the company is to get the first two sections in operation early next year, and the third before the opening of 1910.

Manitoba.

WAWANESA.—The C.N.R. Co. are improving their bridges across the Souris River by building concrete piers.

Alberta.

MACLEOD.—It is believed there is a likelihood that the Macleod, Cardston and Montana Railway will be in operation by the time next season's crop is ready for shipment.

SEWERAGE AND WATERWORKS.

British Columbia.

VERNON.—The city council have decided to spend $25,000 on the B. X. Creek water supply. Reports were received from Mr. John Galt, C.E., and Messrs. Meredith & Tracy. The reports estimated the Long Lake scheme would cost $96,000, but this scheme, besides supplying water for $5,000, would furnish 300 to 500 horse-power.

VANCOUVER.—Mr. James D. Schuyler, of Los Angeles, has advised the British Columbia Electric Railway Co. to undertake at the mouth of Lake Coquitlam the construction of a dam 75 feet high. This will create a great storage reservoir, furnishing a greatly increased supply, which will flow through the hydraulic tunnel to Lake Buntzen, there being delivered to the pipes which carry it to the generating station on the North Arm of the inlet. This scheme is now being laid before the Provincial Government, whose permission is necessary for the consummation of the plan. The waterworks system of the city of New Westminster is affected by the work, but in this regard the British Columbia Electric Railway Co. has promised to thoroughly protect the source of water supply of the Royal City.

TELEPHONY.

Ontario.

PORT ARTHUR.—The city now has 1,170 telephones on their lines.

Saskatchewan.

MOOSE JAW.—A Rural Telephone Company is being organized at Postville, north-west of the city, the principal subscribers being J. A. Maharg, N. E. Harris, J. A. Sheppard, M.L.A., Hugh Yake, Arthur Rathwell, and S. K. Kathwell.

Foreign.

ST. PAUL, MINN.—It was stated at the general offices of the Great Northern Railroad that a telephone system for train despatching purposes is being installed on the Minot division, which extends from Devil's Lake to Williston, a distance of 239 miles, and that the work of installation is nearly complete. The Northern Pacific, which for some time has been despatching trains between here and Fargo by telephone, as well as blocking them in the same manner for the 250 miles, is about to put in a telephone blocking system between Trout Creek, Mont., and Spokane, a distance of 125 miles, on its Idaho division. Trains will still be despatched over this division by telegraph, however.

FINANCING OF PUBLIC WORKS.

Ontario.

WESTON.—The by-law authorizing the expenditure of $57,000 on waterworks for the village was given its first and second readings. It will now have to be advertised in the local papers and then submitted to the vote of the people.

Manitoba.

BRANDON.—By-law 885. By-law to provide for the raising by loan of credit on the City of Brandon, the sum of $25,000.00 for the purpose of repairing, renewing or rebuilding of bridges within the City of Brandon. Thirty-year bonds, at 5 per cent.

CURRENT NEWS

Ontario.

HAMILTON.—The Simpson Brick Co., of Hamilton, has been purchased by the Hamilton Brick Co., capitalized at $40,000. The gentlemen who are said to have made the purchase are Robert E. Carter and V. V. Steven, owner of the Carter-Stevens Lumber Co., Toronto. The head office of this lumber company will be transferred from Toronto to Hamilton.

TORONTO.—The Parkin Elevator Co., manufacturers of freight and passenger elevators, of Hespeler, Ont., have established a Toronto branch office at 18 Toronto Street, with Mr. J. F. Roelofson in charge. Mr. Roelofson has been connected with the firm for some time.

TORONTO.—In view of the increase in the number of rural telephone systems it is expected that a Telephone Commissioner will be appointed by the Provincial Government at the coming session. The question at present under consideration is whether such an official should be under the Department of Agriculture or the Department of Public Works. It is also suggested that an additional member may be added to the Railway Board for this purpose.

MISCELLANEOUS.

Nova Scotia.

CHARLOTTETOWN, P.E.I.—After putting down the new supply of casing recently received from the States, with the hope that it would shut off the water and enable him to go the required 2,500 feet, Contractor Stover, who is boring for coal at Earnscliffe, found after going another hundred feet that the water continued to come in as freely as ever, and this at a depth of 1,900 feet, so he suspended work and telegraphed to Ottawa for further instructions. The answer came back to move the drill a mile or so away and bore another hole.

SABLE RIVER.—The Berlin Lumber Company, operating near Sable River, Shelburne County, has completed the construction of 5½ miles of railway which taps the H. and S. W. Railway at Wilkins' Siding. The company expects to ship 10,000,000 feet of lumber next season.

New Brunswick.

ST. JOHN.—At a meeting of the Navy Island Bridge Committee held, December 1, it was decided to recommend to the Common Council the advisability of employing a competent engineer for the purpose of obtaining plans and estimates of the proposed structure.

Ontario.

BECHER.—A movement is on foot to secure a bridge on the Lambton line at Becher in place of the ferry. Mr. Neil Grant has charge of the resolutions.

BROCKVILLE.—About five thousand cubic yards of stone have been crushed with the crushing plant purchased last year at a cost of $1 per cubic yard, which has saved to the town on the price paid in 1907 ($1.80), more than sufficient to pay the cost of the plant.

KINGSTON.—The Government have approved of the good roads proposals for Frontenac County. The total expenditure will be $160,000, of which the county will pay two-thirds and the Government the remainder. The plans were placed before the officials of the department only a few weeks ago. There are 104 miles of road to be improved.

ST. THOMAS.—The Yarmouth and Malahide Councils have just completed a large breakwater at Rush Creek, near Pt. Spruce, 610 feet long, containing 205 spiles from 18 to 24 feet long, under the direction of J. A. Bell, C.E. Mr. J. H. Smale was the contractor, and R. H. Roberts, Sparta, inspector.

THOROLD.—A large number of men have arrived from the Canada Foundry Company and they will begin work immediately at the installation of steel girders at the N. S. & T. trestle, and also at the trestle near the Lincoln Paper Mills, in Merritton.

TORONTO.—The Otis-Fensom Elevator Company, whose headquarters are at Yonkers, N.Y., and who have a branch in Hamilton, want to locate in Toronto. In this connection they ask the city to sell them the freehold rights to 22 acres, of which five acres is land and the remainder water, on the east bank of the bay, south of the mouth of the Don.

WELLAND.—The Provincial National Gas and Fuel Company has paid $10,000 for a lease of 5,000 acres of marsh land south of here, and will prospect for oil and gas. They are preparing to drill a well to a depth of 3,300 feet.

WELLAND.—The Provincial National Gas and Fuel Company has paid $10,000 for a lease of 5,000 acres of marsh land south of here, and will prospect for oil and gas. They are preparing to drill a well to a depth of 3,300 feet. Strong indications of oil have been found in this district.

WINDSOR, ONT.—Following a strike by a few jackmen and the timber men the funnel contractors laid off practically the entire force of about five hundred men at No. 3 and 4 shafts last night. The men were laid off indefinitely, but it is expected that work will be resumed in a week or two. The lay-off is not considered a serious drawback, as the work on this side of the river has been pushed ahead so rapidly that only about six months more will be needed to complete it. A separate force is still working in the other shafts.

PERSONAL.

MR. E. R. JAMIESON, who for years was general superintendent of the western division of the Canadian Pacific, has been elected mayor of Calgary, Alta.

MR. J. GRANT MACGREGOR, Assoc. Mem. Can. Soc. C.E., formerly assistant chief engineer on the Guelph-Goderich Railway, has left on a three months trip to Scotland.

MR. C. B. HIBBARD, who was formerly general manager of the Quebec, Montreal & Southern Railway, has been appointed second vice-president of the Quebec Eastern Railway.

MR. W. N. RYERSON, general superintendent of the Ontario Power Company, Niagara Falls, Ont., leaves on January 2nd, 1909, to take a somewhat similar position with the Great Northern Power Company of Duluth, Minn.

MR. E. I. SIFTON has been appointed Engineer of the City of London, Ont. Mr. Sifton will commence his duties at once.

MR. THOS. TAYLOR, M.P.P. for Revelstoke, has been sworn in as Minister of Works in the McBride Government, British Columbia.

OBITUARY.

MR. R. M. PRATT, C.E., a prominent civil engineer and railway contractor, died in Toronto, Ont., December 11th, 1908. Mr. Pratt spent his life in the developing of the Canadian west. In the employ of the Canadian Pacific and Canadian Northern Railway Companies he lent his splendid abilities to the extension of the transportation facilities of the country, leaving as monuments some of the most important works in the country. With the C.P.R. he was engaged on the work of constructing the Crow's Nest Pass line in British Columbia, and with the Canadian Northern he was engaged on the work of planning and constructing their docks and coal handling plant at Port Arthur. He was also engaged on various other pieces of railroad work in the west. In addition to his work in railroad construction he was for some time the city engineer of St. John's, Newfoundland, and as consulting engineer he was frequently called on various works of importance. His last work was the building of the C.N.O.R. ore docks at Key Inlet.

AMERICAN BRIDGE IN BURMA.

Despatches received from Rangoon, Burma, state that the new Scherzer rolling lift bridge across the Ngawun River is completed and opened for railroad traffic. This, the largest bridge constructed in Burma, has a movable span 220 feet long, the total length of bridge being 320 feet. The bridge is constructed on the main line of the Burma Railway's extension connecting Rangoon with Kyngin. The Ngawun River is in the fertile delta of the Irawaddy River, and forms a connection between this river and the Bay of Bengal. The Government authorities required the large movable span to expedite the railroad traffic and the heavy traffic on the river carried on by the Irawaddy Flotilla Co.'s vessels, which traverse these waterways from the coast to the interior of Burma as far as Mandalay, more than 400 miles inland. The bridge was designed by the Scherzer Rolling Lift Bridge Co., of Chicago and New York, and manufactured in England at the works of Spencer & Co., Melksham, Wilts, and erected in Burma under the charge of the engineers of the Scherzer Rolling Lift Bridge Co. Though the difficulties to contend with were very great, the bridge was completed within a year. During the rainy season, extending from May to October, the river was subject to great floods.

ACTION OF SEA WATER ON CONCRETE.

There has been much discussion regarding the action of sea water on concrete, some claiming that there is chemical action, and others that the disintegration of the surface exposed in tide water is at least largely due to frost action.

In order to secure authentic data on the disintegration of concrete between tide levels, the Aberthaw Construction Company is about to undertake an extended series of painstaking tests on full sized specimens.

Through the permission and co-operation of the Navy Department these tests will be conducted at the Navy Yard, Charlestown, Mass., upon concrete piers made of various mixtures of concrete and of different brands of cement. These will be placed in such positions that they can be photographed at the water's edge, and so located that the base will be entirely submerged and the shaft will extend above the water.

The Government is to detail an officer to record these tests, and Mr. H. L. Sherman, Cement Chemist, of Boston, is to make most careful analysis and records of all cement, aggregate, stone and sand entering into the work. As the results of these tests will be made public they will doubtless be anxiously awaited by all who are interested in concrete construction.

The Aberthaw Construction Company will be glad to receive suggestions regarding the arrangement, the mixes, and the material to be used in the various piers, etc. It is desired to make these tests as useful as possible to the engineering community at large, for it seems possible in the course of a few years to establish by these means some general principles regarding the effect of freezing and thawing and the general action of salt water.

Since exposure tests are primarily comparison tests, their chief result will be the comparison of the different materials, mixtures, consistencies, etc., which are separately represented. It is highly desirable to include in this single series of tests, where the same external conditions affect all the samples, every promising method or procedure and every commonly used mixture or kind of concrete. On this ground it is to be hoped that a comprehensive range of suggestions will be forthcoming for the assistance of the Aberthaw Company.

RAILROAD ORDERS.

(Continued from Page 916.)

5607—November 4—Directing the C.P.R. to provide, construct and maintain a suitable highway crossing in the town of Mortlach, Sask.

5608—November 3—Granting leave to the City of Edmonton to construct, at rail level, the lines of its Electric Street Railway, and erect the necessary poles and wires for the transmission of power, across the lines of the Calgary and Edmonton Railway, at the intersection of said railway with White Avenue, in the City of Strathcona, and at the intersection of the proposed line of the Calgary and Edmonton Railway Company with Jasper Street, near Tenth Street, Edmonton.

5609—October 20—Directing the Michigan Central R. R. to provide a suitable farm crossing where the railway intersects the farm of Robert MacVicar, Township of Brook County of Lambton, Ont.

5610—September 14—Ordering the C.P.R. Ry. to treat with C. R. Muttleberry, Winnipeg, with respect to certain lands owned by the applicant in the City of Winnipeg, through which the G.T.P. Ry. is intended to pass, as to the purchase of the said property.

5611—October 20—Dismissing the complaint of Wellingington Wigle, Kingsville, against the refusal of the Pere Marquette R.R. Company to carry passengers on its way, freight, or local trains.

5612—November 4—Allowing the G.T.R. to leave out the filling and packing mentioned in Section 230 of the Railway Act, 1903, from the month of December to the month of April in each year, both months included.

5613—October 20—Dismissing complaint of Wellington Wigle, Kingsville, Ont., that the W.E. & L.S.R. Ry. is charging excessive rates for passenger traffic, in violation of the provisions of the Railway Act.

5614—October 22—Authorizing the C.P.R. to cross road allowances on its Stoughton Weyburn branch, in the Province of Saskatchewan, between mileage 0 and 36.

5615—September 14—Authorizing the Grand Trunk Pacific Railway Company to construct its railway over level crossings in the municipality of Miniota, Man.

5616—October 6—Authorizing the G.T.P. Ry. to cross road allowances on its main line, grade diversion, on the Medicine Hat section, between Kincorth and Walsh, Alta., between mileage 102.11 ond 110.56.

5617—October 28—Directing the Ottawa Electric Railway Company do not allow passengers to stand on the front platforms of cars.

That motormen be forbidden to engage in conversation with passengers or others, while cars are in motion.

That a printed notice to this effect be posted in a conspicuous place inside every car.

That the distance between cars on the Britannia line be not less than 1,000 feet while descending grades.

That cars carrying passengers shall always have both a motorman and conductor upon them while in operation.

The steel rail production of the United States for the current year will be the smallest in years past, being estimated at 1,800,000 tons, against 3,633,654 in 1907.

MARKET CONDITIONS.

Montreal, December 23rd, 1908.

The metal markets are exceedingly slow in the United States, and a recovery is not looked for for weeks to come. Meantime, however, prices of pig-iron are well maintained in a general way, although it is probable that in a number of instances lower prices were accepted. The prospects are that business will pick up and prices improve very shortly. As a matter of fact, selling interests in the United States to-day, will not book for many months ahead at current prices, but are asking advances for future deliveries. The general situation seems to be that present prices would be accepted for first quarter, while for second quarter an advance of 50 cents would be asked, and for second half delivery, an advance of $1 over present figures would be demanded. There is but little going on at the moment, however.

Mail advices from England are not very encouraging, some of them quoting the market at a decline. Some pessimistic letters arrived at the same time as cables which quoted an advance in the price of warrants of a shilling per ton. It is not thought that there will be much change, now, until after the first of the year. This year, owing to the dullness of trade, it is thought that the holidays will be prolonged later than usual.

The local market is very dull. The active trade reported has entirely disappeared and has been replaced by lethargy. Merchants, however, have been expecting this and do not regard it as of much significance. Under the circumstances, no changes in price are noted, everything on the list remaining practically the same as a week ago, as follows:—

Antimony.—The market is steady at 9 to 9½.

Bar Iron and Steel.—Prices are steady all round, and trade is quiet. Bar iron, $1.[illegible] per 100 pounds; best refined horseshoe, $2.15; forged