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The Canadian Engineer

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THE CIVIL ENGINEER'S PLACE IN COUNTY BRIDGE WORK.

In his annual report on Highway Improvements, Mr. W. A. McLean, C.E., Provincial Engineer of Highways, devotes some space to discussing the place the civil engineer should hold in reference to county bridge construction. Mr. McLean's remarks are particularly well chosen, and we look forward to their being extensively quoted in the agricultural papers of Canada, for they bring home, very pointedly, a number of truths that councils, at times, forget when, in addition to their legislative duties, they constitute themselves engineering experts for their municipality.

The average council should look with suspicion upon the publication which purposes to enable him to draw plans and specifications for bridges. Bridge building is strictly within the sphere of the civil engineer, and municipalities that disregard this fact not only add to the first cost of their structures, but usually secure bridges that are much inferior to those contracted for. The experienced farmer looks with amusement, and sometimes contempt, upon attempts at farming made by the remittance man or the provincial man from the city who wishes to take up farming as a hobby. The merchant gives one to clearly understand that he is very sympathetic for the farmer who attempts store-keeping. Councillors who will give the matter any consideration will realize that their own well-meant attempts to build steel and concrete bridges without trained advice usually make mistakes as disastrous as those of the inexperienced farmer in agricultural proceedings.

When a bridge is required in a municipality, even where they have a successful county engineer, unless he be a man experienced in bridge construction, he will usually find it to his advantage and to the advantage of his clients to employ a consulting engineer of experience in that particular kind of work.

In this connection it may be noted that the allowing of the companies submitting tenders to prepare their own strain-sheets and specifications is not by any means a wise proceeding. The corporations requiring the structure must pay for this work. Then why not have it entirely under their own control? If the bridge company prepares the strain-sheets, plans and specifications, they simply add the cost of this work to their tender for the bridge, and if the corporation have it prepared, it is included in the engineer's fee. When the engineer prepares his own plans and specifications the bids are more uniform, and the engineer is in a better position to decide upon the most favorable tender.

Mr. McLean makes one statement which is worth very special attention: "The services of a capable engineer will only double the length of a bridge, as compared with the contract that is let without proper provision."

In addition to mathematical training and experience in the designing office, a bridge engineer to be successful must be a man of practical judgment and experience, and the public should not expect their councils to be bridge engineers.

Even after the contract is awarded, councils possessed of good judgment will retain competent engineers to see that the plans and specifications are adhered to and that the work is carried on in the proper manner.

STEEL PIPE LINES FOR WATER MAINS.

Custom has prescribed that water mains shall be cast-iron pipe. At a recent meeting of the New England Waterworks Association, Mr. Emil Cuichling, consulting engineer of New York city, read a very complete paper on the use of steel pipe for water mains.

In the course of his paper Mr. Cuichling gave an extensive review of the history and practice of steel pipe line construction. His own experience in connection with the Rochester pipe lines, both wrought iron and steel, furnished the text for a considerable portion of his discussion. Considering corrosion, it was pointed out that wrought iron was evidently the superior pipe, it being mentioned that in thirty-five years the wrought iron pipe lines of Rochester had given little or no trouble.

The discussion which followed brought out very clearly that the corrosion of steel pipe recently placed was due to the fact that it is impossible to get coatings that would adhere to steel surface.

The general feeling appeared to be that for pipes of 36 inches or larger, steel was just as economical as cast-iron, the difference in the first cost more than covering the repair charges.

THE CANADIAN MUNICIPALITY IN ITS CONTACT WITH AN AMERICAN ENGINEERING FIRM.

American capitalists and American trade houses are looking to Canada for opportunities. The Canadians are welcoming their Anglo-Saxon brothers from the South who purpose making Canada their future home and field for further development. Many things Canadians have learned from the Americans, because their larger population has required their professional men to deal first with problems that in later years have become Canadian problems. In engineering matters Americans have frequently been consulted, and more so in the West than in the East.

Just now the city of Vancouver is considering the advisability of entering into a five years' contract with a firm of American consulting engineers in connection with certain engineering matters that require handling in the near future.

The financier behind each scheme has a perfect right to select from where he chooses his engineering staff, so has the municipality, but we do think there are strong sentimental reasons why the Canadian municipality should employ British subjects in connection with its public works.

The British subject cannot be a stenographer in the office of the corporation in the United States. It is true a Canadian who goes to the United States and becomes a part of the commonwealth receives every encouragement and has many opportunities. The same applies to Americans coming to Canada, but a municipal corporation in the United States would not think of using a Canadian consulting firm for municipal work, nor should the Canadian corporation think of using an American consulting firm for corporation work when there is in Canada a number of engineers of equal standing who could give equally good advice in the matters being considered.

INAUGURATION OF NIAGARA POWER.

The harnessing of Niagara has been the dream of the last half century. Four electrical companies are now generating power along the Gorge, but Ontario and Canada are more particularly interested in the municipal-owned, government-controlled distribution system which has been designed to deliver at cost Niagara power to Ontario municipalities.

This is the first large public ownership scheme—outside of railways—that has been attempted in Ontario. On October 11th, 12th and 13th inaugural demonstrations will be held at Berlin, Ont., in which the Premier of the Province and the Hon. Adam Beck, together with members of the Hydro-Electric Power Commission, will take part.

This will be an eventful occasion for the thirty-five municipalities that are interested in this great undertaking, and it is expected that representatives from a large number of Ontario municipalities, together with press and commercial men, will meet at Berlin the second week in October.

REGISTRATION IN THE DEPARTMENT OF APPLIED SCIENCE.

It would appear from the registration figures recently given out by Registrar Lang, of the Faculty of Engineering in Applied Science, University of Toronto, that the interest in engineering is not by any means dying out. The figures for 1909 and 1910 are as follows:—

	1910.	1909.
First year	167	125
Second year	129	166
Third year	139	138
Fourth year	65	54
	<hr/>	<hr/>
	500	483

This shows an increase up to the present of 17.

EDITORIAL NOTE.

In the September proceedings of the American Society of Civil Engineers, Mr. T. Kennard Thompson, M. Am. Soc. C.E., has a brief and remarkably interesting paper on "Rust," as shown in the removal of a seventeen-storey building. Elsewhere in this issue we publish a paper in full.

SHERBROOKE POWER PLANT.

C. B. Woodyatt.

Sherbrooke is the third largest city in the Province of Quebec, and is the commercial centre of the Eastern Townships. It has exceptionally good railway facilities, as it is on the main line of the Grand Trunk Railway; is a divisional point on the Canadian Pacific Railway, the Canadian terminus of the Boston and Maine system, and the headquarters of the Quebec Central Railway Company.

It is the distributing centre for the now rapidly developing asbestos district to the north, the rich farming land of the Eastern Townships to the south and west, and the vast pulp limits to the north and east. Since the development of the mineral and timber resources of the district on a truly large scale, the population of Sherbrooke has increased very rapidly, and this fact is made very plainly evident by the opening of many new streets, and the great activity in the building trades. Situated about two miles to the south of the city is the beautiful residential town of Lennoxville, which is given ready access to the city by a line of the street railway, on which a very up-to-date service is main-

Magog River between the municipal plant and the St. Francis River, giving a total available head of 63 feet, by which a minimum of 4,000 h.p. can be developed. By means of dams between the lake and the gorge the water in the lake can be held back during the flood period, thus providing a magnificent storage, by means of which a practically constant flow can be maintained the year around.

Sherbrooke is to the Province of Quebec what Hamilton is to Ontario, and it has long been felt that the one thing needed to make it a most important manufacturing centre was a plentiful supply of cheap power.

It was with this end in view that the Sherbrooke Railway & Power Company was incorporated. Development was commenced early this summer.

The Development.

The new development combines the two old developments below the municipal plant, and the two old dams will be discarded. A new concrete dam will be erected at the upper level, and the water carried by a large steel penstock to the new power house 650 feet below, thus obtaining a working head of 63 feet of the 4,000 h.p. thus developed.



Site on Magog River, showing Foundation Work of New Power Development Being Erected By Sherbrooke Railway and Power Company.

tained. Lennoxville also has the railway facilities afforded by the four roads mentioned above, and of late years several large industrial concerns have located there. The joint population of the two communities thus served by the Sherbrooke Railway & Power Company is now over twenty thousand.

The Magog River draining Lake Memphremagog, a body of water thirty miles long, enters a deep and narrow gorge just above the city, and flows through the centre of the city, emptying into the St. Francis within the city limits. There is a municipal hydro-electric plant in the gorge supplying the city with a most efficient lighting service. After passing through the city's plant, the waters of the Magog were again utilized at two lower developments to operate the old plant of the Sherbrooke Street Railway, and several industrial concerns situated on its banks.

The new Sherbrooke Railway & Power Company, incorporated in 1910, took over the system of the Sherbrooke Street Railway, and acquired the water power rights on the

About 800 h.p. will be required to operate the street railway with its contemplated extensions, and the remaining 3,000 h.p. will be available for industrial purposes.

The power house and dam are now being constructed by the Bishop Construction Company of Montreal, under the supervision of Messrs. Ross & Holgate, consulting engineers, who have had entire charge of the engineering of the new company since its inception. The whole plant will be in commercial operation by November 1st, 1910.

The Dam.

The new dam is some 300 feet long, and will be built across the rock gorge. The conditions are very favorable as in the centre of the river at this point is a large island of solid rock. The dam is built entirely of concrete. About 2,500 cubic yards of concrete will be utilized in its construction. It will be built in three sections, a large spillway section in the centre, and bulkhead and stop log sections on the sides. A large steel plate thimble 13 feet in diameter will be let into the bulkhead section to convey the water into the penstock.

Penstock.

The penstock is of steel plate 9 feet 6 inches in diameter, carrying the water from the thimble in the dam, down stream 650 feet to the distributing section in the power house. The penstock is carried on reinforced concrete columns of varying heights spaced 16 feet apart, and suitably anchored at different points. The penstock will be built in places and shored up, the supporting columns being constructed afterwards.

At the end of the penstock there will be a large steel standpipe. This will be 18 feet in diameter and 56 feet 6 inches in height, mounted on a solid concrete foundation 22 feet above the tail water level. This will bring the top of the standpipe 15 feet above the level of the head water, and with its large cubical capacity will reduce the strains on the penstock and water wheel governors to a minimum.

The Power House.

The power house is built on solid rock just above the point where the Magog River empties into the St. Francis. It is built of concrete up to the level of the window sills, and finished in red brick. The framework for the crane and roof trusses is steel. The main section comprising the water wheel and generator room is 110 feet long by 90 feet wide. To this will be added a gate house over the tail-race, a transformer house at the down-stream end, and an office section. A 15-ton travelling crane running the whole length of the building will be part of the equipment of the power house.

Hydraulic Equipment.

The three main water wheels take their water from the distributor in the penstock through 66-inch motor operated gate valves. They will be of the twin horizontal type, having a rated capacity of 1,325 h.p. each with three quarter gate at a speed of 360 r.p.m. The water will enter at one end of the steel plate casing and be discharged into the tail-race through a draft tube 22 feet long, inclined at 30 degrees to the vertical. The governing of these units will be effected by Lombard governors of liberal capacity to insure a very close regulation. One of these wheels already completed has just been tested at Holyoke. The results of the test show that a very high efficiency of 85 per cent. was obtained at slightly over three quarter gate.

The two exciter turbines having a capacity of 100 h.p. each at 750 r.p.m., will be of the single horizontal scroll case type. They will take their water from a common feeder opening from the stand pipe through hand operated gate valves. They will be controlled by Woodward governors.

Electrical Equipment.

This part of the installation has been carefully designed to conform with the very best modern standards. The three main units will have a rated capacity of 940 k.v.a. at 2,300 volts, 3 phase, 60 cycles, 360 r.p.m. These generators are of rather special design in order to insure close regulation and absence of hunting. The rotors will have a weight of 24,000 lbs. each, giving a fly-wheel effect of 100,000 ft. lbs.

The exciters will each have a capacity of 50 k.w. at 125 volts.

The power from the main units will be taken to the switchboard and distributed to the local feeders, railway motor generator sets, and transformers for long distance transmission lines.

The power for the railway will be obtained from two induction motor-generator sets having a capacity of 250 k.w. each at 500 volts. As in the case of the main units, these machines are of special design to meet the requirements of the fluctuating load on the railway without inter-

fering with the voltage regulation of the plant.

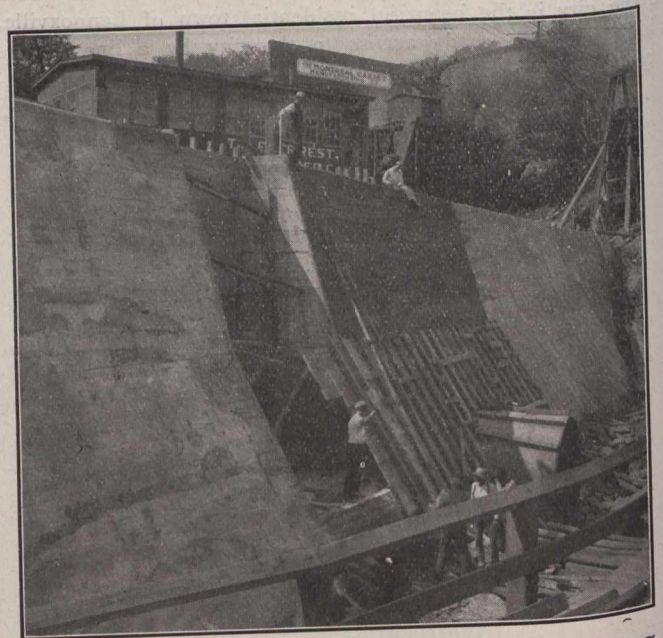
The power for transmission will be raised at 22,000 volts by means of three single phase transformers having a capacity of 677 k.v.a. each.

The switchboard consists of 11 marble panels and will be equipped with instruments and protective devices of the most modern type to guarantee against break down, and to insure a constant and reliable service with good regulation.

The power house equipment is protected from lightning troubles by electrolytic lightning arresters.

Transmission Lines.

The charter of the company gives it the right to transmit and sell power throughout the St. Francis district. This will open up to the company a large district rich in minerals and timber, which has hitherto been greatly handicapped in its development by reason of a lack of power. A very close study of the district has been made, and transmission



Reinforced Concrete Dam on the Magog River, Being Constructed by Sherbrooke Railway and Power Company.

lines will be run from the power house covering the district within a radius of 30 miles. The transmission will be at 22,000 volts, the lines being carried on wooden poles spaced 100 feet apart. Already several large contracts have been made for power, and the transmission lines will be pushed forward as rapidly as possible, along with the rest of the development where the work has been carried on by both night and day shifts since the spring.

The Railway.

The street railway was built some twelve years ago, and while the traffic has been large and the returns good, it was felt that they could be greatly increased by extensions and a general reconstruction of the system, the population of the city having doubled since the road was constructed. The present system consists of 7 miles of track, including the line to Lennoxville, sixteen cars, a freight car and a snow plow, car barns, power house, and office.

The old system will be entirely relaid and extensions amounting to 6 miles run this summer. The rails to be used for this work will be of the 70-lb. girder type, 60 feet long, 7 inches deep. These will be laid on new ties, and will be held by the rods and well bonded.

(Continued on Page 466.)

THE SANITARY REVIEW

THE PROVINCIAL BOARD OF HEALTH AND TORONTO'S WATER SUPPLY.

The Provincial Board of Health of Ontario administers one of the best-equipped chemical and bacteriological laboratories in Canada under the direction of a renowned and most efficient health chemist.

Dr. Amyot is known not only in Canada but throughout the whole American continent for his research and experimental work in the causes and prevention of zymotic diseases. The laboratory has in connection with it an experimental station, where advanced and useful work is done in water and sewage purification.

For the past twelve months exhaustive research work into the character of Toronto's water supply has been made, as well as experimental work in filtering and disinfecting the water.

Dr. Amyot, of the Provincial Board of Health, has had in his possession during the last twelve months information and deductions of a practical character, which, if applied to the water supply of Toronto, would have ensured that not a single case of typhoid could possibly have arisen from the use of the water.

Dr. Amyot's expert knowledge has been available to every municipality throughout Ontario on application to the secretary of the Provincial Board of Health.

Dr. Amyot's expert knowledge has never been made use of by the city of Toronto during its present and recent period of infected water.

Only and not until there is proof of cases of typhoid in the Province being caused by visitors, during the Exhibition period, drinking Toronto water, is data relating to the city water made public by the Provincial Board of Health.

It may be concluded that if the evils resulting from Toronto's infected water were confined to the citizens of Toronto, then Dr. Amyot's data would have remained pigeon-holed in the archives of the Provincial Board of Health.

The purposes of the Provincial Board of Health, of its laboratory, and of its experimental station, are that the whole Province may benefit in advice and administration in health matters. Toronto is the capital of the Province, but Toronto receives no advice or benefit. Why?

If Judge Winchester is to have the scope of his enquiry enlarged in order to report upon the health administration of Toronto in connection with its impure water supply, he can easily obtain evidence which will allow him to answer the question. Points of interest which His Honor might take up:—

(1) Prior to hypochlorite being used as a disinfectant to Toronto water supply, for the first time last May, as advised and recommended by T. Aird Murray (a private consulting engineer), is it a fact that Dr. Amyot had already experimented with hypochlorite and found that it was an efficient method of disinfecting Toronto water?

(2) Is it a fact that, although Dr. Amyot had sufficient knowledge to enable him to advise Toronto's Health Department as to an efficient method of killing disease germs which were acknowledged to be in the water, that such information was never asked for or made use of?

(3) Is it a fact that the M.H.O. of Toronto, who is also the chairman of the Provincial Board of Health, telephoned to Dr. Hodgetts (the then

secretary of the Provincial Board of Health) as to the application of hypochlorite at Boonton, N.Y., and never asked for information as to Dr. Amyot's experiments with hypochlorite on the city water?

(4) Is it a fact that the city of Toronto's water engineer, Mr. Fellowes, consulted with Dr. Amyot at the Engineers' Club of Toronto in April last, and was then advised to use .5 parts in 1,000,000 of chlorine, as he (Dr. Amyot) had found that this amount was necessary to disinfect the city water?

(5) Is it a fact that, in spite of this advice, never was more than .33 parts in 1,000,000 of chlorine used, or a little more than half of the required quantity?

(6) Is it a fact that Dr. Amyot's experience was substantiated in the letter to Mayor Geary sent by Mr. T. Aird Murray, in which he also advised .5 parts of chlorine?

(7) Is it a fact that during the month of May, while the M.H.O. was on a holiday, that the city water was analysed regularly both before and after chlorination, and that the results showed an average reduction of 75 per cent. of bacteria during that month?

(8) Is it a fact that on the M.H.O. returning from his holiday, he at once ordered a reduction of the amount of hypochlorite, and that comparative analysis of the water ceased to be made?

(9) Is it a fact that Dr. Amyot had the information that during periods of turbidity, caused by east winds, that the water required more hypochlorite than otherwise, and that in spite of this well-known and understood information, the amount of hypochlorite applied to the city water was never varied with reference to turbidity?

(10) Is it a fact that when North Toronto made application to the Provincial Board of Health for permission to treat its water supply with hypochlorite, that the M.H.O. of Toronto, acting as the chairman of the Board, only gave such consent on condition that comparative analyses be made of the water on each and every day it was used during the whole period of its application?

(11) If such a policy was good for North Toronto, then why not for the city of Toronto? Are lives more valuable in North Toronto than in the city?

(12) Is it a fact that Dr. Naysmith (Dr. Amyot's assistant) has made tests with the city water which show that .5 parts in 1,000,000 of chlorine added to the city water produce neither taste nor odor, and yet the reduction of the amount of chlorine to .22 was ordered by the M.H.O. in order to prevent taste and odor?

(13) Is it a fact that in the case of all the samples taken by the Provincial Board of Health during August and September, even when infection was proved present, such was at once removed by the addition of hypochlorite so as to bring the total amount added to .5 parts in 1,000,000?

An investigation of the above points might lead his Honor to make some recommendations by which the city may in the future act more in harmony with Provincial Health administration, and so obtain any possible benefits from the advice of this central expert authority.

HEALTH RESORTS AND TYPHOID.

The Medical Health Officers of Philadelphia, Pa., and of Poughkeepsie, N.Y., both report an increase of typhoid in their respective cities owing to infection incurred at so-called health resorts.

The former reports as follows:—

This city has expended a lot of money in filtering water and taking other safeguards to avoid typhoid fever, and when her people go away for the summer they are stricken down in the very places where they are supposed to be benefited. This week we have nine cases of typhoid fever that are directly traceable to Ocean City, six from Atlantic City and five from other New Jersey resorts. Fifty per cent. of the typhoid fever in Philadelphia in one week had its origin in New Jersey coast cities. It is incumbent on the New Jersey authorities to make investigation and then act. Three of the total number of cases were the result of contact, due to lack of proper precautions.

The latter reports as follows:—

Of the typhoid fever cases reported five are at Vassar Hospital, coming from the country. One at 46 Albany Street used water from a well that is suspicious, and which should be closed. I have investigated all these cases, and in each instance I have been able to establish the fact that the patient was absent from the city when the infection probably occurred.

ECONOMY IN SEWAGE DISPOSAL.*

By C. Chambers Smith, M.INST.M.C.E. (Fellow).

A duty cast upon local authorities by statute is that they must effectually purify sewage before discharging it into natural streams, watercourses, canals, or lakes. Such a duty has been rendered imperative in Great Britain owing to the comparatively short length of our rivers, and the small volume of fresh water contained in them, and also to the heavy population residing in cities and towns on the banks of such rivers, conditions similar to which are not to be found in any other country. Moreover, no other country has found it necessary to prohibit by statute the pollution of their streams. It must be admitted that this obligation of local authorities is not one which is carried out by them with any degree of willingness, for such obligation involves not only heavy expenditure for the construction of sewage disposal works, but also a serious annual expenditure for labor in the daily purification of sewage. Such expenditure is commonly looked upon by members of local authorities as unremunerative and wasted, and they also allege that the burden imposed on local rates in consequence is excessive and detrimental to the district.

* Read at the Royal Sanitary Institute Congress at Brighton, England.

There are, it is impossible to deny, good grounds for complaint. Heavier expenditure in the construction of many sewage disposal works, especially in the smaller towns and villages, has been incurred than has been warranted, and the cost of maintaining such works is not, in numerous cases, justified. In other words, economy does not appear to have been, and is not, a prominent factor in the design nor in the upkeep of a considerable number of sewage works. It rarely happens that members of local authorities have sufficient technical knowledge to form a proper judgment or to exercise sufficient control over these matters, whilst data which would assist them in making comparisons of cost with other places and works are rarely procurable. It would tend to economy if such data were insisted upon. No sewage disposal works belonging to a local authority, whether large or small, should be deemed to be satisfactorily administered unless a record is kept of the daily volume of sewage treated, and the quantity of sewage pumped, the quantity treated on various filters or on land, the amount of rainfall, the number of times contact beds are worked, and the periods of rest of beds or filters; moreover, an accurate record of expenditure should be maintained to a unit of cost per million gallons of sewage treated, and showing the cost on the rates, which would be reduced so that a comparison may be made with the records of previous years and with the cost of treatment at other places.

Economy in management is largely bound up with efficiency in original design of the works, and unless the author of the design has specialized knowledge of the subject and considerable experience, errors are often committed which are practically irretrievable. Thus it is essential in the first place that the site to be selected for the outfall works be such that the sewage can be delivered on to them by gravitation. Many works in the smaller towns are to be found where most of the sewage has to be pumped, and yet this might have been avoided. Every endeavor should be made, and more especially does this apply to pumping schemes, in the construction of the main and tributary sewers, to exclude all surface and subsoil water from roads, and to prohibit all rainwater from the roofs and yards of houses from being connected to sewage drains. Powers may be obtained under building by-laws, and in by-laws with respect to the drainage or redrainage of existing houses, to enforce this requirement, which is effected by compelling the provision of separate drains to houses for sewage and surface water, and such by-laws should be adopted prior to the carrying out of a new sewerage scheme.

Special precautions should be taken to ensure that all new sewers and all private drains are constructed so as to be absolutely watertight, and none should be permitted to be covered up until they have passed the hydraulic or water test. Manholes, too, should be so built that they exclude all surface and subsoil water.

The practice formerly prevailed of purchasing an area of land for sewage disposal works sufficient to treat the whole daily volume arriving at the works by broad irrigation. This, however, is not to be commended, for broad irrigation cannot be carried on so economically nor so reliably as one of the biological systems, and it is neither expedient nor justifiable to obtain land beyond what is required for the necessary tanks, filters, and a space on which to construct sludge lagoons. Provision should, of course, be made for reasonable extensions of filters. Land attached to the smaller sewage works, which necessitates extra labor for crop growing, rarely yields a return equal to the cost of the labor.

Whatever system of disposal is decided on, sedimentation tanks will be necessary for the arrestation and deposit of matters in suspension. In some cases where trade wastes have to be dealt with chemical treatment may be necessary, but this should be in very exceptional cases only. Screening of the sewage, excepting in pumping schemes, is rarely desirable or necessary. The proper trapping of the inlets and outlets of the tanks act more efficiently. The capacity of the tanks should be not less than half the daily volume of the sewage. Two or more tanks are to be preferred to one tank only. These should be constructed that they may be used either in combination or singly, so that one may be in use while others are being emptied of sludge. The tanks should be placed in such a position that the sludge may be drawn off to a lower part of the works by gravitation. The adoption of the Dortmund type of tank will often obviate the pumping of sludge. A detritus tank or deposit channel is often necessary to intercept mineral matter before reaching the tank. When works have to be situate near public highways or dwelling houses, and nuisance from smell has to be suppressed, the adoption of the Dibdin slate bed in lieu of sedimentation or septic tanks may be found advisable. Slate beds, however, necessitate a loss of head as the sewage must be drawn off from the floor level, whilst in sedimentation tanks it is drawn off from the surface. The covering over of sedimentation or septic tanks with costly roofs is not necessary. If for any reason it is desired to obscure the surface a light roof of corrugated iron may be used.

In the selection of a biological system for purification, and when economy is to be an important factor, there will be roughly two systems available, viz., (1) the percolating or trickling filter, and (2) the contact bed system. Effective purification can be better obtained from the former system. A uniformly high degree of purification superior to that from contact beds has been obtained from percolation filters designed by and constructed under the author's supervision at Sutton, Surrey, with a depth of 5 feet 6 inches, whilst good results have been obtained from another filter having a depth of 4 feet 3 inches only. The area of land required for percolating filters on which to purify a given quantity of sewage to a given standard is less than half that of contact beds, whilst the cost of construction of such filters when compared with that of contact beds with concrete walls and floors has been 50 per cent. less at works under the charge of the author.

The first coarse grain or primary contact bacteria beds in England for the treatment of crude sewage were constructed at Sutton by the author, acting on suggestions made by Mr. W. J. Dibdin, and these works acquired the reputation of being "the home of the contact system." It was only after very prolonged investigation that a departure was made from that system and the percolating system adopted. The results have fully justified the change.

Where contact beds are decided upon (and there will be cases where owing to local conditions such may preferably be adopted) expenditure may be restricted by constructing the enclosing walls (where below ground) on a batter and of cement concrete not more than 6 inches thick. A depth of material of more than 6 feet in contact beds is not generally advisable. Shallowness in depth of beds ensures better aeration and less liability to clog up. Percolating filters, too, of a greater depth than that named do not appear to be warranted. The use of cheap material for contact beds is not in general an economy. Such material as burnt clay ballast, improperly burnt destructor clinker, and broken

loca stone of a non-absorptive and smooth surface are not to be recommended either for contact beds or percolating filters.

One of the great advantages of percolating filters over contact beds is that the former may be constructed without artificial walls, whilst the latter require such walls for both primary and secondary beds. To excavate the soil to a considerable depth to secure open ground around percolating filters and then to exclude the air by surrounding them with concrete walls is somewhat anomalous. The sides of a percolating filter may be built up with lump clinker. Aeration of the interior is assisted by this method of construction.

There does not appear to be any sound reason why percolating filters may not be constructed below ground level if desired. A filter 80 feet in diameter, and 4 feet 3 inches in depth, so constructed by the author at a cost of £485, and treating 75,000 gallons per day, has been quite successful. The collecting channel is carried through the centre of the floor of the filter, and discharges into a humus chamber.

It is open to controversy as to whether double filtration by two sets of percolating filters, one generally being built up with very coarse material, and the second with finer material, is justified. Single filtration through one filter, composed of material of $\frac{3}{4}$ in. gauge in the upper part, and of 3-in. gauge in the lower, treating a properly sedimented tank effluent under proper management, is in general adequate for securing a good effluent. Where the effluent is to be discharged into a stream used for potable purposes, further treatment in a sand filter may be advisable.

The endeavor which is sometimes made to obtain an effluent much superior to the standard required by a rivers conservancy board or county council, is one which is good in theory, but when carried out at the cost of a small community is not to be commended.

One of the most difficult problems to deal with at sewage works is connected with the disposal of sludge. In some cases it is possible to pump the sludge into trenches on land and then plough it in, but this is generally practicable only in comparatively large works, and where power is available. The method adopted by the author at the Sutton works was to construct special sludge beds or lagoons in compartments, so that one bed was always ready to receive a new supply from the sedimentation tanks. These beds were provided with shallow underdrains a few feet apart, which were connected to a main drain, and discharged into the low-level sedimentation tanks. These drains were covered with coarse clinker, and over the whole surface of the bed was spread a 6-in. layer of ashes, from house refuse. Upon this the sludge was discharged by gravitation. The excessive moisture was quickly drained away from it, leaving the comparatively solid sludge behind, which was readily cleared away in carts by farmers. There is singularly little smell from such sludge, and it is often used as a top-dressing to lawns for private houses. The cost of such a method is very small.

It is expedient to notice that the periodical removal of sludge from sedimentation tanks should not be too long delayed, and in this and the supervision of filters and contact beds good management is the essence of success. Excellently designed works may be, and are too commonly, failures through inefficient management, whilst indifferently designed works may, on the other hand, by good management, give satisfaction. It has often been considered that authorities owning small works should have the advantage of

an inspecting and advisory officer for sewage works who should visit them quarterly, advise and report on them. Local authorities would, it is suggested, save much unnecessary expenditure if the system could be adopted, and there is doubtless much to be said in favor of it.

It may usefully be pointed out that the Royal Commission on Sewage Disposal have as a result of their inquiries estimated the cost of treating a "hypothetical domestic sewage," which includes loan charges and working expenses, to be as follows:

Cost of Complete Treatment Per Million Gallons (Dry-Weather Flow).

Preliminary Process	Final Process	Contact Perc'lat'g	Beds.	Filters.
Quiescent settlement, with chemicals...	£5 12 10	£5 0 4		
Continuous flow settlement, with chemicals ...	6 6 9	4 18 5		
Quiescent settlement, without chemicals	6 11 4	4 1 7		
Continuous flow settlement, without chemicals...	7 2 3	4 3 7		
Septic tanks ...	7 5 10	4 7 2		

At Sutton the cost of working the farm, exclusive of loan charges, including pumping, works out at £2 16s. 6d. per million gallons, or 7d. per head of the population, and 1d. in the £ on the rates per annum.

In presenting the foregoing and somewhat rough notes which the author has given, the result of some considerable experience in sewage disposal, the author is fully conscious that they are open to criticism, which will of course be welcomed. Before, however, concluding, he offers for consideration the following suggestions:—That economy in sewage disposal may be carried to a much further extent than has yet been attained; that no rule can be laid down as to which is the best system to adopt for any hypothetical case, but that experience has shown that the cost of treatment by sedimentation tanks and percolating filters is less than in contact beds.

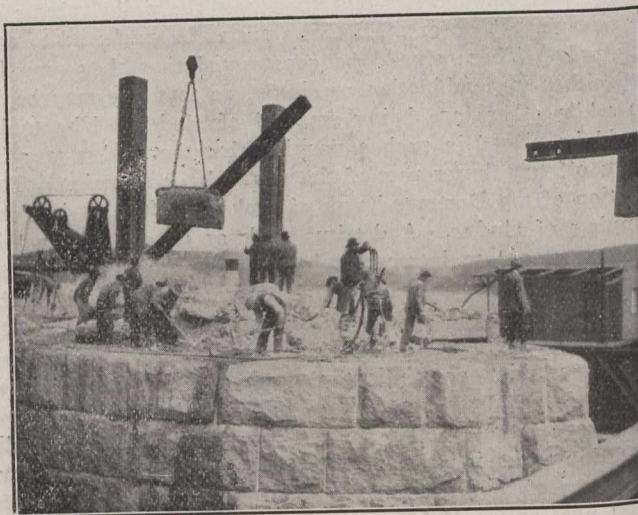
GROWTH OF CITIES.

	(% of increase)	Area in
	1900-1910.	1890-1900. square miles.
1. New York ...	4,766,883	38.7 37.1 326¾
2. Chicago	2,185,288	28.7 54.4 190½
3. Philadelphia	1,549,008	19.7 23.6 129½
4. St. Louis	687,029	19.4 27.3 61½
5. Boston	670,585	19.6 25.1 42¾
6. Cleveland	560,663	46.9 46.1 45
7. Baltimore	558,485	9.7 17.2 31½
8. Pittsburg	533,905	18.2 31.3 41
9. Detroit	465,766	63. 38.8 40
10. San Francisco	14.6 43
11. Buffalo	423,715	20.2 37.8 42
12. Milwaukee	373,857	31. 39.5 22¾
13. Cincinnati	364,463	11.8 9.8 43½
14. Newark	347,469	41.2 35.3 23
15. Toronto	*341,991	71.3 19.0 28
16. New Orleans	339,075	18.1 18.6 192
17. Washington	331,069	18.8 21.0 69¾

*Assessor's figures.

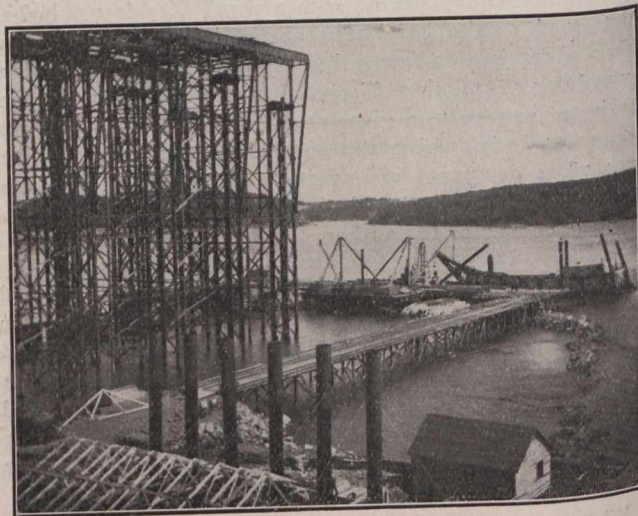
THE NEW QUEBEC BRIDGE.

Tenders are now being called for the construction and erection of the new Quebec bridge, and tenders will close October 1st, 1910. The bridge which is to replace the one that collapsed in August, 1907, while in course of erection, will still be the largest and heaviest in the world, although the centre span will be 42 feet shorter than the old one.



The Demolition of the Old North Main Pier.

The design which has been completed by the Board of Engineers appointed by the Dominion Government, is of the cantilever type, single intersection trusses, and has a maximum span of 1,758'-0". The trusses are 88 feet centre to centre, and have a maximum height centre to centre of pins over the main pier of 290'-0". A clear headroom of 150 feet above highest water has been provided for a width of 600 feet under the centre of the bridge.



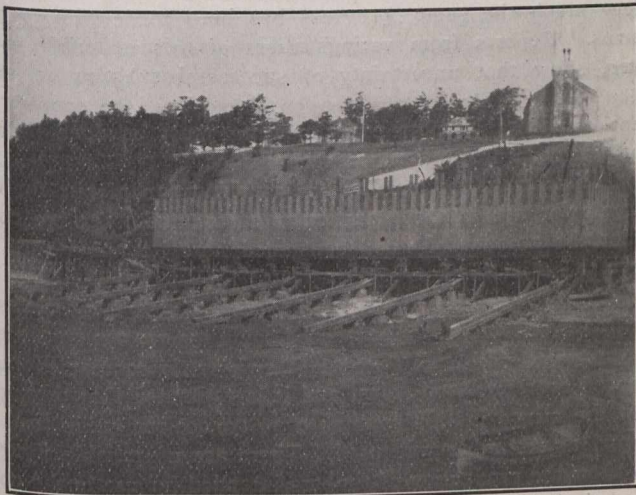
View of the Contractor's Layout, North Side.

The contract for the masonry was let last year to Messrs. M. P. and J. T. Davis, who were also the contractors for the old bridge piers. Practically all the masonry will require to be reconstructed as the bridge is 21 feet wider than the old one and nearly twice as heavy. The north main pier will be entirely rebuilt and carried down to rock. The south main pier will be reconstructed and enlarged, the foundations only being used. The anchor piers will be torn down and rebuilt and the abutments enlarged.

The caisson for the north pier was launched July 7th,

1910, and the work of sinking will start at once. This caisson is 180 feet by 56 feet square and over 60 feet high, requiring approximately 3,000,000 feet of timber, 90% of which is 12" x 12" southern pine. Nearly 70 tons of bolts were required in its construction.

At the lower depths to which the caisson will be sunk the men are working under a pressure of about four atmos-



View Showing Launchway at Low Tide.

pheres. At this depth man can only work for about two one-hour shifts in the twenty-four hours, for which they receive a full day's pay. Work will go on night and day and a force of some 2,000 men required.

Between 40,000 and 50,000 barrels of cement will be required in the construction of the north pier alone, and about 125,000 barrels for the entire work.

The caissons for the south pier will be constructed this winter.

It is interesting to compare a few of the principal features of this bridge with those of the Firth of Forth bridge, at present the largest existing bridge in the world.

	Quebec bridge	Forth bridge
Total length of cantilevers.....	2,930 ft.	5,349.5 ft.
Number of channel spans.....	1	2
Length of longest channel span..	1,758 ft.	1,710 ft.
Roadways on bridge	{ 2 rail'y tracks 2 st. ry. tracks 2 highways 2 ry. tracks 2 sidewalks	
Load per lineal foot bridge is designed to carry exclusive of its own weight	13,340 lbs.	4,480 lbs.
Total weight of bridge	72,000 tons	57,000 tons
Weight per lineal foot for cantilever only	49,150 lbs.	21,360 lbs.
Greatest depth of piers below high water	93 ft.	87 ft.

The weight per lineal foot of steel in the Quebec bridge is 2.30 times as great as that of the Forth bridge.

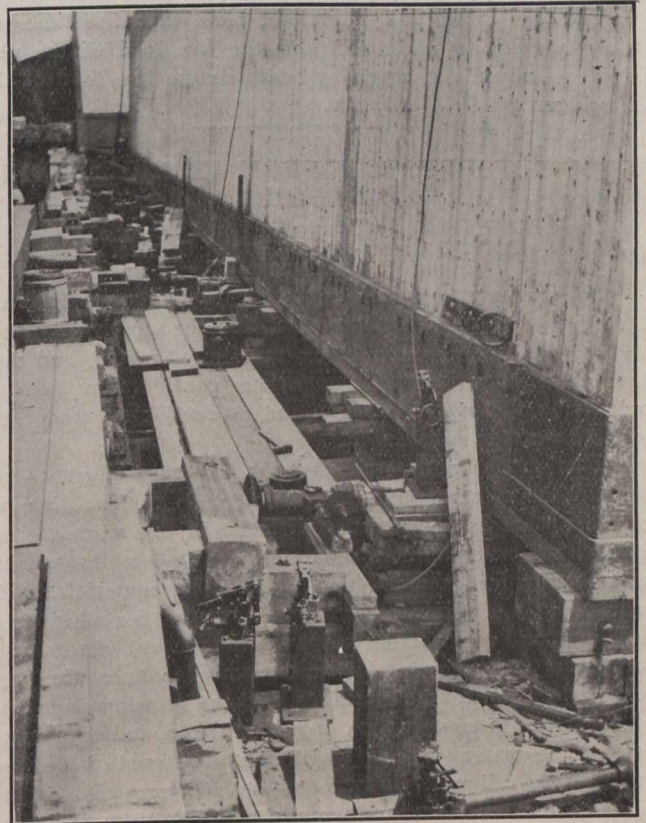
The load for which the Quebec bridge is designed is 2.98 times as great as that for which the Forth bridge was designed.

The Forth bridge has 4.77 lbs. of carbon steel for every pound of live load it is designed to carry.

The Quebec bridge has 3.69 lbs. of nickel steel for every pound of live load it is designed to carry.

The prescribed test load for the Quebec bridge is 4 1/2 times heavier than that used for the Forth bridge.

Models of all the important members, both compression and tension, have been made and will be tested to destruction in order to learn as nearly as possible what the elastic limit and ultimate strength of such members are under approx-



Showing Horizontal Jacks in Place at Upper Side to Give Initial Movement to the Caisson When Ready to Launch.

imately actual conditions. Some of these tests have already been made.

Test pieces of the compression chord of the old Quebec bridge broke at 26,850 lbs. per square inch.

Test pieces of similar chords for the new bridge broke at 56,800 lbs. per square inch.

DENSITY OF POPULATION.

The following table gives the population, area, and average density of population of some of the chief European, American and Canadian cities:—

Name.	Area, Acres.	Population Number.	Density of Population, No. per Acre.
London	440,320	7,200,000	16.3
New York	206,420	4,300,000	20.7
Paris	115,712	3,900,000	33.7
Berlin	76,288	3,200,000	42.1
Chicago	120,576	2,100,000	17.4
Philadelphia	81,152	1,500,000	18.5
Boston	27,072	1,300,000	43.3
Montreal	27,520	476,000	17.3
Toronto	16,750	345,000	20.6

The new chords are, therefore, more than twice as strong per square inch as the old ones.

The maximum section of the compression chords of the old bridge was 843 square inches; in the new bridge the maximum section is 2,037 square inches.

According to the tests the old chords would break under a pressure of 22,634,000 lbs. and the new ones under a pressure of 115,701,000 lbs.

The new chords are, therefore, more than five times as strong as the old ones, although the live load of the new bridge is only about twice as heavy as the live load of the old bridge.

WOOD PRESERVATION FROM AN ENGINEERING STANDPOINT.*

C. T. Barnum—U. S. Forest Service.

For a number of years engineers throughout the country have been confronted with the fact that the supply of timber for structural purposes is being rapidly exhausted, and they have been compelled to give serious consideration both to conserving the present supply and to developing other materials to act as substitutes.

That much energy and thought has been given to the substitution of other materials for wood is evident when we consider what has been accomplished. In this work the use of steel and concrete, both separately and in combination, has undoubtedly far exceeded that of all other materials. The vast quantity of reinforced concrete now used for all kinds of buildings and construction purposes, the amount of steel used for towers and poles in electric transmission lines, the number of steel and concrete bridges, and the growing popularity of steel for the construction of railroad cars, indicate only a few of the many ways in which these materials have been successfully utilized. Experiments are being carried on continually to extend these uses, and there is every reason to believe that much more will be accomplished. The effect of this substitution on the growing demand for structural timber is enormous, but in spite of this successful substitution the demand for wood as a structural material has steadily increased from year to year. In illustration of this increasing demand for timber, the Forest Service estimates show that the lumber cut of the United States increased from eighteen billion board feet in 1880, to forty billion board feet in 1907. In view of these figures it is safe to assume that it will be a very long time before we find ourselves able to do without it.

There is another factor to be considered in the substitution of inorganic materials for wood. The limited supply of these materials must be kept in mind. Iron, for example, once taken from the mine is gone and cannot be renewed. Wood, on the other hand, is capable of growth, and hence of indefinite replenishment from the same area. This fact will cause metals especially to rise in value, so that the ratio of cost between them and wood for construction purposes is a sliding and ever-changing one.

It is to be regretted that the energy which has been devoted to conserving our wood supply has not been equally as strong as that devoted to finding wood substitutes. Why it has not met with the same consideration is hard to determine, but the fact remains that in view of its importance only indifferent attention has been given to it. For certain classes of construction wood is, on account of its inherent properties, best adapted for use, and it has so far resisted all attempts to displace it.

*Read before the Western Society of Civil Engineers.

For railroad ties, telephone and telegraph poles, piling, mine props, and structural lumber, wood has shown its superiority. The extensive use of other materials for these purposes, of course, cannot be overlooked. Steel and concrete railroad ties, reinforced concrete and glass poles, steel and concrete piles, and mine props are instances of this. In 1907, 572,233 steel ties were sold by one company. This company claims that the steel tie is no longer an experiment. Very much the same progress has been made with other forms. Reports from various users of this material, however, show that uncertainty of successful substitution still exists and the general impression throughout the country is that considerable more experimenting must be done before satisfactory substitution is accomplished.

This brings us back to the consideration of our timber supply for use in these particular cases, and when we consider the amount of wood consumed here its importance is seen to be justified.

Census statistics show that in 1907 the steam and electric railroads of the country purchased some 153,000,000 cross ties, the telephone, telegraph, and other electric companies purchased over 3,500,000 poles, and it is estimated that throughout the mines in this country over 170,000,000 cubic feet of round mine timber was used. There are no reliable figures to show the production of timbers intended for use in the construction of bridges and for use in piling, but it is estimated that for the latter at least 2,000,000,000 feet were used. When we consider that these products constitute less than one-fifth of the total volume of lumber cut we get some idea of the enormous drain on our timber resources. It is further estimated by the Forest Service that the rate of cutting at the present day is exhausting our resources at the rate of about three times their growth. It is quite evident, therefore, that unless some radical changes be made a serious shortage of structural timbers is inevitable. This is especially true of the harder and more durable woods. The supply of this better grade of timber, which through its own properties resists decay for a reasonable time, is rapidly waning and in consequence its price in the market is rising. The average price of white oak, for instance, increased at the mill from \$13.78 per thousand feet in 1900 to \$21.23 per thousand feet in 1907, or 59 per cent. Leading lumber dealers, railroad managers, mine superintendents, and other consumers of timber for structural purposes, are accordingly turning their attention to ways and means of substituting cheaper and more plentiful kinds of timber for the better and more durable grades. Thus, where specifications once rigidly insisted upon first quality white oak for ties, or heart longleaf pine for dimension stuff, they are now given a very liberal interpretation, and other species than white oak are accepted with no difference in price, or considerable amounts of sapwood are allowed on "all-heart sticks."

The deterioration in quality naturally results in a decreased length of life, which in turn compels a large annual cut of timber.

Treatment.

A feasible and effective way of relieving the situation is by the treatment of the timber to protect against decay. A successful treatment of this sort, provided the cost can be kept within economical limits, will, in the long run, not only greatly decrease the cost to the consumer, but will also tend to decrease the annual demands on the forest. A proper preservative treatment will prolong the life of decay-resisting species as well as those of an inferior grade. If all ties, poles, posts, piling, mine props, shingles, and structural lumber adapted to treatment were given an efficient preservative

treatment, an estimated annual saving of five million board feet would ensue. The practice of preservative treatment will also create a new and increasing market for many timbers not formerly used, and timber consumers will more easily break away from their former custom of adhering closely to a few well-known kinds and disregarding others which may be equally as good in other respects but lack durability. Moreover, there will be an increasing realization that by the use of cheaper woods properly treated with preservatives, as good or better results can be obtained, together with the reduction of the annual cost. This last item, the saving in dollars and cents, is the all-important factor of wood preservation. As soon as the consumer fully understands that his annual expenses can be actually reduced by these methods, it is only natural to conclude that a strong effort will be made for their adoption.

Wood preservation is an exceedingly complex subject, and upon considering it many problems arise for solution. There has been a great deal of thought given to it, and it has undoubtedly made rapid strides during the comparatively short time it has been practised in this country. Nevertheless, it is still far from being on a sound scientific basis. The experiments that have been made show very clearly that each different species of wood, and wood of the same species but differing in the character of growth, present an entirely different set of problems. They differ greatly in the receptibility of different preservatives and they differ in the kind of preparation necessary for treatment and in their action in contact with the preservative, and after. The kind and condition of wood to be treated and the conditions under which it is to be used are very important factors in determining the kind of treatment that is best. The effect of the preparation and of the preservative on the mechanical properties of the wood are also very important, and must be carefully considered before any treatment is decided upon. Present practices are now largely determined by the experience derived from preceding years rather than an intimate knowledge of the theory of the subject. This latter feature, however, is most important and is at the present time receiving much deserved consideration. The Forest Service in its laboratory now being erected at Madison, Wis., expects to study very comprehensively the different theoretical questions arising in this work, and it is hoped that this will result in extending our knowledge of the action of different preservatives and the way they should be applied to each species of timber to secure the best results.

During the early period of wood preservation in this country, the expense of the treatment and the necessary apparatus and the lack of reliable information regarding the results prevented to a great extent its extensive adoption. As the demand for it increased and more reliable figures were obtained regarding the actual increase in life from various treatments, the economic results were better understood. This led to a larger development, and at the present time there are over sixty wood preserving plants operating in the United States, with an output, in 1907, of one and one-fourth billion feet.

Preservatives.

Of the many antiseptics which at one time or another have been proposed for the preservation of timber, two different classes may be made: (1) Antiseptic salts and various substances, such as zinc chloride, corrosive sublimate and copper sulphate; and (2) antiseptic oils, of which creosote, or dead oil of coal tar, is most generally used. The most common preservatives in general use are zinc chloride and creosote, and both are excellent antiseptics. It may be said,

however, that the principal value of zinc chloride is its cheapness and its ease of transportation, for it can be hauled in the form of a solid and dissolved at the treating plant. The principal defect of zinc chloride is its liability to leach out of the timber when exposed to moisture either in the soil or in the atmosphere. It readily dissolves in water and so its subsequent leaching out is merely a question of time, and the wood is left once more subject to attack. Its use, therefore, is limited to less moist situations. Creosote, on the other hand, is practically insoluble in water, so when a high grade of oil is used and injected into the timber, decay will be postponed almost indefinitely. Its principal disadvantages are its higher cost as compared with zinc chloride, and its limited supply and the subsequent difficulty in getting a good grade. In treatments for many structural purposes, such as piling and timber in wet situations, and especially where a long life is desired, creosote undoubtedly has demonstrated its ability to give the best results. Upon examination of certain timbers that have resisted decay for a long time, it has been learned that it is the heavier constituents of the oil that have remained in the wood, and it is therefore concluded that these constituents are to be depended upon in preservation work. For this reason, it is considered advisable that when specifying for creosote the heavier fractions should be called for.

Treating Processes.

Treating processes as practised to-day may be divided into two general classes: those which use pressure, and those which treat without pressure. Both of these may be subdivided into what is known as full cell and empty cell processes. The pressure process is too general and too well known to need description here. It is the more widely used of the two and without doubt the more effective for work on a large scale, and where a variety of woods must be treated. Pressures above 175 lbs. per square inch are seldom exceeded in these plants, as with proper preparation practically all woods can be treated with this pressure, and for many woods less is needed. The quantity of treated wood required determines the volume and size of the apparatus used and its cost. A plant of this kind having a capacity of about 3,000 ties per day would cost about \$40,000 to install. Within the last year or so there has been introduced a plant in which only a medium amount of pressure is used. This type may be called a medium pressure plant. In it pressures ranging from 50 to 100 lbs. per square inch are used. It is principally adapted for use by mining companies or city traction companies, where woods of a porous nature not especially resistant to the entrance of the preservative are used. Such a plant would usually be of a much less capacity than the ordinary plants, on account of being designed for the treatment of special classes of timber for local use, and can be built more cheaply on account of being of lighter construction. A plant of this type, with a capacity of 1,500 ties per day, would cost, approximately, \$20,000 to install.

Plants which treat without pressure are rightly called non-pressure plants. This type of plant is not the open-tank proper like that used in the treatment of butt telephone poles, but a closed cylinder similar to those of the pressure and medium pressure plants, but made of very much lighter material, usually $\frac{1}{4}$ -inch iron. The Forest Service has done much to develop this latter plant, because this process has filled a real need, a need which the pressure process could not fill. The development of this non-pressure process is due very largely to the heavy expense involved in the purchase and installation of the pressure plant, an expense which confines such plants to large commercial companies or to com-

panies such as railroads, which demand a very large and fairly constant supply of structural timber, comparatively resistant to the entrance of the preservative. It is not to be understood that this non-pressure process is to replace in any manner the older and more firmly established pressure processes for all timbers and conditions.

What was needed was a process by which the more porous lumber of different kinds and for different conditions could be treated efficiently and cheaply in a plant inexpensive to install and simple to operate. The record of attempts to meet this need is the history of the non-pressure process. This type of plant generally has a treating cylinder 6 feet in diameter and about 50 to 60 feet long, and a capacity of about 500 ties per day. It may be completely installed for from six to eight thousand dollars.

For the butt treatment of telephone and telegraph poles an ordinary open tank, either rectangular or round, about 9 feet in diameter by 9 feet deep, and fitted with steam coils, is used. A storage tank of small capacity for holding a supply of the preservative, and a jib crane for handling the poles in and out of the treating tank, complete the equipment. Such a plant can be installed for eight or ten hundred dollars.

A full cell treatment or process occurs when the wood cells and intercellular spaces of the timber are completely filled with the preservative. The portion of the timber treated in this case is made to take as much of the preservative as the cells are capable of containing.

On account of the expense involved in a treatment of this kind, with a preservative as costly as creosote, means have been sought to remove from the timber a portion of the preservative injected. In this manner the same penetration is secured with a much less amount of the preservative, and the cost of the treatment is consequently decreased. In treatments of this kind the preservative contained in the cells proper is withdrawn, and the cell walls left simply coated or painted with the preservative. This process is used largely in treating railroad ties with creosote, where mechanical wear destroys them before the increased life to be derived from a full cell treatment can be obtained.

Length of Life.

The length of life of treated timber, like the treatment, depends on a variety of conditions. The kind of wood, kind of preservative used, the kind of treatment given, and the conditions under which the treated timber is used; all have an important bearing on the length of life. In the Southern States, Louisiana and Texas particularly, a loblolly pine tie untreated will last little more than a year. Ties treated with zinc chloride and placed in a track in the same locality have been removed in three years on account of decay. The life of the same species of timber in one section of the country will not be the same when exposed to the climatic conditions in another section. The use of zinc chloride as a preservative does not give as long life as creosote. Ties properly treated with this can, however, be made to give an average life of about 12 years. In the Central West, hemlock and tamarack ties treated by the Wellhouse process have shown a life of twelve to fourteen years, while untreated ties under the same conditions have to be removed at the end of four years on account of decay. Properly creosoted ties can be made to last until destroyed by mechanical wear, and if protected against this wear can be made to give 20 to 30 years' service. With the proper kind of treatment, a pile can be made to last from twenty to twenty-five years. The L. & N. R. R. Company in 1882 used large quantities of creosoted piles, stringers, and caps in the construction of trestles and

docks in the vicinity of Pensacola, Fla. All of this material gave a service of over twenty-five years. The New Orleans and North Eastern Railway Company's bridge across Lake Pontchartrain is another notable example of the efficient service to be expected from a good treatment. This bridge was built in 1876 on creosoted piling, most of which to-day is in a good state of preservation. Most of the timber used in these instances was southern pine which, if untreated, would be destroyed by marine borers in 3 years or less. At Girardville, Pa., in the Reading Coal Company's mine, treated timbers have given 12 years' service where ordinarily they would be removed in 2 years.

The Forest Service has estimated that proper preservative treatment will increase the life of ties over 200 per cent., poles 100 per cent., posts 300 per cent., piles 700 per cent., mine props 400 per cent., and lumber 300 per cent. These figures are made up of the average estimates of treated and untreated life for the various forms all through the country and under all conditions, so they naturally give merely an indication of the results of treatment which, in specific instances, may be much more or less than the general average.

Economic Considerations.

It has been clearly demonstrated that the life of timber in many situations has been increased at least two-fold by the use of preservatives, and often the increased life is very much greater. Suppose, for example, that certain timbers put to a certain use will last 5 years without treatment. Disregarding interest charges, it is therefore true that the cost of treatment must be less than the additional cost of new timbers 5 years later, plus the cost of their setting in order to effect a saving. In treating on a large scale the additional cost of any treatment now practised does not usually exceed the present purchase price of the timber. Therefore, the saving means at the least the cost of resetting the timbers, plus the advance in price of the timber, over a period of 5 years. For example, the popular grade of mine timber in the West has increased some 40 to 50 per cent. in price within the last 5 years, and it is reasonable to suppose that a corresponding, if not greater, increase will occur within the next 5 years. Therefore, the financial saving from a treatment, which will double the life of the timber, will be equal to the cost of replacement, naturally a variable quantity, plus 50 per cent. of the present cost of timber. More frequently a good treatment will triple and quadruple the life, and the financial saving is correspondingly greater. Another factor entering into the economic value of the treatment is that often replacement of timber is an expensive undertaking. It means in some cases a shutting down of work on hand during the period of replacement, with the consequent more or less serious financial loss. For instance, the replacement of the timber in a mine shaft will often partially, if not wholly, stop all the work through that section during the period of replacement, with a corresponding financial loss to the company. Since by treatment these replacements may be easily reduced by one-half and oftener to a greater extent, it can be seen that this element bears an important relation to the financial saving growing out of preservative treatments.

With railroad ties a wide field for the betterment of conditions exists in the more general introduction of preservative treatment. Formerly, white oak was the most popular and widely used species for this purpose, but in the past 10 years the cost of the oak tie has more than doubled, and railroads have consequently been turning their attention to other species. Thus, loblolly and shortleaf pine in the South, hemlock and tamarack in the Lake States, lodgepole pine and

(Continued on Page 466.)

ROADS AND PAVEMENTS

COST OF RURAL ROAD BUILDING IN PEEL COUNTY, ONTARIO.

C. R. Wheelock,* Orangeville, Ont., County Engineer.

The following tabulated statement is similar to the one sent to the Minister of Public Works for Ontario when the county was making its claim for their proportion of the Government grant.

The following is a summary of work done:

Miles of road graded	19 $\frac{3}{4}$
Miles of road metalled	15 $\frac{1}{2}$
Number of tile culverts	89
Number of other culverts under 10 feet span	2
Number of bridges 10 feet span and over	10

During the season county and township graders were used on the work 113 days and the steam rollers 164 days. The rock crusher and rotary screen were not used this season, the crushed stone being purchased from the quarry companies—suitable stone for crushing could not be procured in sufficient quantities convenient to the roads being built. The cost of operating the graders was \$14.50 per day, and the cost of operating the rollers was from \$3.90 to \$4.25 per day. To the latter must be added the cost of sprinkling—about \$4 per day—making the total for rolling and sprinkling about \$8 per day.

The wages paid during the season were as follows:

Ordinary laborers	\$1.50 to \$2.00 per day.
Foremen	2.00 to 2.50 per day.
Roller engineers	2.50 per day.
Teams	3.50 to 4.00 per day.

The following is a summary of the expenditures:

Roads (including culverts)	\$34,377.30
Bridges	6,313.75
New machinery	63.50
Engineering	691.45

Total \$41,446.00

The following twelve sections of road refer to work done on different classes of work throughout the county, but the general statement applies.

Road No. 1.—Hurontario Street.

The work done on this road was as follows:

In the Township of Toronto: From the Lake Shore Road to Dundas Street, a distance of 2 $\frac{1}{2}$ miles, was graded. The soil along this portion of the road is a fine drift sand which would not stand rolling. As an experiment a short piece, running southerly from Dundas Street about forty rods, was first well graded, then crowned with a layer of stiff clay about four or five inches in depth and upon this was spread a layer of gravel about eight inches deep. If it is found that this piece of road will stand the traffic satisfactorily, it is our intention to build the remainder of the 2 $\frac{1}{2}$ miles in the same way. Ten tile culverts were used along the road, and at a springy place 20 rods of 4-inch tile under-drain was put in. Cost of work:

Grading	\$200.95
Clay	60.00

* In a report to the warden and council of the county of Peel, Mr. Wheelock, the county engineer, gave the following information:

Gravel	86.70
Tile culverts	100.30
Tile under-drain	29.10
Labor	188.20

Total \$665.25

The three miles of stone road which was built last year from lot No. 8 to the northerly boundary of the township was repaired by filling in all ruts and low spots with crushed stone and rolling thoroughly with the steam roller. Our experience has been that the new roads require some repairs of this description the first spring after being built. They should then give good satisfaction as the metal is well consolidated and thickened along the wheel tracks. In addition to the repairs the stone road was extended twenty rods southerly, being graded and metalled similar to the part built last year. Two small cement concrete bridges of similar design were built, on opposite lot No. 6 and the other opposite lot No. 8. These bridges are 10-foot span over all, the tops are flat, reinforced with seven 5-inch I-beams. The railing is 2-inch gas pipe with globe fittings, which makes a strong railing with a good substantial appearance at a reasonable cost. The cost of the railing painted and complete was sixty-four cents per foot. Similar railing has been used on several of the bridges built for the County this year. The width of the roadway over these bridges is 18 feet, and I would strongly recommend that a width not less than this be used for small structures on leading roads.

Cost of work:

Stone (including freight)	\$166.93
Rolling	57.50
Labor, teaming, etc.	197.90
Tile	12.30

Total \$434.63

Cost of bridges:

Concrete work	\$305.00
Metal	42.04
Railing	37.14
Approaches, etc.	92.91

Total \$477.09

In Chinguacousy Township: Sixty rods of road were graded and metalled with Hagersville crushed stone opposite lot No. 3, at a cost of \$266.65. The three-quarters of a mile of road built opposite lots Nos. 9 and 10 last year was repaired by filling and levelling the ruts and hollows with gravel, at a cost of \$57.50. Six and one-half miles, from Side Road No. 10 to lot No. 27, were graded, and the five miles from Side Road No. 10 to Side Road No. 22 were metalled with crushed stone. Hagersville stone was used from Side Road No. 10 to Side Road No. 17, and stone from the Credit Forks and Shaw on the remainder. The average length of the haul in teaming the stone was one mile and a quarter. The grading was well done, knolls cut down and hollows filled, and the metal well sprinkled and rolled with a steam roller. Forty-seven tile culverts were put in and one reinforced cement concrete arch 10-foot span over all. The arch is a good, solid structure with a flood-proofing pavement between the abutments under the stream and reinforced with $\frac{1}{2}$ -inch steel longitudinal and cross rods; the longitudinal rods pass over the arch-ring through the abutments and pavements, thus tying the whole structure together. Cost of work from Side Road No. 10 to Side Road No. 17:

Grading	\$ 378.90
Stone (including freight)	5,925.18
Tile	283.29
Labor, etc	3,509.35
Total	\$10,096.72
Cost of work from Side Road No. 17 to Lot No. 27:	
Grading	\$ 690.35
Stone (including freight)	3,480.75
Tile	282.75
Guard railing	32.60
Labor, etc.	2,135.55
Total	\$6,622.00
Cost of arch:	
Concrete work	\$345.53
Steel	40.18
Railing	35.85
Overseeing, etc.	25.00
Total	\$446.56

In Caledon Township: Opposite lots Nos. 7, 8 and 9 three-quarters of a mile was graded and 120 rods of the same metalled with gravel. Opposite lots No. 14 and 15, 120 rods running south from the village of Caledon were metalled with gravel. One tile culvert was put in on this piece and a cement concrete arch built at Harris Creek, opposite lot No. 14. The arch is 36 feet span over all and is reinforced with two rows of longitudinal rods and two rows of cross rods, one inch in diameter. The railing is 2-inch gas pipe. Opposite lots No. 17 to 24, running north from the village of Caledon, three miles of road, which were graded last year, were metalled with gravel. This is a continuation of the piece of road which was completed last year. The gravel cost about 71 cents a yard delivered on the road. The average length of the haul was about one mile.

Cost of work opposite lots Nos. 7, 8 and 9:	
Grading	\$126.45
Metalling	131.20
Total	\$257.65
Cost of work opposite lots Nos. 14 and 15:	
Metalling	\$120.00
Tile	11.75
Total	\$131.75
Cost of work opposite lots Nos. 17 to 24:	
Preparing road for metal	\$ 103.75
Metal, labor, etc.	2,055.71
Total	\$2,159.46
Cost of arch:	
Concrete work	\$452.56
Steel	61.50
Railing	48.00
Approaches, etc.	58.50
Total	\$626.56

Road No. 2.—Lake Shore Road.

The only work done on this road was to repair the 2½ miles of stone road built in 1907 and 1908 by filling in the ruts with crushed stone and rolling. The cost was \$164.38.

Road No. 3.—Dundas Street.

Four miles of this road running easterly from Cooks-

ville were graded and metalled. This is an old stone road, wide and flat on top, and the grading consisted mainly in cutting off the shoulders, although in some places it had to be regarded and ditched. Hagersville crushed stone was put in the centre of the road 9 feet wide, and along each side of this stone a strip of gravel about 3 feet in width, forming a boxing for the stone, and making the total width of the metal about 15 feet. Twelve tile culverts were put in, and one riveted steel Warren truss bridge built. The bridge is 43-foot span, with cement, concrete and stone abutments, and reinforced concrete floor, with a roadway 17 feet wide, and is designed for a 12-ton load.

Cost of work:	
Grading	\$ 496.01
Stone (including freight)	5,258.17
Gravel	201.80
Ditching	130.65
Tile	57.10
Labor and incidentals	3,254.51
Total	\$9,398.24

Cost of bridge:	
Steel superstructure	\$699.00
Concrete work	551.30
Approaches and incidentals	221.59
Total	\$1,471.89

Road No. 5.—The Third Line, Toronto Tp.

The work on this road consisted of draining a low, wet piece of the road about 60 rods in length, in the second concession. Tile was run along the sides of the road and to an outlet on lot No. 6 in the second concession. About 160 rods of tile were put in, 80 rods of 4 inches and 80 rods of 6 inches. The cost was \$73.10.

Road No. 6.—Side Road No. 5, Through Chinguacousy and Toronto Gore.

The work done on this road was as follows:

In the Township of Toronto Gore:—Three tile culverts were put in the 7th and 8th concessions, and a cement concrete and steel beam bridge built at Woodhill. The bridge is a 24-foot span skew bridge, with a flat top, supported by seven 12-inch I-beams, the concrete being arched between the beams from the bottom flange. The railing is 2-inch gas pipe extending over the wings. There were formerly two bridges at this place, but by putting the new bridge on a skew and opening up the creek we have put it in a shape that there is no doubt the one will take the water and so have filled in the channel at the other, and removed the bridge.

Cost of bridge:	
Concrete work	\$486.20
Steel beams and railing	390.00
Approaches, filling at old bridge, clearing creek, etc.	195.00
Total	\$1,071.20
Cost of tile	28.60

In the Township of Chinguacousy: Concessions Nos. 4 and 6, W.H.S., were graded and one tile culvert put in. In Concession No. 3, W.H.S., a 6-foot span reinforced cement concrete culvert, and a bridge, 14-foot span, were built. The bridge is cement concrete, with flat top, reinforced with 6-inch I-beams embedded in the concrete, and with gas pipe railing. At the Huttonville bridge a cement concrete retaining wall 30 feet long was built.

Cost of work, Concessions Nos. 4 and 6:

Grading, etc.	\$385.67
Culvert, 6-foot span	198.35
Tile culvert	12.00
<hr/>	
Total	\$596.02
Cost of bridge	317.39
Cost of retaining wall	137.50

Road No. 7.—Side Road No. 17, Chinguacousy Tp.

On this road a short piece was improved, extending from the C. P. Railway at Snelgrove to a point 80 rods westerly. This piece connects with the part built last year. There were 80 rods graded and about 50 rods metalled with crushed stone. Two tile culverts were put in.

Cost of work:

Grading	\$ 67.50
Stone (including freight)	200.00
Labor, etc.	84.60
Tile	16.00
<hr/>	
Total	\$368.10

Road No. 8.—Side Road No. 27, Chinguacousy, and Side Road No. 10, Albion.

The work done on this road was as follows:

In the Township of Chinguacousy: Part of Concessions Nos. 2 and 3, E.H.S., and Concession No. 3, W.H.S., were graded, about one mile in all. This work consisted mainly of grading and improving hills. One tile culvert was put in. The cost of the work was \$355.32.

In the Township of Albion two tile culverts were put in in Concession No. 1, one in Concession No. 2, and one in Concession No. 3. The total cost was \$64.30.

Road No. 9.—Side Road No. 15, Caledon Tp.

The improvements made on this road consisted of the following:

East of Hurontario Street: The E½ of Concession No. 1 was graded, and the road was raised and widened along the creek by filling in with large stones. The W½ was graded last year. The E½ of Concession No. 2 was graded, and in this Concession also the W½ was graded last year. Concession No. 3 and the W½ of Concession No. 4 were graded this year, making in all two miles graded this year. Concession No. 1 and the W½ of Concession No. 2, a distance of about one mile and a quarter, running east from the village of Caledon, were metalled with gravel. One tile culvert was put in and one small cement concrete arch 6-foot span, and one reinforced cement concrete flat top bridge were built. The bridge is 16-foot span, with a 17-foot roadway, and the top is reinforced with 6-inch I-beams embedded in the concrete. The railing is 2-inch gas pipe.

West of Hurontario Street, in Concession No. 3, 25 rods of road adjoining the piece built last year were graded and metalled with gravel at a cost of \$36.00.

Cost of work east of Hurontario Street:

Grading	\$544.35
Gravel and incidentals	704.95
Tile culvert	7.90
Small arch culvert	111.60
<hr/>	
Total	\$1,368.80

Cost of bridge:

Concrete work	\$251.48
Steel	47.59
Railing	35.00
Incidentals	21.50
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Total	\$355.57

Road No. 10.—The Seventh Line, Albion.

On this road about two-thirds of a mile opposite lot No. 29 was improved by filling in low places with stone and earth and metalling with gravel. Two tile culverts were put in.

Cost of work:

Gravel (at the pit)	\$80.00
Labor (drawing gravel, filling, etc.)	576.00
Tile culverts	17.31
<hr/>	
Total	\$673.31.

Road No. 11.—Side Road No. 25, Albion.

This is a very hilly road, and the work done this year consisted of cutting down, grading and improving hills in Concessions Nos. 4, 5 and 6. About 70 rods in all were graded, and about 58 rods were metalled with gravel. The cost was \$233.00.

Road No. 12.—The Ninth Line, Toronto Gore.

The improvements made on this road were as follows:

Opposite lot No. 3 a hill was improved and graded at a cost of \$77.25. Opposite lot No. 13 about 20 rods of road were graded and a guard railing put up, at a cost of \$51.77. Opposite lots Nos. 1, 2 and 3, three tile culverts were put in, costing \$20.00. Opposite lot No. 9 two reinforced cement concrete arches were built. The arches are over the same stream at different points, and are similar in size and construction. The span is 34 feet, with a 16-foot roadway, and the reinforcement consists of two rows of longitudinal and two rows of cross rods, one inch in diameter. The railing is 2-inch gas pipe.

Cost of arches:

Arch No. 1: Concrete work	\$481.43
Steel	145.00
Approaches, etc.	160.91
<hr/>	
Total	\$787.34
Arch No. 2: Concrete work	\$517.18
Steel	145.00
Approaches, etc.	97.97
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Total	\$760.15

The only expenditure for new machinery or implements during the year was the following:

One plough for Toronto Township.	\$12.50
One breaking plough for Caledon Town'p	31.00
Two scrapers for Chinguacousy Town'p.	20.00
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Total	\$63.50

The following is a summary of the total expenditure for the year:

Roads (including culverts)	\$34,377.30
Bridges	6,313.75
New machinery	63.50
Engineering	691.45
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Total	\$41,446.00

WOOD PRESERVATION FROM AN ENGINEERING STANDPOINT.

(Continued from Page 462.)

Engleman spruce in the West, birch in Wisconsin and the New England region, and maple and beech in Michigan, Pennsylvania, New York, and Vermont, are gradually attaining recognition and rarely fail, when properly protected from decay and mechanical wear, to give satisfactory results. For example, it has been estimated by the Chicago and Northwestern Railway Company that the cost of the average untreated hemlock or tamarack cross-tie, when laid for use west of the Mississippi, is 75 cents. The cost of a satisfactory impregnation with zinc chloride is about 12 cents per tie, making the cost of the treated tie 87 cents.

The annual charge on an untreated tie costing 75 cents is 16.8 cents. For a treated tie costing 87 cents and lasting 6 years, the annual charge is 16.6 cents; lasting 7 years, 14.5 cents; lasting 8 years, 12.8 cents; and 10 years, the estimated life of a treated tie is 10.7 cents. These figures demonstrate that an added life of a single year makes the cost of treatment practicable and an added life of 5 years (a conservative estimate) secures a saving of 36.3 per cent. in the annual charge. By the substitution of a creosote for the zinc chloride treatment, although somewhat increasing the initial cost, the tie can be conservatively counted upon to resist decay for 18 years, and this added length of life will amply repay the extra cost of the treatment.

By proper preservative treatment and the prevailing rates of interest, it can be conservatively estimated that the net annual saving for each form treated would be about 3 cents for a tie, 9 cents for a pole, 1 cent for a post, 2 cents for mine props, and about 50 cents per thousand feet for lumber. This would result in a total annual saving of about \$71,780,000. This includes the cost of labor as well as that of the timber itself, and this represents the amount of money that could be turned each year into other channels if wood preservation were uniformly adopted throughout the United States. It must be remembered, of course, that these figures are made up of average estimates of untreated and treated life, and naturally cannot be applied to specific cases.

Wood preservation, then, accomplishes three great economic objects: (1) It prolongs the life of durable species in use; (2) it prolongs the life of inferior and cheaper woods and thus enables the utilization of those inferior woods which, without preservative treatment, would have little or no value; and (3) it reduces the annual charge and renewal charges whenever it is used, enabling the money saved to be put to other uses.

SHERBROOKE POWER PLANT.

(Continued from Page 454.)

Orders have already been placed for eight new cars. These will be of the "pay-as-you-enter" single-ended type, and will have cross seats. They will be equipped with two 50 h.p. motors. The rolling stock will be supplemented by the addition of a new snow plow and a sweeper.

With this new equipment the service will be much improved. As a matter of fact the service in the city has now been reduced from twenty minutes to five minutes, and will be still further improved when the new equipment is received.

To accommodate the new rolling stock, large extensions to the car barns and shops are contemplated.

FIRES: EFFECTS ON BUILDING MATERIALS AND PERMANENT ELIMINATION.

That modern methods of fireproof building construction may be depended upon for the permanent elimination of fires is the belief of Mr. Frank B. Gilbreth, contractor, New York, whose paper on "Fires: Effects on Building Materials and Permanent Elimination" will be presented at the New York meeting of the American Society of Mechanical Engineers, 29 West 39th Street, at 8.15 p.m., October 11th. The paper discusses the enormous annual fire loss of the country, shows the effect of a destructive fire on a typical steel-frame building, and outlines the methods by which the permanent elimination of fires may be assured. Following this paper, Mr. H. deB. Parsons, consulting engineer, New York, will show by means of lantern slides the effects of fires on a number of office buildings. The subject will also be discussed by Mr. Henry B. Keasbey, of the National Fireproofing Company; Prof. Ira H. Woolson, of the National Board of Fire Underwriters; Mr. Wm. D. Grier, chairman of the special committee on manufacturing risks and special hazards of the National Fire Protection Association; Mr. C. A. P. Turner and others concerned with various phases of fireproofing building construction.

Mr. Gilbreth's paper calls attention to the fact that the total cost of fires in the United States in 1907 amounted to almost half the cost of the new buildings constructed in the country for the year. The total fire loss, excluding that of forest fires and marine losses, amounted to over \$456,485,000. In addition to this waste of wealth and natural resources, 1,449 persons were killed and 5,654 were injured in fires. The buildings consumed, if placed on lots of 65 feet frontage, would line both sides of a street extending from New York to Chicago. A person journeying along this street of desolation would pass in every thousand feet a ruin from which an injured person was taken. At every three-quarters of a mile in this journey he would encounter the charred remains of a human being who had been burned to death. The results obtained indicate that the total annual cost of fires in the United States, if buildings were as nearly fireproof as in Europe, would be \$90,000,000, and that, therefore, the United States is paying annually a preventable tax of more than \$366,000,000, or nearly enough to build a Panama Canal each year.

The author of the paper has made careful observations of the great fires at Toronto, Sioux City, Baltimore, San Francisco, Chelsea, and elsewhere, and his conclusions as to fireproof construction are the result of painstaking observation. He believes that no structure of the future should be built of wood, or contain any wood. The increasing cost of lumber and the improved methods of fireproof construction have contributed to the result that it is to-day possible to build non-combustible structures at no greater first cost than wooden ones.

The disuse of wood in building construction would mean the saving of forests, uninterrupted business, the saving of life, the saving of buildings, and the saving of the contents of buildings.

Mr. Gilbreth believes that the permanent elimination of fires can never be thoroughly and completely brought about without Government aid, and suggests the following lines along which Government assistance can be directed:—

- (a) By passing laws restricting the use of wood in buildings.
- (b) By levying taxes discriminating in favor of fireproof houses and against wood in construction.
- (c) By educating the people by Government documents on how to build fireproof houses.

(d) By establishing a Government bureau for disseminating information regarding honest, unbiased fire tests on material, together with Government experiments on different full-sized buildings.

ECONOMY IN THE INDEPENDENT PLANT.

The superior economy of an independent steam plant compared with purchased electric power under a particular set of circumstances has often been demonstrated; but it is not often, perhaps, that the economy is so pronounced as in a case recently made the subject of a report by F. W. Dean, mill engineer and architect, of Boston. The circumstances of this case were somewhat peculiar, but they enforce the lesson that only the large central electric station can sell power at rates that are economical to large consumers of power.

The plant in question, considered by Mr. Dean, was that of a packing company which had a steam boiler plant of about 300 horse-power, used mainly for heating and cooking purposes, and for running one of its two refrigerating machines. Power to operate the machinery of the plant was purchased from a local electric power company. In the afternoons of the winter season, when the power company's lighting load reached its peak, there was often not enough power to run the packing plant, which, therefore, had to install and operate an 80 k.w. generator driven by an engine supplied with steam from its own plant. At times the purchased power failed altogether, and at such times only part of the machinery of the packing plant could be operated.

Purchased regular power amounted to 123 E.H.P. For various irregular uses, such as the operation of the large, motor-driven refrigerating machine, elevators, fans, and for one department during the fruit season, there was occasional need of additional 73 M.H.P.; and additional machinery to be at once installed would require 57 M.H.P. more. The lighting requirements called for 34 E.H.P., making a total of 323 E.H.P. required. Owing to the fact that alternating current was used, it was decided that for an independent plant a 300 k.w. generator would be necessary as soon as the contemplated extension of the plant was in operation. Double this power was likely to be soon required, owing to the rapid expansion of the packing company's business, and two 300 k.w. generators had to be considered if the factory was to be assured of running all the time.

Mr. Dean's discussion of the apparent and the actual cost of purchased power to the packing company is worth following in some detail, because, although his argument is obvious enough, it is based on reasoning that often escapes business men who might be supposed to see it for themselves. It is indispensable, says Mr. Dean, that a factory should be able to operate constantly, and this requires in this case a full power equipment of engines and generators exactly as if no power were purchased. The cost of the purchased power was at the rate of \$24 per horse-power per year, and the payments were based on the maximum readings of the ammeters each day. The maximum reading would be 138 E.H.P., while the actual average was 123 H.P. The latter is 89 per cent. of the former, and the cost of average power was, therefore, $\$24 \div 0.89 = \27 . The real cost of power to the company was thus \$27 per H.P. per year, plus the fixed charges on its own engine plant and some other charges, such as a portion of the coal used, a portion of the labor costs, and some oil, waste and supplies. If the company furnished its own power, the \$27 charge would be eliminated, and there would remain only the fixed charges, plus coal, attendance, oil, waste and supplies. To make this definite,

if the whole steam plant were used for power only, and consisted of a first-class condensing Corliss engine with electric generator, the costs would be as follows:—

Estimated Cost of 1,000 I.H.P. Steam Plant.

Engine and condenser at.....	\$20 00	\$20,000 00
Foundations	5 50	5,500 00
Electric generators	12 00	12,000 00
Boilers	7 50 per I.H.P.	7,500 00
Smoke flue	75 " "	750 00
Chimney	2 50 " "	2,500 00
Heater	1 00 " "	1,000 00
Pumps	50 " "	500 00
Buildings	20 00 " "	20,000 00

\$69,750 00

Cost per indicated H.P..... 69 75

The costs of operation were estimated as follows:—

Fixed charges, 13 per cent. of \$69.75.....	\$ 9 07
Attendance	3 21
Oil, waste and supplies.....	20
	<hr/>
	\$12 48

Cost of coal, including banking, and assuming a good bituminous coal, was estimated as follows:—

One I.H.P. x 1.75 lbs. x 9 hrs. x 310 ds. = 2.441 tons.
2,000 lbs.

2.441 tons at \$2.75 (the local price).....	= \$ 6 71
Add from fixed and operating costs.....	12 48

Total cost of steam power per I.H.P. per year.... \$19 19

This figure would reduce to about \$18 per I.H.P. when heating and cooking were charged with their proper share of the fixed charges and attendance.

The true cost of purchased power was estimated as follows, after reducing \$27 at the switchboard to the cost per indicated horse-power, or $\$27 \div 0.85 = \22.95 . The figures were, of course, based on the assumption that, while power was purchased, an independent plant capable of running the whole factory would also be installed.

Summary of Total Cost of Power.

	Per I.H.P. per year.
Purchased power	\$22 95
Fixed charges on own steam plant.....	9 07
Attendance on own steam plant, say.....	75
Oil, waste and supplies	05
Coal	1 00
	<hr/>
	\$33 82

This figure, \$33.82, can properly be compared with \$19.19 for the cost per I.H.P. from an independent steam plant, or with \$18 for the steam plant, if allowance for division of the steam charges is made. From this comparison it was clear that the company would effect a great economy by installing an adequate, economical steam plant and discontinuing the purchase of electric power.

METHOD OF DESIGNING A LONG SPAN CONCRETE GIRDER.

The Pierce Arrow Motor Car Company, Buffalo, N.Y., desired a clear floor space from wall to wall in their new garage located at their Buffalo works. Their cars have an exceptionally long wheel base, and it would greatly facilitate the handling of same to have a garage in which there were no columns. As the new garage was a continuation of the one already built the width was fixed at 54 feet 4 in-

ches from centre to centre of the supporting columns. The designing engineers, Messrs. Lockwood, Greene & Company, worked out two types of clear span roof supports, (1) a plate girder encased in concrete, and (2) a simple reinforced concrete beam. The preliminary estimates showed the relative cost to be in favor of the latter type.

The roof girders were spaced 13 feet 6 inches on centres with a roof slab of concrete 5 inches thick. The total weight supported by each girder, allowing a live load of 40 lbs. per sq. ft., is 118,062 lbs.

The maximum tension on the steel allowable is taken at 16,000 lbs. per sq. in.; the maximum compression on the extreme fibre of the concrete as 650 lbs. per sq. in.; the ratio of the moduli of elasticity of steel and concrete as 15,

and the bending moment, $M = \frac{WL}{8}$.

The width of the girder was determined by the width of the column, 16 inches, and the depth at the support was de-

termined by the equation $\frac{W}{2} \times \frac{1}{\text{Area of cross section}} = 120$.

the maximum shearing stress allowable on the concrete being 120 lbs. per sq. in., with proper web reinforcement. This would give a girder 30.7 inches deep at the column which with a roof pitch of $\frac{5}{8}$ of an inch per foot would be 47.6 inches deep at the centre.

The preliminary figures showed that with this depth of girder there would be an excessive compressive stress on the concrete at the centre of the girder unless some method were devised for transmitting the compression stress over a wide area of the Tee section at the slab. This was accomplished by haunching the girder so that the slab at the sides of the girder was 15 inches thick, reducing to 5 inches at a point which made the total Tee section 64 inches wide.

Under these conditions the amount of steel required would be determined by the following equation:

$$M = \frac{fs(d-1/2t)}{2}$$

The bending moment in inch pounds = 9,616,150 lbs.

This gives 15 sq. in. as the amount of steel necessary.

The reinforcement chosen was $5/1\frac{1}{4}$ in., $5/1\frac{1}{8}$ in., and $5/1$ in. round rods with a total sectional area of 15.033 sq. in. With this amount of steel the actual fibre stress on the steel with maximum loading would be 15,640 lbs. per sq. in. These rods were placed in three layers, the $1\frac{1}{4}$ in. rods in the lower layer, the $1\frac{1}{8}$ in. rods in the middle layer, and the 1 in. rods in the top layer, there being at least one diameter of concrete between the rods.

The maximum compressive stress with a beam designed as above would be $M = \frac{1}{2} fs \times b \times t(d-1/2t)$.

$$fs = \frac{9,616,150 \times 2}{64 \times 12 (47\frac{1}{2} \times 12)} = 609 \text{ lbs. per sq. in.}$$

All the rods, except three in the bottom row, are bent to take any diagonal tension. The point where the first rods were bent was taken at a point where the shear equalled 50 lbs. per sq. in., and there were six other bend points determined by the usual angletical methods. One feature which should be noted in connection with the diagonal rods, is the bending of the four outer sets in a different plane from the three inner sets, by this means furnishing reinforcing in two diagonal planes in the section of the beam nearest the support.

The stirrups used were $\frac{1}{2}$ -inch rounds, and the spacing determined by the formula

Area of stirrups at section \times fs.

Width of beam \times (actual shearing — 50 lbs. per sq. in. shear)
In this case at the support the stirrups would be spaced
 $2 \times 0.196 \times 16,000$

$$= 5 \text{ in.}$$

$$16 \times (118-50)$$

and at 14 ft. from the centre,

$$2 \times 0.196 \times 16,000$$

$$= 13 \text{ in.}$$

$$16 \times (53-50)$$

As in the determination of the bend points for the horizontal rods, 50 lbs. per sq. in. is considered as the maximum shearing stress allowable without reinforcing for diagonal cracks.

The question of bond stress does not have to be considered in this girder as the reinforcing rods are buried more than sixty diameters beyond the point of maximum tension and the beam is figured as a simple and not a continuous girder.

This girder was designed by Lockwood, Greene & Co., Boston, Mass., the architects and engineers for the entire Pierce Arrow Motor Car Company's Buffalo plant.

RUST, AS SHOWN IN THE REMOVAL OF A SEVENTEEN-STOREY BUILDING.*

By T. Kennard Thomson, M. Am. Soc. C. E.

The Gillender Building, a seventeen-storey structure at the north-west corner of Wall and Nassau Streets, New York City, was built in 1896, and removed in 1910.

When built, all the columns were encased in solid brickwork. The steelwork received one coat of paint in the shop and two after erection, but on removal, showed little evidence of ever having been painted at all.

From the top to the bottom, wherever the spaces between the brick and steel were filled with Portland cement mortar, there was no rusting, but, wherever the mortar did not fill such spaces completely, rusting had begun. Generally, the under sides of the top and bottom flanges of the floor-beams had begun to show rust, while the web and upper surfaces, having been in contact with mortar, were in good condition.

The worst rusting of all was from the sixth floor down, on the north-east corner, where the columns had been against the adjoining building, on the north side. The cover-plates of these columns looked as if they had never been painted, but had stood in the open, exposed to all weather, for 6 or 7 years. On these columns one-half, in volume, of many rivet heads could easily be removed.

This building had been erected by first-class contractors and with first-class materials; and although the rusting had not yet made the building unsafe, there is no telling how soon it would have become so.

It would seem that if the columns had been encased and filled with wet concrete there would have been little danger of rust, and they could thus have been easily protected from electrolysis. Oil or oil paints should not be placed on steel to be thus encased.

Messrs. Trowbridge and Livingston are the architects for the thirty-nine-storey Bankers' Trust Building which will take the place of the Gillender Building, and Messrs. Marc Eidlitz and Son are the contractors, to whom the writer gives his thanks.

* Paper presented to the American Society of Civil Engineers.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

11638—September 13—Authorizing the C.P.R. to construct bridge No. 80.09 over Potois Creek on the North Bay Subdivision, Lake Superior Division of its line of railway.

11639—September 13—Authorizing the G.T.R. to construct bridge over road allowance between Lots 89 and 90, Concession 1, Township Tiny.

11640—September 13—Extending the time within which C.P.R. was directed, in Order No. 10707, to install bell at Maple Street Crossing, Hartland Village, N.B., until September 30th, 1910.

11641—September 13—Extending the time within which the C.P.R. was directed, in Order No. 10682, to install bell at Foundry Street Crossing, town of Woodstock, N.B., until September 30th, 1910.

11642—September 13—Authorizing the G.T.R. to construct bridge over road allowance between Lot 93, Concession 1, and Lot 93, Concession 2, Township of Tay.

11643—September 7—Ordering the C.P.R. to re-open the crossing where its line of railway crosses the farm of A. D. Hartley, East Florenceville, N.B., about one mile south of Florenceville Station.

11644—September 6—Authorizing the C.N.R. (successor by amalgamation to the Alberta Midland Railway Company) to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 11, T. 25, R. 26, west 4th Meridian, Alberta.

11645—September 7—Authorizing John A. Thompson, of Moorefield, Ont., to lay and thereafter maintain a one-inch water pipe under the lands and tracks of the G.T.R. on the west ½ of Lot 11, Concession 9, Township Maryborough, Ontario.

11646—September 7—Authorizing the G.T.R. to reconstruct bridge No. 50 over the Conestoga River, one-half mile north of Moorefield, on the 22nd District.

11647—September 13—Extending the time within which the Toronto, Hamilton & Buffalo Railway Company were directed in Order No. 9026, to construct a highway bridge carrying the line of Garth Street in the city of Hamilton, until October 15th, 1910.

11648—September 13—Authorizing the Corporation of the city of Peterborough, in the Province of Ontario, to lay and thereafter maintain a sewer and a drain pipe under the track of the Grand Trunk Railway, where the same crosses Romaine Street, Peterborough, Ontario.

11649—September 13—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain its transmission line across the wires of the Bell Telephone Company at James Street, Hamilton, Ontario.

11650—September 13—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain transmission line across the track and wires of the Galt, Preston & Hespeler Electric Railway Company at North Water Street and Macadamized Road, Galt.

11651—September 13—Authorizing the Volcanic Oil & Gas Company to lay and thereafter maintain a three-inch gas pipe, to convey natural gas under the track of the C.P.R. at a point where the same crosses the Belle River Road, east of Belle River Station, County of Essex, Ontario.

11652—September 8—Authorizing the C.P.R. to construct bridge over new yard in the city of Calgary, shown on plans on file with the Board under file No. 15542.

11653—September 14—Approving of the location of Young-Prince Albert Branch of the G.T.P. Branch Lines Company, from Section 31, Township 40, Range 26, west 2nd Meridian, to Prince Albert, District of East Saskatchewan, Saskatchewan, mileage 55.148 to mileage 111.536.

11654—September 13—Authorizing the C.P.R. to construct, maintain and operate an industrial spur from a point on the right-of-way of said railway near the east boundary of Roseberry Street, thence southerly and westerly to the east boundary of Tenth Street, also four sub-spurs from the last-mentioned spur in Blocks 70, 71, and 72, lying between Pacific Avenue and Rosser Avenue, Brandon, Man.

11655—September 14—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 6 and 7, Concession A, Township of Haldimand, County Northumberland, at Station 631.80.

11656—September 14—Authorizing the Water Supply Committee of the town of Grand Falls, Province of New Brunswick, to lay and thereafter maintain a water pipe under the main line and siding of the C.P.R. at Broadway, Grand Falls.

11657—September 14—Authorizing the Ontario Power Company of Niagara Falls, to erect, place and maintain electrical transmission line across the track of the G.T.R., Welland Division, south of Crowland Road, Lot 23, Concession 7, Township of Crowland, County Welland, Province of Ontario.

11658 to 11661 Inc.—September 14—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain transmission lines across the wires of the Hamilton Radial Electric Railway Company at Lot 32, Concession 1, Township Saltfleet, Ont., across the wires of the Bell Telephone Company, at Lot 2, Concession 2, Township Waterloo, County Waterloo, Ont., across the wires of the Bell Telephone Company at Allen Street, town of Waterloo, across the wires of the Bell Telephone Company at Lot 20, (Snyder Road), Township Waterloo, County Waterloo, Ont.

11662—September 15—Approving of the application of the C.N.O.R. for approval of the station building at Brighton, Ontario.

11663—September 15—Declaring that the crossing of Main Street, by the track of the G.T.R. in the town of Glencoe, Ontario, is protected to the satisfaction of the Board; and ordering that Order No. 11443 be rescinded.

11664—September 14—Approving of application of the C.N.O.R. plans of strain sheets for 100-foot girder span across Factory Creek, on its Toronto-Ottawa line.

11665—September 14—Authorizing the C.N.Q. Railway Company to join its lines or tracks with the lines or tracks of the National Transcontinental Railway by connecting spur, west of the River Charest.

11666—September 15—Approving of the application of the G.T.P. Branch Lines Company location of its station at New Norway, on its Tofield-Calgary Branch, in Section 11, Township 45, Range 21, west 4th Meridian.

11667—September 15—Approving of the application of the G.T.P. Branch

Lines Company's station at Duhamel, on its Tofield-Calgary Branch, in Sections 34 and 27, Township 45, Range 21, west 4th Meridian.

11668—September 15—Approving of the application of the G.T.P. Branch Lines Company's station at Kingman, on its Tofield-Calgary Branch, Section 8, Township 49, Range 19, west 4th Meridian.

11669—September 14—Authorizing the C.P.R. to construct, maintain and operate two industrial spurs for the Globe Elevator Company, near Calgary Junction, on the said railway, being in the N.W. ¼ of Sec. 1, T. 24, Range 1, west 5th Meridian, Alberta.

11670—September 15—Extending the time within which the C.P.R. were directed, by Order 10707, to install electric bell at the crossing of Maple Street, village of Hartland, N.B., until 30th September, 1910.

11671—September 15—Relieving the C.P.R. from providing further protection, for the present, at the crossing 1¼ miles west of Michel, B.C.

11672—September 15—Authorizing the Board of Light and Heat Commissioners of the city of Guelph, to lay and thereafter maintain a gas main under the track of the G.T.R. where the same intersects the roadway known as Woolwich, in the city of Guelph.

11673—September 14—Authorizing the Mt. Stephen Mining Syndicate to lay and thereafter maintain an iron pipe under the track of the Canadian Pacific Railway, at a point 875 feet east from 13.1 tunnel at Mt. Stephen, 3 miles east of Field, B.C.

11674—September 13—Amending Order No. 10344 by deleting the clause that the Township of Ops build the approaches to the bridge, 2 miles west of Lindsay, Ont., and apportioning the cost of constructing the bridge as follows: 20 per cent. to be paid by the Township, 20 per cent. out of the Railway Grade Crossing Fund, and remainder by the G.T.R.

11675—September 16—Authorizing the Montreal Light, Heat & Power Company to lay and thereafter maintain a gas pipe under the track of the C.P.R. on St. Denis Street, Montreal.

11676—September 15—Authorizing the C.N.O.R. to construct its line of railway across the side road between Lots 18 and 19, Concession 1, Township Sidney, County Hastings, Ontario.

11677—September 15—Authorizing the C.N.O.R. to construct its line of railway across the side road on Lot 32, Concession 1, Township Sidney, County Hastings, Ont.

11678—September 15—Authorizing the C.N.O.R. to construct its line of railway across the side road between Lots 30 and 31, Concession 1, Township Sidney, County Hastings, Ont.

11679—September 15—Authorizing the C.N.O.R. to construct its line of railway across the side road in Lot 12, Concession 1, Township Sidney, County Hastings, Ont.

11680—September 15—Authorizing the C.N.O.R. to construct its line of railway across side road between Lots 7 and 8, Concession 1, Township Sidney, County Hastings, Ontario.

11681—September 15—Extending the time within which the city of Montreal may construct a tunnel under the track of the C.P.R. at St. Lawrence Boulevard Crossing until the 1st day of December, 1910.

11682—September 16—Authorizing the Esquimalt & Nanaimo Railway Company to operate bridges Nos. 29.8, 35.6, 39.3, 4.79, 65.1, 87.12, and 87.37; also rescinding Order No. 11407.

11683—September 16—Authorizing the Esquimalt & Nanaimo Railway Company to operate bridges at miles 26.8, 28.2, 28.4, and 28.6; and rescinding Order No. 6611.

11684—September 16—Authorizing the C.N.O.R. to reconstruct the eastern approach of the bridge over the Ottawa River, near Hawkesbury, by the erection of a 30 and 85-foot place girder span.

11685—September 16—Authorizing the G.T.R. to construct, maintain and operate certain lines of railway, or sidings, with spurs therefrom from a point on the Sixteenth District of its railway west of Sherman Inlet, Hamilton, thence extending northerly and crossing Gilkinson Street to and into the premises of the Oliver Chilled Plow Works of Canada, Limited.

11686—September 15—Authorizing the C.N.O.R. to construct its line of railway across the side road between Lots 3 and 4, Concession 1, Township Sidney, County Hastings.

11687—September 17—Approving of the location of the C.P.R. Company's new station building at Strongfield, Sask., on the Moose-Jaw North-Westerly Branch of its railway.

11688—September 16—Extending the time within which the C.P.R. were directed, in Order No. 1103, to install an electric bell at the crossing of the highway at Weston, Township York, Province Ontario, until the 30th September, 1910.

11689—September 16—Directing that the C.P.R. be relieved from providing, for the present, further protection at the crossing of the highway known as the Eaton Road, at mileage 52.09, Brighton Station, Quebec.

11690—September 16—Directing that the G.T.R. be relieved from providing, for the present, further protection at the crossing of Ontario St., Cobourg, being the second level crossing west of Cobourg station, Ontario.

11691 to 11695 Inc.—September 17—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain transmission line across the wires of the Bell Telephone Company at Joseph Street, in Preston, Ont., at Lot 20, Snyder Road, Township Waterloo, County Waterloo, Ontario; at Strange Street, Berlin, Ontario; at Lot 21, Concession 1, Township North Oxford, Province Ontario; at Mill Street, Woodstock, Ont.

11696—September 16—Authorizing the city of Toronto to construct a sewer between Sunnyside and Roncesvalles Avenue, across the lands and under the tracks of the G.T.R.

11697—September 15—Authorizing W. P. Ferris, of St. Williams, to lay and thereafter maintain a drain under the track of the South Norfolk Branch of the G.T.R., where the same crosses the 2nd Concession, Township Walsingham (South), opposite Lot No. 23, in the 2nd Concession of said township.

11698—September 16—Authorizing the Provincial Natural Gas and Fuel Company, of Ontario, to lay and thereafter maintain a three-inch pipe line to convey natural gas under the track of the G.T.R., where the same crosses the public road known as the town-line between the Township of Humberstone and Crowland, County Welland, Ontario.

11699—September 17—Authorizing the town of Montreal East, to lay and thereafter maintain a sewer under the track of the Montreal Terminal Railway Company at Laurendeau Avenue.

11700—September 17—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain transmission wires across the wires of the Bell Telephone Company at Mutual Street, Ingersoll, Ontario.

- 11701—September 17—Authorizing the Guelph Waterworks Department to lay and thereafter maintain a four-inch pipe under the track of the G.T.R. on Liverpool Street.
- 11702—September 17—Authorizing the Guelph Water Works Department to lay and thereafter maintain a six-inch water pipe under the track of the G.T.R. on Glasgow Street.
- 11703 to 11706 Inc.—September 17—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain transmission line across the wires of the C.P.R. at Mutual Street, Ingersoll, Ont.; of the Bell Telephone Company at Queen Street East, in the town of Hespeler, Lot 10, Concession 3, Township Waterloo, Ontario; of the C.P.R. near Beachville Road, Lot 6, B. F. Township West Oxford, Ont.; of the Bell Telephone Company at King Street and William Street, Waterloo, Ontario.
- 11707—September 15—Authorizing the C.N.O.R. to construct its line of railway across the side-road between Lots 24 and 25, Concession 1, Township Sidney, County Hastings.
- 11708—September 19—Authorizing the C.N.O.R. to construct its tracks across Division Street, in the town of Cobourg, Ontario, by means of a subway carrying the said Division Street under its said tracks at the point shown on plan on file with the Board under file No. 3878.43.
- 11709—September 17—Authorizing the C.P.R. to construct, maintain, and operate an industrial spur for Frank Fairey, in Lots 35 to 40, both inclusive, and along the lane at the rear of Lots 32 to 36, both inclusive, in Block 72, of the city of Calgary, Alta.
- 11710—September 13—Rescinding Order No. 10509, dated April 21st, 1910, re subway at Division St., Cobourg, Ont., upon the application of the C.N.O.R.
- 11711—September 13—Approving of the application of the C.N.O.R. for approval of the revised location of its line of railway through the town of Cobourg, Ontario.
- 11712—September 13—Authorizing the G.T.R. to construct, maintain, and operate a branch line of railway or siding from a point on the 20th District of its railway west of Caledonia Station, thence extending in a northerly direction across the right-of-way lands of the Toronto & Niagara Power Company on Lot No. 10, Range 2, Township of Seneca, County Haldimand, Ontario, to premises of Caledonia Gypsum Company.
- 11713—September 13—Authorizing the G.T.R. to construct, maintain and operate a branch line of railway, or siding, and spur therefrom from a point on the 20th District of its railway west of Caledonia Station, thence extending in a north-easterly direction across the right-of-way lands of the Toronto & Niagara Power Company, on Lot 11, Range 2, Township Seneca, County Haldimand, Ont., to and into the premises of the Alabastine Company, Paris, Ont.
- 11714—September 15—Approving of the application of the C.N.O.R. for approval of station building at Don Junction, Ontario.
- 11715—September 19—Authorizing the Essex Terminal Railway to construct, maintain and operate a branch line of railway through portions of the town of Walkerville, and the city of Windsor, Ont.
- 11716—September 20—Authorizing the town of Montreal East, Que., to lay and thereafter maintain a sewer pipe under the track of the Chateaugay & Northern Railway, at Laurendeau Avenue.
- 11717—September 20—Authorizing the C.P.R. to construct bridge No. 71.53, North Bay Subdivision, Lake Superior Division.
- 11718—September 20—Ordering that, for the present, the G.T.R. be relieved from providing further protection at the crossing of the highway, being the first level-crossing east of the station at Seguin Falls, Ontario.
- 11719 to 11722 Inc.—September 19—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Abel's Lane, London; at lane on Pipe Line Road, London; at Pipe Line Road and Johnston St., London; and at entrance to Springbank Park, in the city of London, Ont.
- 11723—September 13—Authorizing the C.N.O.R. to construct its lines and tracks across the lines and tracks of the C.P.R. near Chaudiere Junction.
- 11724—September 13—Approving of the application of the C.N.O.R. for approval of the location of its line of railway through the Township Gloucester, County Carleton, mileage 0 to 5.3.
- 11725—September 20—Authorizing the G.T.P. to construct, maintain and operate an industrial spur track from its Main Line south of the crossing of the Wetaskiwin Branch of the C.P.R. across Railway Avenue and Alberta Avenue to Third Street, in the town of Camrose, Alta.
- 11726—September 19—Approving the location of G.T.R. proposed station and freight house and rearrangement of tracks at Hawkesbury, Ont.
- 11727—September 9—Refusing the application of the St. Mungo Cannery Company, of New Westminster, B.C., for an Order directing the Vancouver Victoria and Eastern Railway and Navigation Company, to provide shipping facilities by railroad from the St. Mungo Cannery, situate on Subdivision Three, Lot 18, Group 2, New Westminster District, B.C.
- 11728—September 9—Ordering the Vancouver, Victoria and Eastern Railway and Navigation Company to construct wooden bridges over their cutting, where the same intersects Lakewood Drive, Woodland Drive, and Broadway, in the city of Vancouver, within six months from date of Order: same to be constructed in all respects in compliance with plans to be approved by an Engineer of the Board.
- 11729—September 9—Refusing the application of the Municipal Corporation of the Township of Sumas, B.C., for an order directing the C.P.R. and the V.V. & E. Railway and Navigation Company to provide offices on the Canadian side of the International Boundary line, in the townsite of Huntingdon, District of New Westminster, B.C.
- 11730—September 9—Refusing the application of the city of Vancouver, for approval of plans and mode of crossing the tracks of the C.P.R. at Clarke Drive, in the city of Vancouver, B.C.
- 11731—September 6—Approving of the application of Fred. Allen and Mary Allen, for an Order approving of the extension of the C.P.R. tracks from the boundary of Lot 7, Block 54, Subdivision 185, Vancouver, B.C., up to which point said tracks are now laid across Lots 7 and 8, in said Block and Subdivision for the purpose of getting trackage to wharves already constructed on said Lots.
- 11732—September 6—Approving of the application of the Vancouver, Victoria and Eastern Railway and Navigation Company for approval of a branch line from a point on the Company's Main Line in the town of Huntingdon, B.C., to the International Boundary.
- 11733—September 9—Permitting the Western Canada Power Company to join its tracks with the tracks of the C.P.R. at or near Ruskin, B.C.
- 11734—September 6—Ordering the Vancouver, Victoria and Eastern Railway and Navigation Company to protect the crossing between the city of New Westminster and the towns of Port Moody and Barnet, B.C., being the North Road Railway Crossing.
- 11735—September 20—Amending Order No. 11605, re interlocking plant at crossing of Trans. Ry. and C.N.R. near St. Boniface, Man., by adding the words "maintained and operated" after the words "installed" in the second line of the operative part of said Order.
- 11736—September 20—Amending Order No. 9129, re branch line of C.P.R., in Lot 6, Concession 4, Township of Etobicoke, Ont., by permitting the C.P.R. to put in switches and semaphores which can be operated by hand, and to that end to put a day and night watchman at the point of connection and flag its trains on and off the joint section for a period of three months from the date of this Order.
- 11737—September 20—Authorizing the Hydro-Electric Power Commission of Ontario, to erect, place and maintain transmission wires across the track of the C.P.R. between Lots 157 and 158, Township Stamford, County Welland, Ontario.
- 11738—September 9—Dismissing the application of the Corporation of the city of New Westminster, for a direction that the Vancouver Power Company raise the wires to at least 190 feet above the Fraser River, that have been erected by the company on the bridge over the Fraser River at New Westminster, B.C.
- 11739—September 9—Directing that the Minister of Public Works of the Province of British Columbia be at liberty to construct a highway crossing at a point shown on the plan, over the right-of-way of the C.P.R. east of Kault Station.
- 11740—September 20—Authorizing the Esquimalt & Nanaimo Railway Company to construct, maintain and operate a branch line of railway, or spur, for the Cowichan Creamery Company at Duncan's crossing, Duncan Street, as shown on plan on file with the Board under file No. 15589.
- 11741—September 13—Authorizing the C.P.R. to use and operate jointly and on equal terms with the G.T.R. the branch line of railway, or spur, which the G.T.R. was authorized by Order No. 4816, to construct, from a point on the Mowat Avenue siding, in the city of Toronto, used jointly by said railway companies, to and into the premises of Henry Disston & Sons, on the east side of Mowat Avenue.
- 11742—September 20—Authorizing the Government of the Province of Saskatchewan to construct a highway across the track of the C.P.R. in the S.E. ¼ of Sec. 36, Tp. 1, Range 7, west 2nd Meridian.
- 11743—September 21—Extending the time within which the C.P.R. were authorized in Order No. 11402, to construct, maintain and operate a branch line of railway from a point near Agassiz to a ballast pit in the Province British Columbia, until the 1st June, 1911.
- 11744—September 21—Authorizing the C.P.R. to reconstruct bridge over the public roadway at mileage 70.5, Toronto Subdivision, Ontario Division.
- 11745 to 11749 Inc.—September 21—Authorizing the Simcoe Railway & Power Company to erect, place and maintain transmission wires across the wires of the Bell Telephone Company on road allowance between Concessions 7 and 8, opposite Lot 10, Township Tay, County Simcoe, Ont.; on the given road through Lot 8, Concession 9, Township Tay, County Simcoe, Ont.; on the road allowance between Concession 9 and 10, opposite Lot 9, Township Tay, County Simcoe, Province Ontario; and on the given road through Lot 9, Concession 10, Township Tay, County Simcoe, Ontario.
- 11750—September 9—Ordering that the Vancouver, Fraser Valley and Southern Railway Company be at liberty to carry its tracks over certain highways in the city of Vancouver, named in Order.
- 11751—September 9—Authorizing the Vancouver, Fraser Valley and Southern Railway Company to cross the tracks of the Vancouver, Victoria and Eastern Railway Company in the municipality of Burnaby, B.C.
- 11752—September 9—Authorizing the Vancouver, Fraser Valley and Southern Railway Company to cross, with its tracks, several highways in the townsite of Hastings, B.C.
- 11753—September 9—Authorizing the Vancouver, Fraser Valley and Southern Railway Company to cross, with its tracks, several highways in the municipality of Burnaby, B.C.
- 11754—September 21—Authorizing the Municipal Corporation of the town of Brampton, Ont., to lay and thereafter maintain an eight-inch sewer pipe under the track of the C.P.R., where the same crosses Jessie Street, Brampton, Ont.
- 11755—September 21—Authorizing the Municipal Corporation of the town of Brampton, Ont., to lay and thereafter maintain an eight-inch sewer pipe under the track of the C.P.R., where the same crosses Railroad Street, Brampton, Ontario.
- 11756 to 11760 Inc.—September 21—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the track of the G.T.R. at Beachville, Lot 23, Concession 1, Township North Oxford, Ont., at Mutual Street, Ingersoll, Ont., and to erect, place and maintain its transmission wires across the wires of the Bell Telephone Company, at Lot 50, U Block, Township Waterloo, County Waterloo, Ont.; at the city of Berlin, Township Waterloo, County Waterloo, Ont., and at the town of Preston, Township Waterloo, County Waterloo, Ont.
- 11761—September 21—Authorizing the Municipal Corporation of the town of Irvine, Alta., to construct a highway across the right-of-way of the C.P.R. at Dunmore Street, Irvine, Alta.
- 11762—September 8—Authorizing the Provincial Government of British Columbia to open Seventh Street, Township of Sumas, B.C., across C.P.R. right-of-way; to extend "C" Street northerly across the "Y" of the C.P.R. The C.P.R. agreeing to open International Avenue across its right-of-way, and to remove all buildings necessary to afford a proper crossing. The Provincial Government to pay for work in connection with the opening of International Avenue and removal of buildings.
- 11763—September 9—Dismissing the application of the Board of Trade for the District of Burnaby, in the Province of British Columbia, for relief in the matter of freight rates charged by the Great Northern Railway, from Vancouver to points between that city and New Westminster, B.C.
- 11764—September 22—Extending the time within which the G.T.R. were authorized, in Order No. 9344, to construct, maintain and operate a branch line of railway in the town of Goderich, until the 21st December, 1910.
- 11765—September 13—Approving of the proposed separation of grades at crossing by the C.P.R. over Yonge Street and Avenue Road, in the city of Toronto, Ont.

11766—September 22—Ordering that within ninety days from the date of this Order, the Railway Company shall install a Whyte Signal Electric bell at the crossing of the public road by the track of the Guelph & Goderich Branch of the C.P.R., between Moffatt and Corwin Stations.

11767—September 23—Limiting the speed of the trains of the C.P.R. over the portion of its line of railway known as the Kipp-Aldersyde Branch, from mileage 0 to mileage 28.2, to twenty miles an hour.

11768—September 22—Authorizing the corporation of the town of Paris to erect, place and maintain power wires across the track of the G.T.R. from a point on Broadway Street south of the depot to a point on Broadway Street north of the depot at the east end of the G.T.R. station, in the town of Paris.

11769—September 21—Authorizing the Ontario Power Company of Niagara Falls, Ontario, to erect, place and maintain wires for the transmission of electrical energy across the track of the Michigan Central Railroad Company, Buffalo Branch, between Lots 22 and 23, Concession 7, Township of Crowland, County Welland, Ontario.

11770—September 23—Approving of the application of the approval of the location of its line of railway from Red Deer easterly, a distance of forty miles, as shown by plan on file with the Board under file No. 14997.1.

11771—September 23—Authorizing the Niagara, St. Catharines & Toronto Railway to construct, maintain, and operate a spur on Pine and Water Streets, in the town of Thorold, through a portion of the property of the Montrose Paper Mills, Limited.

11772—September 24—Authorizing the Canadian Niagara Power Company to erect, place and maintain wires across the wires of the Bell Telephone at junction of Courtwright and Robinson Streets, Bridgeburg, Ontario.

11773—September 24—Extending the time for publishing and filing the said revised westbound tariff until the 1st November, 1910.

11774—September 23—Authorizing the Simcoe Railway & Power Company to erect, place and maintain transmission wires across the wires of the Bell Telephone on the road allowance between Concession 2 and 3, opposite Lot 17, Township Tay, County Simcoe.

11775—September 23—Authorizing the Water Commissioners for the city of London, to erect, place and maintain electric wires across the wires of the G.N.W. Telegraph Company at the corner of Colborne and York Streets, in the city of London, County of Middlesex.

11776—September 23—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the track of the Grand Trunk Railway Company at Lot 32, Concession 1, Township Saltfleet.

11777—September 23—Authorizing the Simcoe Railway & Power Company to erect, place and maintain transmission wires across the wires of the Bell Telephone Company on the road allowance between Concessions 4 and 5, opposite Lot 15, Township Tay, County Simcoe.

11778—September 23—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission wires across the wires of the G.T.R. at station grounds in the Township of New Hamburg.

11779—September 23—Relieving the C.P.R. for the present, from providing further protection at the crossing of the highway two miles east of Methven, in the Province of Manitoba.

11780—September 23—Approving of the application of the Algoma Central and Hudson Bay Railway for approval of its Standard Passenger Tariff C.R.C. No. 41, providing a maximum passenger toll between all stations on its line of railway of four cents per mile or fraction thereof.

11781—September 23—Authorizing the construction of a drain under the right-of-way of the G.T.R., known as the "Pierce Award Drain," in the 7th Concession of the Township of Malahide, Ont.

11782—September 24—Authorizing the G.T.R. to construct the branch line of railway, or siding, on Mowat Avenue, in the city of Toronto, authorized by Order No. 4816, dated May 19th, 1908, between the points lettered "E" and "F" as shown in full green lines on the plan on file with the Board under file No. 15485, instead of between the points lettered "E" and "F" as shown on the plan on file with the Board in connection with the said Order No. 4816.

11783—September 24—Authorizing the G.T.R. to construct, maintain and operate a branch line of railway, of siding, from a point on the siding on Mowat Avenue, Toronto, which the C.P.R. was authorized to construct by Order No. 4816, thence extending southerly along, upon and across Mowat Avenue, and upon Lots 44, 43, 42, 41, 40, 39, 38, and 37, on the east side thereof to and into the premises of H. Disston & Sons; that the C.P.R. have the right to use and operate jointly and on equal terms with the G.T.R. the said branch line or siding; that G.T.R. construct and complete said branch line within three months from the date of this Order.

11784—September 24—Authorizing the town of Swift Current, Sask., to lay and thereafter maintain a water main under the track of the C.P.R. at the point and as shown on the plan and profile dated August 30th, 1910, on file with the Board under file No. 15685.

11785 and 11786—September 24—Authorizing the Burroughs Falls Power Company, Limited, to erect, place and maintain electric wires under the track of the Boston and Maine Railway Company at crossing south of Ayer's Cliff Station, Ont., and at the crossing north of Ayer's Cliff Station, Ontario.

11787—September 24—Authorizing Matt. Richardson to lay and thereafter maintain a one-inch gas pipe under the track of the Grand Trunk Railway, on the town-line between the County of Brant and the County of Haldimand, in the Township of Seneca.

11788—September 24—Authorizing the Water Commissioners for the city of London, Ontario, to erect, place and maintain electric wires across the wires of the Bell Telephone Company at intersection of Beaconsfield Avenue and Wharrincliffe Road, London.

11789—September 26—Approving of the application of the C.N.R. for approval of standard building plans for structures to be built on its line of railway, Toronto-Ottawa Section.

11790—September 26—Approving of the application of the Niagara, St. Catharines & Toronto Railway for approval of its Standard Passenger Tariff C.R.C. No. 13, applying a rate of three cents per mile, or fraction thereof, between all points on the Applicant Company's line of railway.

11791—September 24—Approving of the application of the C.N.R. for approval of the location of its railway between Edmonton and Camrose, mileage 0 to 44.49, through Townships 47-52, and Ranges 20-24, west 4th Meridian.

11792—September 24—Amending Order No. 11228, by substituting the words "Medicine Hat" for the word "Lethbridge" where it occurs in said Order, made upon the application of the C.P.R.

11793—September 26—Approving of the application of the C.N.O.R. for approval of the station building to be erected at Port Hope.

11794—September 26—Authorizing the C.N.O.R. to construct its line of railway across the public road known as Quetton Street, in the village of Washago, Township of North Orillia, County Simcoe, Ontario.

11795—September 26—Sanctioning and approving of the application of the C.N.O.R. for sanction and approval of the location of part of its Sudbury-Port Arthur Division through unsurveyed territory in the Sudbury Mining Division, District of Algoma, Province of Ontario, mile 220 to mile 240 from Sudbury Junction.

11796—September 26—Approving of the application of the C.N.O.R. for approval of the station building to be erected at Cobourg, as shown on the plans dated July, 1910.

11797—September 26—Relieving, for the present, the G.T.R. from providing further protection at the crossing of the highway at Park Hill, mileage 133 1/4, Concession 21, Township West Williams, County Middlesex, Ontario.

11798—September 26—Authorizing the C.N.O.R. to construct its lines and tracks across the lines and tracks of the spur line from the Grand Trunk Railway to the Lehigh Valley Cement Works, subject to certain conditions named in Order.

11799—September 26—Authorizing the Toronto, Hamilton & Buffalo Railway Company to change the signalling system where the Applicant Company's main line of railway crosses that of the Northern & North-Western Division of the G.T.R., east of Victoria Avenue, south, Hamilton; and that the Applicant Company operate its trains over the said crossing at a speed limit of ten miles an hour.

11800—September 26—Authorizing the C.N.O.R. to construct its lines and tracks across the lines and tracks of the spur line from the G.T.R. to the Belleville Cement Works, Point Anne, subject to certain conditions named in Order.

RAILWAY EARNINGS: STOCK QUOTATIONS.

The following table gives the latest traffic returns it is possible to obtain at the time of going to press:

Road	Wk ended	1910	Previous week	1909
C. P. R.	Sept. 30	\$2,933,000	\$2,029,000	\$2,763,000
G. T. R.	Sept. 30	1,237,013	949,498	1,179,150
C. N. R.	Sept. 30	453,300	282,300	375,900
T. & N. O.	Sept. 30	33,503	25,022	50,050
Hal. Elec.	Sept. 30	6,775	4,479	7,863

Figures showing the earnings of Canadian roads since July 1st, this year and last, are appended:

Road	Mileage	July 1st to	1910	1909
C. P. R.	10,326	Sept. 30	\$26,701,000	\$15,300,000
G. T. R.	3,536	Sept. 30	11,116,111	11,301,982
C. N. R.	3,180	Sept. 30	3,598,000	2,727,400
T. & N. O.	264	Sept. 30	334,589	437,527
Hal. Elec.	13.3	Sept. 30	66,093	62,500

Stock quotations on Toronto, Montreal and London exchanges, and other information relative to the companies listed in the above tables, are appended. The par value of all shares is \$100.

Co.	Capital. 000's	Price Sept. 30 1909.	Price Sept. 22 1910.	Price Sept. 29 1910.	Sales last week.	
C. P. R.	\$150,000	186 3/4	186 5/8	191 1/2	190 1/2	1,307
Mont. St.	18,000	214 1/2	214	242	238 1/2	245
Hal. Elec.	1,400	118	115 1/2	130	125	129
Tor. St.	8,000	126 1/2	126	125	124 1/2
G. T. R.	226,000	1st pfd., 110 1/2	2nd pfd., 57 5/8	57 5/8	com. 27 3/8

CANADIAN PACIFIC RAILWAY, IN A STATEMENT FOR AUGUST AND TWO MONTHS OF THE FISCAL YEAR, SHOWS ENORMOUS INCREASE IN EARNINGS.

The gross earnings for August are \$9,255,331, and for the two months of July and August, \$18,124,545 while the working expenses for the two periods, respectively, were \$5,563,650 and \$10,948,254. The net profits in August of last year were \$2,964,057, and in the present year, \$3,691,672, an increase of \$727,614.

For the months of July and August, last year, the net profits were \$5,443,928, and for the same period of the present year, \$7,176,291, being an increase of \$1,732,363.

CANADIAN PACIFIC ANNUAL REPORT.

Gross Earnings Aggregated \$94,989,000, Comparing With \$76,313,000 in the Previous Year.

The Canadian Pacific Railway Company has issued its full pamphlet for the year ended June 30, 1910. The detailed income account compares as follows:

Gross earnings:

	1910	1909	1907
Passenger	\$24,812,021	\$20,153,001	\$19,528,878
Freight	60,158,887	48,182,520	45,885,968
Mail ex &c	10,018,582	7,977,800	6,802,681
Total	\$94,989,490	\$76,313,321	\$72,217,527

Operating expenses:

	1910	1909	1907
Traffic	\$ 2,436,651	\$ 2,123,860
Transp	27,425,238	25,568,990	23,765,138
Mt w & str	13,653,938	10,074,049	10,110,957
Mt equip.....	12,567,404	11,080,886	9,083,249
P & sl cars	600,796	461,433	318,824
L & riv st	858,834	758,989	564,552
Gen exp	2,548,800	2,356,403	2,188,857
Com teleg	1,057,783	933,138	882,641
To op ex	\$61,149,534	\$53,357,738	46,914,218
Net earn	33,839,956	22,955,573	25,303,309
Other inc	3,335,712	2,306,488	2,364,451
Tot inc	\$37,175,669	\$25,262,061	\$27,667,760
Charges	9,916,940	9,427,033	8,571,756
Balance	\$27,258,728	\$15,835,028	\$19,156,004
S S repl & pen fund	980,000	880,000	780,000
Surp for div.	\$26,278,728	\$14,955,028	\$18,376,004
Divs.	*12,382,112	11,107,867	9,036,999
S for year	\$13,896,616	\$3,847,161	\$9,339,005

*Includes 4% or \$2,214,933 dividends paid on the \$55,616,666 preference stock, 6½% or \$9,750,000 on \$150,000,000 ordinary stock and \$417,179 interest on instalments on new stock subscriptions paid July 1, 1910. After deducting the preference stock dividends and interest paid on stock subscriptions the balance \$23,646,616 is equal to 15.76% on \$150,000,000 ordinary stock as compared with 8.56% earned on same amount of ordinary stock the previous year. The balance (\$24,063,795) after deducting preference stock dividends but including the \$417,179 interest paid on stock subscriptions is equal to 13.36% on the new capitalization of \$180,000,000 ordinary stock.

The principal traffic statistics compare as follows:

	1910	1909	1907
Miles oper	10,270	9,878	9,153.9
Rev pass carried	11,050,924	9,675,075	8,671,438
Pass car'd 1 mile	*1,341,255	*1,058,913	*1,052,286
Rate per pass per mile	1.81c	1.86c	1.79c
Tons rev frt carried ..	20,551,368	16,549,616	15,733,306
Tons car'd 1 mile	*7,569,824	*6,210,087	*5,789,192
Rate per ton per mile	0.778c	0.76c	0.77c
Av tons rev per car mile	17.46	17.11	16.67

* 000 omitted.

The appropriation made by the Canadian Pacific Railroad Company from surplus for additions and improvements for the year ended June 30, 1910, shows as follows:

Add and improve fund June 30, 1910	\$1,135,721
Prem on sale of \$3,984,000 ordinary stock	2,394,779
Amount appropriated during year	7,000,000
Total	\$10,530,499
Less expended during year included in expenditure on capital account	4,235,079
Add and improve fund, June 30, 1910	\$6,295,421

President Sir Thomas G. Shaughnessy remarks in part as follows:

The sales of agricultural land during the year aggregated 975,930 acres, for \$14,468,564, being an average of \$14.84 per acre. Included in this area were 145,421 acres of irrigated land, which brought \$26.59 per acre, so that the average price of the balance was \$12.78 per acre.

After further surveys and reports the directors have decided that water should be provided for the eastern section of the irrigation block, containing about 1,100,000 acres, before anything is done in the central section, and, as a consequence, they have authorized the execution of the work, which will cover a period of about three years, and will involve an estimated expenditure of \$8,500,000, for which they will ask your approval. The average cost per acre of irrigating this block exceeds by a considerable amount the average in the western section, due to the greater difficulty in reaching the source of water supply, to the mileage of the ditches, namely, 3,500 miles, as compared with 1,600 miles, and to the improved character of the structures, but, in the light of past experience, the directors are confident that the financial and other results will be eminently satisfactory. The money required for this work will, of course, be provided from the accumulated land funds.

An arrangement has been completed for the transfer to your company on demand of practically all of the capital stock of the Dominion Atlantic Railway Company, consisting of £270,000 of preference stock and £230,000 of ordinary stock, at the price of 60% of its face value for the preferred and 20% of its face value for the common shares.

THE ENGINEERS' CLUB OF TORONTO.
96 King St. West.

PROGRAMME FOR OCTOBER, 1910.

THURSDAY, 6th, 8 p.m.

Social Evening. Smoking and Refreshments.

THURSDAY, 13th, 8 p.m.

Discussion on "Technical Education," introduced by Dr. John Galbraith. It is proposed to place the views of the meeting before the Royal Commission on Technical Education.

THURSDAY, 20th, 8 p.m.

Illustrated address on the "St. Andrew's Movable Dam, Winnipeg," by Mr. A. H. Harkness, Consulting Engineer, Toronto.

THURSDAY, 27th, 8 p.m.

Meeting of the Toronto Branch of the Canadian Society of Civil Engineers.

C. M. CANNIFF, President,
15 Toronto St.

R. B. WOLSEY, Secretary,
25 Lowther Ave.

COMING MEETINGS.

Continued from page 474.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—October 10-14. Annual convention at Atlantic City, N.J. Secretary, H. C. Donecker, 29 West 39th Street, New York City.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-14. Annual convention at Erie, Pa. Secretary, A. P. Folwell, 239 West 39th Street, New York City.

RAILWAY SIGNAL ASSOCIATION.—October 11-13. Annual meeting at Richmond, Va. Secretary, C. C. Rosenberg, Bethlehem, Pa.

AMERICAN ELECTROCHEMICAL SOCIETY.—October 13-15. Annual meeting at Chicago, Ill. Secretary, Jos. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—October 18-20. Annual convention at Denver, Colo. Secretary, C. A. Lichty, Chicago and Northwestern Railway, Chicago, Ill.

THE ENGINEERING FEATURES OF HOLLAND.

Mr. W. T. H. Preston, Canadian Trade Commissioner to Holland, contributes a very interesting report written from Amsterdam in September, in which in addition to referring to the agricultural and commercial possibilities, devotes considerable space to public utilities.

Holland covers 12,648 square miles, a little less than half the area of Nova Scotia.

The population of this compact kingdom is 5,700,000. An average of 2,500 emigrate annually, almost entirely to North America. Thirty-one per centum of the adults are engaged in industrial and commercial pursuits, while 600,000 people, over 12 years of age, are agriculturists. There are 180,000 occupiers of land in the Netherlands of one hectare (two and one-half acres) and upwards, and 160,000 of these occupy less than 50 acres in extent. About 90,000 are land owners.

Hollanders are firm believers in preventing public utilities falling under the control of private corporations. The ownership of the railways is about equally divided between the State and Dutch corporations. Many other enterprises are managed either by the State or by provincial or municipal governments.

Government Telegraph System.

The telegraph system is operated by the State, upon the construction of which 7,749,000 gulden (\$3,099,600) has been expended.

The rate is uniform throughout Holland. The first ten words, counting the address and signature, cost 25 cents (10 cents currency). Each subsequent five words cost 5 cents (2 cents currency). Local or city telegrams cost for the first ten words 15 cents (6 cents currency) and each subsequent five words 5 cents (2 cents currency). The telegraph lines aggregate 4,578 miles.

Government Telephone Trunk System.

The trunk lines are operated by the State, upon the construction of which 7,117,000 gulden (\$2,846,800) have been expended.

The charge for the long distance telephone service is uniform, 30 cents (12 cents currency) per conversation of not more than three minutes. The maximum distance served by the State trunk lines is 205 miles, which represents the northern and southern extremities of the kingdom. The trunk lines aggregate 1,808 miles.

In the administrations of both the telegraph and telephone systems provision is made from ordinary receipts for redemption or sinking funds.

Amsterdam Telephone System.

The Amsterdam local telephone service forms part of the municipal administration. The municipality has expended 4,695,697 gulden (\$1,878,279) on construction account. A redemption fund of 2,885,201 gulden (\$1,154,080) is already provided from the general receipts.

The cables are laid under ground. In certain districts they are brought to the surface and distributed from steel towers about 100 feet in height. On December 31st, 1908, the aggregated length of system was 13,698 miles. Since then the mileage has considerably increased.

There is only one rate for office or household services,—90 gulden (\$36.—) per annum, giving a subscriber right to an unlimited number of calls. Subscribers in public places are permitted to allow non-subscribers to use their telephones, for which a charge of five or ten cents (2 or 4 cents currency) for local calls is usually made. The service is under the management of an official appointed by the city council. After providing for interest on the capital expenditure and the usual

charges, including management, depreciation, sinking fund, etc., this service paid to the city treasury last year 100,000 gulden (\$40,000.)

Electricity and Gas.

The corporation of Amsterdam supplies its citizens with electric energy, and also gas for lighting, heating and cooking. The installation of the electric plant entailed an expenditure of 6,947,928 gulden (\$2,779,171).

After providing for the cost of operating, coal for creating energy, maintenance, interest and reserve fund, now amounting to 1,370,275 gulden (\$548,110), on capital expenditure, the sum of 150,000 gulden (\$60,000) was paid to the municipal treasury and 52,900 gulden (\$21,160) in value was supplied for public lighting.

The receipts, exclusive of energy supplied for the purpose of the municipality, amount to 1,410,000 gulden (\$564,000).

Cost of Electric Energy.

Electricity is supplied at following rates per kilowatt hour:—

Lighting—

The first 2,500 kilowatt hours, 15 cents (6 cents currency) per K.W.H.

From 2,500 to 5,000 kilowatt hours, 13 cents (5¼ cents currency) per K.W.H.

Exceeding 5,000 kilowatt hours, 12 cents (4¾ cents currency) per K.W.H.

Power—

The first 2,500 kilowatt hours, 10 cents (4 cents currency) per K.W.H.

From 2,500 to 5,000 kilowatt hours, 9 cents (3¾ cents currency) per K.W.H.

Exceeding 5,000 kilowatt hours, 8 cents (3¼ cents currency) per K.W.H.

The aggregate length of cables is 466,764 metres (291 miles). The weight of the copper wire is 803,546 kilograms or about 1,700,000 lbs.

Public Gas Supply.

The gas is supplied to the public for 7 cents (2.8 cents currency) per cubic metre which is equivalent to about 2 gulden (\$0.80 currency) per 1,000 cubic feet. On construction account 27,026,337 gulden (\$10,810,535) have been expended. The redemption fund from ordinary receipts amounts to 6,697,535 gulden (\$2,679,095).

The net revenue last year from this service after making provision for management, interest, sinking fund, and depreciation was 1,100,000 gulden (\$440,000) exclusive of public lighting to the value of 171,000 gulden (\$68,400.)

Street Railway System.

The Electric Tram System of Amsterdam is owned by the city. It is the usual overhead system and has been in operation for ten years. The wires, except in certain places where the general system is not available, are supported by stays attached to the houses, instead of street poles such as are in use in Canada. Where poles are used, they are iron and not in any way unsightly. The smallest number are erected. The different routes are numbered so that no difficulty is experienced in finding the cars desired.

The ordinary fare is 7½ cents (3 cents currency) or five tickets for 30 cents (12 cents currency). The charge for the shortest distance is 2½ cents (1 cent currency). Ten cents (4 cents currency) pays for the entire distance of the longest route on all of the lines. Tickets may be purchased at 10 cents (4 cents currency) available for transfer to another line or by the same line on the day of issue.

(To be Concluded Next Week).

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.

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, A. W. Campbell; Secretary, P. Gillespie, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

MANITOBA BRANCH.

Chairman, J. E. Schwitzer; 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

OTTAWA BRANCH.

Chairman, W. J. Stewart, Ottawa; Secretary, S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

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 ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

THE UNION OF CANADIAN MUNICIPALITIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Light-hall, K.C., ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Mayor Reilly, Moncton; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

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

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Hopkins, Saskatoon; Secretary, Mr. J. Kelso Hunter, City Clerk, Regina, Sask.

CANADIAN TECHNICAL SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, E. C. Hopkins, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—President, J. L. R. Parsons, Regina; Secretary-Treasurer, M. B. Weeks, Regina

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—President, N. McMurchy; Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, Charles Kelly, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, Gustave Kahn, Toronto; Secretary-Treasurer, R. E. W. Hagarty, 662 Euclid Ave., Toronto.

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto.

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

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

CANADIAN GAS ASSOCIATION.—President, Arthur Hewitt, General Manager Consumers' Gas Company, Toronto; J. Keillor, Secretary-Treasurer, Hamilton, Ont.

CANADIAN GAS EXHIBITORS' ASSOCIATION.—Secretary-Treasurer, A. W. Smith, 52 Adelaide Street East, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. Frank D. Adams, McGill University, Montreal; Secretary, H. Mortimer-Lamb, Montreal.

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, J. Duguid; Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara Falls; Secretary-Treasurer, A. W. Ashton, Ottawa.

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

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, A. D. Campbell; Corresponding Secretary, A. H. Munroe.

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

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian Members of Council:—Prof. F. D. Adams, J. B. Porter, H. E. T. Haultain, and W. H. Miller, and Messrs. W. H. Trewartha-James and J. B. Tyrrell.

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

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C.B.; Secretary, A. A. Hayward.

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

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; Secretary, J. E. Farewell, Whitby.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, H. W. Selby; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5 Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Alfred T. de Lury, Toronto; Secretary, J. R. Collins, Toronto.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, MCGILL UNIVERSITY.—President, H. P. Ray; Secretary, J. P. McRae.

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

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 TECHNICAL SOCIETIES.

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

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Fitchburg, Mass.; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, L. C. Fritch, Chief Engineer, Chicago G. W. Railway; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

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.

AMERICAN SOCIETY OF ENGINEERING-CONTRACTORS.—President, George W. Jackson, contractor, Chicago; Secretary, Daniel J. Hauer, Park Row Building, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. J. W. Alvard, President; J. H. Warner, Secretary.

COMING MEETINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Ottawa Branch, 177 Sparks Street, October 12, 1910. Programme, H. J. D. Ross, A.M., Can. Soc., C.E. Subject: Inspection. Secretary, S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

NEW YORK CEMENT SHOW.—December 14-20, 1910. First annual convention in Madison Square Garden, New York. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

CHICAGO CEMENT SHOW.—February 15-23, 1911. Fourth annual exhibition, at the Coliseum, Chicago, Ill. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-16. Seventeenth annual convention, Eric, Pa. Prescott Folwell, Secretary, 239 W. 39th Street, New York, N.Y.

Continued on page 472.

TORONTO, CANADA, OCT. 6, 1910.

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AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The American Society of Municipal Improvements will hold their seventeenth annual convention at Erie, Pa., Oct. 11th to 14th.

From the following program it will be seen that very interesting discussions will take place.

TUESDAY, OCTOBER 11.

Morning Session.

10 a.m.—Meeting of Executive Committee at Headquarters, Reed House.

11 a.m.—Convention called to order. Address of welcome on behalf of the city of Erie, by His Honor, M. Liebel, Jr., Mayor.

Response by Julian Kendrick, President of the Society
Regular order of business.

Afternoon Session.

2 p.m.

Report of the Committee on Sewerage and Sanitation.
By George C. Whipple, Consulting Sanitary Engineer, New York, Chairman.

“Present Use of the Septic Tank.”

By H. N. Ogden, Professor of Sanitary Engineering, Cornell University.

“Municipal Sanitation in Cuba.”

By R. Winthrop Pratt, Engineer, Ohio State Board of Health.

“Construction of Exposed Sewers at Leavenworth, Kan.”

By Joseph O’Neil, City Engineer of Leavenworth.

Report of Committee on Disposition of Garbage and Street Cleaning.

Louis L. Tribus, Consulting Engineer, New York, Chairman.

Evening Session.

8 p.m.

“European Sewage Disposal Works.” Illustrated by lantern
By Rudolph Hering, Consulting Engineer, New York.

Report of the Committee on Water Works and Water Supply.
By J. Walter Ackerman, Superintendent of Water Works, Auburn, N.Y., Chairman.

“Improvements in Check Valves on Auxiliary Supplies.”
By J. Walter Ackerman.

Report of Committee on Park Development and Maintenance.
By A. M. Reynolds, Chief Engineer Essex County, N.J., Park Commission, Chairman.

Paper by F. L. Olmsted, Landscape Architect, Brookline, Mass.

Paper by H. S. Richards, Assistant Superintendent of South Park Commission, Chicago, Ill.

WEDNESDAY, OCTOBER 12.

Morning Session.

9.00 a.m.

Report of Committee on Street Paving.
By Wm. A. Howell, Engineer, Street Department, Newark, N.J., Chairman.

“Modern Stone Block Pavements.”
By Wm. A. Howell.

“Bituminous Pavements, Patented and Otherwise.”
By E. A. Kingsley, Superintendent of Public Works, Little Rock, Ark.

Report of Committee on Standard Specifications.
By C. H. Rust, City Engineer, Toronto, Canada, Chairman

Report of Sub-Committee on Asphalt Pavements.
By A. W. Dow, Consulting Chemist, New York.

Report of Sub-Committee on Brick Paving.
By E. H. Christ, Grand Rapids, Mich.

Report of Sub-Committee on Bituminous Paving Nomenclature.

By W. W. Crosby, State Highway Engineer of Maryland, Baltimore, Md.

Report of Committee on Street Lighting.

By E. A. Fisher, City Engineer, Rochester, N.Y., Chairman.

Report of Committee on Fire Protection.

By Alcide Chausse, City Architect and Superintendent of Buildings, Montreal, Canada, Chairman.

Afternoon.

Boat ride on Presque Isle Bay to points of interest. Fish fry at the Country Club.

Evening Session.

8 p.m.

Discussions of Questions and Topics.

Among those submitted are the following:

Catch basins; when should they be used and when simple inlets only?

What can the Society do to increase its value to its members, especially those who cannot attend the conventions?

Standard specifications for curbs, gutters and street crossings.

THIRD DAY, THURSDAY, OCTOBER 13.

Morning Session.

9.30 a.m.

Report of Committee on Municipal Data and Statistics.
By Ernest McCullough, Editor Railway Age Gazette, Evanston, Ill., Chairman.

“The Census Bureau’s Municipal Statistics.”

By A. Prescott Folwell, Editor Municipal Journal and Engineer, New York.

Report of Committee on Taxation and Assessment.

By A. M. Heston, City Comptroller, Atlantic City, N.J., Chairman.

“Taxation.” By A. M. Heston.

Report of Committee on Municipal Franchises.

By Chas. Carroll Brown, Editor Municipal Engineering, Indianapolis, Ind., Chairman.

Report of Committee on City Government and Legislation.
By S. A. Freshney, Secretary and General Manager, Board of Public Works, Grand Rapids, Mich., Chairman.

Report of Committee on Review.

By C. D. Pollock, Acting Chief Engineer, Bureau of Highways, Manhattan, New York, Chairman.

Afternoon.

2.30 p.m.

Automobile ride to points of interest about the city.

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 PENDING.

In addition to those in this issue.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Barrington's Cove., N.S., wharf.	Oct. 17.	Sept. 29.	444
Bic, Que., wharf	Oct. 12.	Sept. 22.	412
Cartwright, Man., bridge	Oct. 8.	Sept. 29.	444
L'Assomption, Que., ice pier	Oct. 12.	Sept. 22.	412
Moose Jaw, Sask., fire equipment.	Oct. 10.	Sept. 22.	412
New Edinburgh, N.S., break-water	Oct. 12.	Sept. 22.	412
Newmarket, Ont., factory building	Oct. 24.	Sept. 29.	444
Oshawa, Ont., sewer extension.	Oct. 14.	Sept. 29.	56
Ottawa, Ont., lighthouse	Oct. 31.	Sept. 1.	275
Ottawa, Ont., lighthouse and buoy steamer	Oct. 31.	Sept. 8.	308
Paspebiac, Que., breakwater	Oct. 10.	Sept. 22.	412
River des Prairies, Que., piers.	Oct. 17.	Sept. 22.	412
St. Joseph de Sorel, Que., pier.	Oct. 17.	Sept. 29.	444
St. Andrews, Que., wharf.	Oct. 24.	Sept. 29.	444
Victoria, B.C., brass fittings	Oct. 24.	Sept. 22.	412
Victoria, B.C., clearing right-of-way	Nov. 2	Sept. 29.	444
Winnipeg, Man., induction motor.	Oct. 20.	Sept. 29.	54
Winnipeg, Man., roundhouse machinery	Oct. 20.	Sept. 29.	444
Yorkton, Sask., electric light plant	Oct. 11.	Sept. 8.	309

TENDERS.

Campbellton, N.B.—Tenders will be received until October 18th for the construction of a public building. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Great Salmon River, N.B.—Tenders will be received until October 18th for the construction of a breakwater. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Hartland, N.B.—Tenders will be received until October 19th for the erection of a public building. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Moncton, N.B.—Tenders will be received until October 17th for alterations to the public building. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Aylmer, Que.—Tenders will be received until October 10th for the construction of a wharf. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

St. Andre, Que.—Tenders will be received until October 26th for the construction of an extension to the wharf. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Hanover, Ont.—Tenders will be received until October 22nd for the erection of a town hall building. John Taylor, Town Clerk.

London, Ont.—Tenders are invited for a 700, 800 and 900-gallon automobile fire engine, and for a steam engine of 1,000 gallons' capacity. T. Harry Jones, City Engineer.

Ottawa, Ont.—Tenders will be received until October 10th for eight or ten million feet of burned timber. J. D. McLean, Secretary, Department of Indian Affairs.

Toronto, Ont.—Tenders will be received until October 11th for the supply of two automobiles. G. R. Geary (Mayor), Chairman Board of Control.

Winnipeg, Man.—Tenders are invited for the construction of a public baths building. M. Peterson, secretary, Board of Control.

Vancouver, B.C.—Tenders will be received until October 26th for the construction of an examining warehouse. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Victoria, B.C.—Tenders will be received until October 31st for the construction of a twin-screw steel lighthouse and buoy steamer for the Pacific Coast. Alexander Johnston, Deputy Minister, Marine and Fisheries, Ottawa, Ont.

Strathcona, Alta.—Tenders will be received until October 24th for the construction of a public building. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Calgary, Alta.—Tenders will be received until November 7th for the supply of street railway material. W. D. Spence, City Clerk. (Advertisement in The Canadian Engineer.)

Calgary, Alta.—Tenders will be received until November 7th for the erection of steel bridges. W. D. Spence, City Clerk. (Advertisement in The Canadian Engineer.)

Calgary, Alta.—Tenders will be received until Oct. 15th, for grading approach to bridge. B. E. Mitchell, chief engineer, McDougall Block.

Calgary, Alta.—Tenders will be received until Nov. 7th, for street railway material. W. D. Spence, city clerk. (Advertisement in the Canadian Engineer.)

Calgary, Alta.—Tenders will be received until Nov. 7th, for the erection of two steel bridges. W. D. Spence, city clerk. (Advertisement in The Canadian Engineer.)

Moose Jaw, Sask.—Tenders will be received until Oct. 10th for the erection of the Saskatchewan college building. R. G. Bunyard, Moose Jaw, and Jno. D. Atcheson, Winnipeg, Architects.

CONTRACTS AWARDED.

Halifax, N.S.—The Silliker Car Company has received the contract for 250 freight cars from the Canadian Northern Company.

Moncton, N.B.—The W. E. Seagrave Company of Walkerville, Ont., was awarded the contract for the new chemical engine at \$2,000. Other bidders were as follows: American LaFrance Fire Engine Company, New York, straight chemical engine, \$2,145. Combination chemical engine \$2,175. The Canadian Fire Engine Company, London, Ont., straight chemical engine \$1,800. Combination chemical engine \$1,350.

Montreal, Que.—Contract for steel pipe dredging work and concrete pier in connection with the new intake for waterworks was awarded to Lemoine & Son, and L. E. Desy, as follows:

Supply of Laying pipe	C'crete pipe	Crib work	Total	
\$52,000	\$81,500	\$18,000	\$4,000	\$155,500

Other tenders were:

Michel Connolly	49,200	90,000	32,000	13,000	184,000
Laurin & Leitch	52,810	85,500	26,145	2,544	167,000
do	55,270	85,500	26,145	2,544	169,463

Canadian General Development Co. . . . 50,500 92,400 38,100 4,000 185,000

Henry Quinlan & Robertson 59,000 104,000 16,000 7,500 186,500

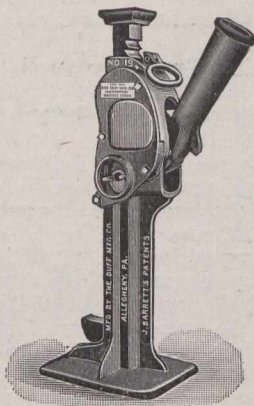
Harris Cons. Co. . . 47,623 120,000 25,000 5,000 197,623

Supply of pipe only: Munderloh & Co., \$45,175.00; John Inglis Co., \$61,500.

Fort William, Ont.—Contract for the Canadian Bank of Commerce was awarded to Seaman & Peniman, local contractors.

Niagara Falls, Ont.—A. B. Robertson, a local man, received the contract for the building of the new armory at \$44,000 against a bid of \$46,000.

Toronto, Ont.—Contracts for the construction of equipment were awarded to the following firms: Transformers—Canadian General Electric Co., \$15,800. Motor generator sets—Lancashire Dynamo and Motor Co., \$2,262. Storage batteries—Chapman & Walker Co., Ltd., \$2,870.



BARRETT JACKS

"For general track repairs we would recommend THE BARRETT JACK, as the best for this work that we know of." (Extract from Report of Committee appointed by Roadmasters' Association.

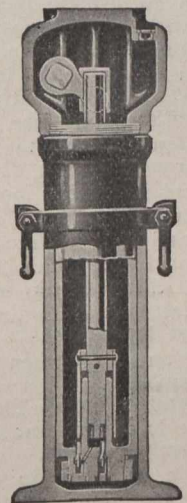
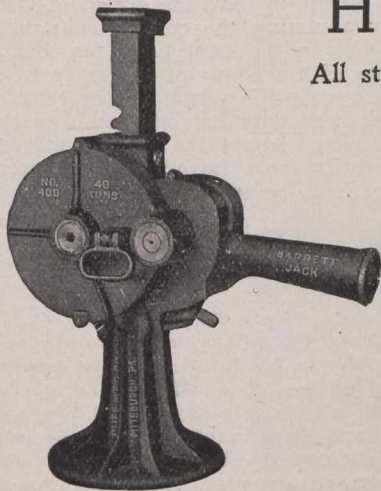
THE DUFF - BETHLEHEM FORGED STEEL HYDRAULIC JACKS

All styles and Capacities for a Vertical or Horizontal Lift

These Jacks are made entirely of forged steel and weigh from 30 to 60% less than any Jack of the same capacity.

They contain but few moving parts and are self contained.

The cylinder and face are forged from the solid, as is also the ram. This reduces picking and lessens the liability of leaking. One man can easily lift the entire stated load of any Jack, whether it is the 10 ton or 250 ton size.



The Canadian Fairbanks Co., Ltd.

Fairbanks-Morse Gas Engines. Fairbanks Scales. Safes & Vaults
 Montreal, Toronto, St. John, N.B., Winnipeg, Calgary, Vancouver

Dauphin, Man.—J. J. Flannagan of Fort William, Ont., was awarded the contract for the installation of a water-works system. An expenditure of \$175,000 is involved.

Viriden, Man.—The Wm. Newman Co., Ltd., of Winnipeg, received the 60-foot reinforced concrete bridge contract at \$2,800. Geo. Haines, Viriden, tendered at \$4,530.

New Westminster, B.C.—The Lincoln Sawmill Company, of Langley Prairie, has secured one of the largest lumber cutting contracts ever given out in the province. It has undertaken to cut and dress 30,000,000 feet of lumber for Michigan capitalists, owners of valuable timber land.

Revelstoke, B.C.—Mr. E. R. Vipont has received from the Natural Resources Securities Company the contract for taking all the merchantable timber off land owned by the company near Nakusp. Contract, to be completed in a year, will yield 2,000,000 feet in saw logs, 100,000 railway ties and 3,000 telegraph poles.

Victoria, B.C.—Bids ranging from \$85,000 to \$131,200 for the work of repairing the steamer Princess May, were recently received and rejected by the underwriters, who considered the figures too high. The tenders were:
 Hefferman Engine Works, Seattle, \$131,200, (including duty), 85 days.

Hall Bros., Eagle Harbor, \$120,000, (plus duty) 95 days.
 Moran shipyards, Seattle, \$125,000, (including duty) 60 days.
 Willamette Iron Works, Portland, \$105,000, (plus duty) 90 days.

Wallace Shipyard Co., Vancouver, \$98,750, 76 days.
 Victoria Machinery Depot, \$94,300, 84 days.
 British Columbia Marine Railway Co., \$85,000, 80 days.

Vancouver, B.C.—The publishers of The World newspaper have let the contract for the steel work in their new building to John Coughlan & Sons, of Vancouver. The building will cost approximately \$125,000. The World building will be one of the largest and most modern in Canada, and the builders have been consistent in the pursuance of their decision to have as much work as possible done by local firms.

Calgary, Alta.—Contract for lining of reservoir was

awarded to Messrs. Batchelor, Marshall & Skarins, a local firm, at \$15,710.08. Other bidders were: The Forest City Paving Co., Calgary, at \$20,425.95; Davidson & Westway, Edmonton, at \$22,970.25.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—At a meeting of the Montreal and Southern Counties Railway Company, the following officers were appointed, viz: Mr. S. T. Willett, president; Mr. Thomas Craig, first vice-president; Mr. W. B. Powell, second vice-president and general manager; Mr. H. William Cooper, secretary-treasurer.

Montreal, Que.—The Canadian Pacific Railway took the first step in the re-organization of its transportation department, when it promoted Chas. Murphy, formerly superintendent of the C.P.R. eastern lines, to general superintendent of the eastern lines, with headquarters at Montreal, Que.

Montreal, Que.—The C.P.R. is now directing its attentions toward the east. It is understood that it has secured the stock for the whole 275 miles, between St. John and Halifax—\$1,350,000 preference, and \$1,500,000 ordinary stock, the former for 60 per cent. of its face value, and the latter for 20 per cent. of its face value. It is stated that the vice-presidents have satisfied themselves as to the practicability of a train ferry across the Bay of Fundy, from Digby to St. John.

Montreal, Que.—It is on record, that in case the Canadian Power Co. controls the Montreal Street Railway, they will offer for the street railway stock exchange debenture bonds bearing 4½ per cent. interest. They will also, it is understood, give a bonus of fifty shares of Canadian Power stock for every hundred shares of street railway stock.

Chatham, Ont.—Mr. Dixon of the railway commission, in consultation with city officials in reference to train service on the Pere Marquette, decided that that company must in-

stall a better schedule for accommodation of passengers. The C.P.R. may be asked to put gates at all their city crossings with watchmen to guard them.

Liskeard, Ont.—Mr. Wes. McKnight, the president of the Board of Trade, pointed out the advantage to the town of Liskeard if the C.P.R. could be brought to realize the magnificent opportunity for getting traffic that now is lost in Temiskaming. Mr. McKnight says that if the C.P.R. extended their Mattawa line around Ville Marie and the head of the lake, it would strike one of the finest agricultural districts, pass through a prolific timber region, and reach many of the greatest mines of Canada.

London, Ont.—A newspaper report says that Mackenzie, Mann & Company are taking steps to secure control of the London Street Railway and the London and Lake Erie Traction Company.

North Bay, Ont.—Surveyors who are out north of North Bay, in an attempt to locate a cut-off for the Temiskaming and Northern Ontario Railway, are expected to submit in a month's time, a report that will induce the railway commission to ask of the legislature at its next session, a grant for the work of construction.

Orillia, Ont.—The fact that the Canadian Pacific Railway intend to rush the construction of the remainder of the line through Orillia, from Atherly to Lindsay, seems to be indicated by recent moves. A corps of surveyors is now engaged re-locating the line on the east side of the Narrows, and it is believed here that the construction contract has already been let. Some extensive cutting work is being done at Silver Creek, west of here. The roadbed will be eight feet below the level of Mud Lake.

Port Hope, Ont.—The G.T.R., will this fall and winter, rebuild and strengthen all its bridges between Midland and Port Hope.

Brandon, Man.—The new C. P. R. double track between Portage la Prairie and Winnipeg will be operated at once.

Winnipeg, Man.—It is understood that the Canadian Northern line now in course of construction, northwesterly from North Battleford, will be diverted to the west to connect with the Yellow Head Pass line at St. Albert, and will form a section of the main transcontinental line.

Winnipeg, Man.—General Manager Chamberlain of the G.T.P., was surprised at story originating in Ottawa to the effect that freight and passenger service is to be installed between Edmonton and the lake head. He stated that the road from Fort William was not complete, but in all probability would be ready for freight in a few weeks. Passenger service would probably not be had until next year.

Regina, Sask.—Hon. Mr. Scott, in referring to the projected Hudson Bay Railway, said he was in favor of Government ownership of the road. He believed it would ensure absolute control of the rates, and that it would facilitate the securing of equal rights for all companies over the line.

Regina, Sask.—At the Board of Trade meeting, Mr. E. M. Saunders, chairman of the railway committee, made public a statement from Mr. Chamberlain of G.T.R., in which he said that the plans for the Regina-Moose Jaw road were approved. This has been the cause of delay in letting the contract, merely that the plans lacked the necessary approval. It is said that the companies, viz., C.N.R. and G.T.R., have agreed to run north and south of each other in ranges 25 and 26.

Saskatoon, Sask.—Work is being rushed at the yards of the C.N.R. here. This work includes the extension of the freight sheds, the new coal chute, and the overhead bridge, all of which will be completed this year.

Victoria, B.C.—The opening of the Esquimalt and Nanaimo Railway extension from Nanaimo to Cameron Lake is expected to take place October 10.

Victoria, B.C.—A party has been dispatched by the firm of Gore and McGregor, land surveyors, of this city, to survey the route of an electric railway, from Barkerville down the Willow River, to join the Grand Trunk Pacific near Fort George, a distance of about 120 miles. Although difficult of construction, it is thought that this will be offset by the easy means of obtaining power from places on the Willow River.

Vancouver, B.C.—It is expected that the proposed branch of the Grand Trunk Pacific between Fort George and Vancouver, will traverse the Lillooet district and strike the Canadian Pacific at or near Agassiz. An engineering party is

working north from Agassiz, its objective being Lillooet. It is expected to be a route on which low grades can be secured from Lillooet to Agassiz.

Vancouver, B.C.—The Board of Trade at a special meeting, formed the first Business Men's Bureau of Transportation in British Columbia. It will contend for better freight rates for the Pacific coast.

Vancouver, B.C.—Once again the Electric Railways Construction Company, Limited, has made a proposal to the park board of Vancouver for permission to construct an electric line around Stanley Park, the route to be on the water's edge. This time the proposition is to divide the earnings as follows: Necessary operating expenses; interest at the rate of five and a half per cent. on the cost of construction; five per cent. on the same amount for maintenance, improvements and repairs; the balance to be divided between the city and the company in the proportion of 25 per cent. to the city and 75 per cent. to the company. At the end of six years the city is to have the option of taking over the undertaking by assuming the cost of construction and the payment of a bonus on the same of 25 per cent., or at the end of eleven years with a bonus of 20 per cent., sixteen years, 15 per cent., twenty-one years, 10 per cent. At the end of the last period, if the city does not care to assume the road, the profits over and above the mentioned fixed charges to be divided equally for a further term of twenty-one years. The proposal is to be further considered by the board.

LIGHT, HEAT AND POWER.

Brockville, Ont.—It is reported, on good authority, that the Long Sault Development Company will commence, in the near future, construction work for developing power in the South Sault channel of the St. Lawrence, Long Sault Island and the mainland, all American territory. It is reported that the Ontario and St. Lawrence Company intend developing power at Waddington, also American territory. If such should be the case, an investigation by the Canadian Government may be made to see that river levels are not affected.

Niagara Falls, Ont.—A web of transmission lines from Niagara Falls to Toronto on the east, and Windsor on the west, and Berlin on the north, has been completed by the Hydro-Electric Commission, a state board appointed by the province of Ontario. This insures for Ontario cheap power, cheap light and cheap heat. This power line, it is said, carries the highest voltage of any line in existence, namely, 110,000 volts.

Toronto, Ont.—The Hydro-Electric Power Commission have announced that electric current, generated by the commission at Niagara Falls, will be delivered to Ontario municipalities for the first time on Tuesday, October 11th. The opening ceremony will be held at Berlin, and it is proposed to make the event a memorable one. Guests at a banquet will include members of the Legislature, prominent engineers, editors, mayors, officials of power companies, etc. Additional towns in eastern Ontario have asked the Hydro-Electric Power Commission for estimates on power. Kingston wants 2,500 horsepower, Deseronto, 300, Belleville, 3,200, Brockville, 500 to 1,000, Oshawa 500, Cobourg 900, Bowmanville 600, Picton 500, and Durham 2,000. The commission has written to the power companies asking for prices.

Brandon, Man.—Professor L. A. Herdt, of McGill University, who was engaged by the City of Brandon to advise them in connection with the power supply proposition of the E. B. Reese Engineering Company, recently submitted his report, which was unfavorable to the proposal.

Fort Saskatchewan, Sask.—The hydro-electric project undertaken by this municipality is progressing. It is expected that the dam will be completed by the end of December, and if machinery is delivered, the power house will be equipped and deliver power before next spring. The dam is situated a mile and a half up the Sturgeon River from the point where it empties into the Saskatchewan, five miles below the town. The amount of power which will be developed is estimated at 300 horsepower per annum. The cost of the work has been figured at \$35,000, which includes the purchase price of the land. As this is the first municipally-undertaken power project in Alberta, the success accompanying it will be watched with interest.

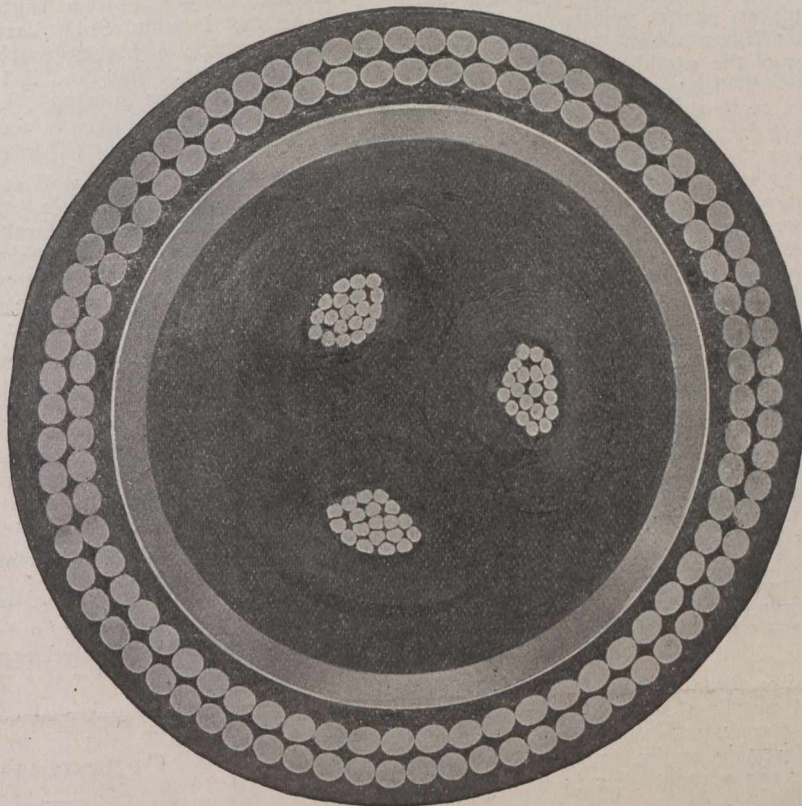
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Capital, - \$7,300,000.00

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POWER CABLES



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PRESSURE

25,000
Volts

No. 1/0 B. & S. Gauge, Three Conductor, Paper-insulated, Lead-covered,
Double-wire Armoured, Sub-marine Cable built to the Specification of
R. S. Kelsch, Esq., Consulting Engineer, Montreal.

Working Pressure 25,000 Volts

Diameter over Lead 3.25 inches
Diameter over-all 4.16 inches
Weight, per foot, 22 lbs.

Sole Canadian Representatives:

Canadian British Insulated Company, Ltd.
MONTREAL

Portage la Prairie.—Mr. A. J. Riddell, representing Smith, Kerry & Chace, engineers of the dam on the Assiniboine, said he was here to push the work, and said the firm intended to finish the work before the freeze-up.

Prince Rupert, B.C.—It is expected that negotiations will be entered upon with the officials of the G.T.P., in the hope of securing the use of the site at Seal Cove for the civic electric plant temporarily.

Detroit, Mich.—The General Electric Company, and others who control most of the water power of Michigan, are seeking to prevent the invasion of Detroit and Michigan by water-power transmitted from Niagara by Canadian companies. The War Department has been requested to interpret the meaning of the legislation affecting Niagara by which the city of Buffalo is permitted to buy and use Canadian-Niagara Power. It is held that the law was meant to permit the purchase and use of Canadian power only in municipalities adjacent to the place of development, and that Detroit and other distant places, cannot reasonably claim the right to import power from Niagara. In the event of the Department ruling in favor of the would-be purchasers, it is probable that arrangements will be made for the introduction of a bill at an early session of Congress, to place on electric power a tariff high enough to assure its exclusion. It is felt that such a bill would have the complete support of men friendly to American electric companies, and they would do their utmost to force its passage, on the ground that it will be intended only to protect established American concerns. If a duty were imposed on imports of power, plans that are now being outlined for the sale of Canadian current in the United States, would be abandoned.

SEWAGE AND WATER

Niagara Falls, Ont.—A committee has been appointed by the Niagara Falls Board of Trade, to co-operate with the Niagara Frontier Pure Water Commission in an attempt to prevent the City of Buffalo from dumping sewage into the Niagara River. The cities of Niagara Falls, N.Y., Lockport and Tonawanda will strongly oppose the pollution of this river, and an effort will be made to secure the support of the government, whose Conservation Commission recently decided to discuss the question of international stream pollution.

Sydney, C.B.—When the sewer contracts are complete, Sydney will have acquired nearly 4 miles of new sewerage in 1910, representing \$40,000 expenditure. This will give Sydney 21½ miles of sewer main at the end of the present year. The expenditure for the present year is nearly twice that for 1909.

Lethbridge, Alta.—Mr. T. Aird Murray, M. Can. Soc. C.E., and Toronto consulting sanitary engineer, called here with regard to the purification of the sewerage disposal for the city, and has submitted his report. He recommends the system known as the "Artificial Biological Filtration," preceded by preliminary removal of solids, followed by disinfection. He places the initial cost at about \$81,000, with annual operating expenses of not more than \$2,000.

BY-LAWS AND FINANCE.

Toronto, Ont.—The ratepayers will be asked to vote on a \$100,000 good roads by-law.

Welland, Ont.—City council passed a by-law to raise \$33,000 for sewer construction.

Vancouver, B.C.—The city council are considering a \$628,000 sewerage by-law to be submitted by the end of October.

CURRENT NEWS.

Ottawa, Ont.—Sir Robert Perks, representing the Dominion Dry Docks Company, of which he is a leading member, has filed plans with the public works department, for a dry-dock at Levis, Que. It is to be a first-class dry-dock and able to handle the largest boat that floats.

Ottawa, Ont.—It is believed that Deputy Minister A. W. Campbell has six tenders for the Quebec Bridge. They include one from the Dominion Bridge Company, of Montreal, one from the Canadian Bridge Company, of Walkerville, Ont., one from the Phoenix Bridge Company, of Phoenixville, Pa., one from the British Empire Bridge Company, of Darlington and Birmingham, England. Tenders are believed to be in from a French concern and also one from Krupps, of Essen, Germany.

Toronto, Ont.—A combination for the control of the Canadian and American markets in radiators, heating boilers, and kindred supplies, has been incorporated in the Steel Radiation Company, of Canada, Limited, with a capital of \$5,000,000. The King Radiator Company and the Expanded Metal and Fireproofing Company of Toronto, are two of the concerns that have been absorbed by the new organization.

Toronto, Ont.—The John Inglis Company, Ltd., have taken over the Toronto Ship Yards, and will operate the plant in connection with their machine and engine works at 14 Strachan avenue. The land is held under lease by the Canadian Shipbuilding Company, Ltd., and is owned by the Grand Trunk Railway. It is valued at \$7,490 and the buildings are valued at \$7,500.

Vienna, Ont.—The gas well struck here a few weeks ago is causing considerable stir. The leasing of lands by companies has caused a considerable raising of rentals.

Winnipeg Man.—The Manitoba Good Roads' Association will appoint a deputation to wait on the Provincial Government, and urge that speedy action be taken in regard to the proposed legislation submitted last May.

Winnipeg, Man.—Arrangements have been made for the installation of a system for the prevention of corrosion of steam boilers by the alkalis of water. It is an electrolysis process, an invention perfected by Mr. Elliott Cumberland, of Sydney, N.S.W., who was in this city. It is done by decomposing water into its component parts, hydrogen and oxygen, and by introducing an electric current, preventing adhesion of the oxygen to the plates of boilers.

Vancouver, B.C.—A recommendation that the city engage the services of Waddell and Harrington as consulting bridge engineers was sent up to the council by the civic finance committee. The offer presented by Waddell and Harrington was to cover the wider range of work, viz.: cost of plans and supervision, for five per cent of the total cost.

PERSONAL.

Mr. E. M. Ashworth, has been temporarily appointed as engineer in charge of the Electrical Department at the City Hall, during the illness of Chief Engineer Aitken.

Mr. C. H. Rust, city engineer of Toronto, and Mr. E. A. James, Editor of The Canadian Engineer, leave this weekend for Erie, Pa., to attend the American Society of Municipal Improvements. The programme of this convention will be found elsewhere in this issue.

Mr. Charles Murphy, formerly superintendent of the eastern lines of the Canadian Pacific Railway, became general superintendent of transportation in the same district on Saturday, October 1st. Mr. Murphy, who has been in the company's employ since 1883, was formerly superintendent at Toronto, and, previous to holding that office, served in many capacities in different parts of Ontario, including Ottawa, North Bay and Prescott, where he was educated.

Mr. E. Duncan, lately resident engineer of the Canadian Pacific Railway at Orillia, has been appointed assistant engineer, with headquarters at Lindsay, Ontario.

Mr. I. Phillips, who for forty-three years has been engineer for the C.P.R., and preceding companies, from which it grew, has retired from service.

Sir Clifton Robinson, noted engineer, who is closely connected with many metropolitan and provincial traction companies, is on his way to this province. He represents a powerful financial group, which expects to take active interest in the development of the colony.

Books For Railway Engineers

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Earthwork Tables.—By R. S. Henderson. Heavy paper, oblong, 32 pages, \$1.00.

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Railroad Structures and Estimates.—By J. W. Orrock. 260 pages. 93 figures, cloth, \$3.00.

Field Engineering.—By Wm. H. Searles, 503 pages, Morocco, \$3.00.

Manual for Resident Engineers Containing General Information on Construction.—By F. A. Molitor and E. J. Beard. 16mo., iv. + 118 pages, cloth, \$1.00.

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MISCELLANEOUS.

Ottawa, Ont.—Sir Robert Perks, who was in Ottawa on Tuesday to confer with the Minister of Public Works relative to the plans of the Dominion Drydock Company, for the proposed four-million-dollar drydock at Levis, said that the drawings were ready to be filed, and construction work would be commenced as soon as the government inspector gave his approval. The plans for the drydock at St. John are not yet complete, and it may be some time before they are submitted to the Government.

Regina, Sask.—The Myers Fence and Iron Company, have decided to locate a branch in Regina. Mr. N. H. Elgar, president of this company, has selected a site.

Vancouver, B.C.—Plans for the proposed isolation hospital on the Admiralty reserve, were submitted at a meeting of the health committee here. They were for a building to cost \$45,000. A resolution was carried, that a dam be constructed to increase the supply on hand in the stream supplying the hospital.

Vancouver, B.C.—The City Council is busy discussing the city engineer. One faction holds that a supervising engineer should be appointed with a salary anywhere as high as \$20,000 per annum, while the opponents say nay, though they do not altogether approve of the course of the present incumbent of the office. The board of works of the council also comes in for criticism. The trouble is the wet weather has arrived and streets are all torn up, waiting for pavement that should have been completed some time ago. The Mayor blames the engineer, and some outside the council blame the board of works because of its custom of changing its mind frequently, too often to permit of consistent work on the part of the operating department. The Mayor has vigorously criticised the results of the season's work, and with civic elections not far distant, the matter will be widely discussed.

MARKET CONDITIONS.

Montreal, October 5th, 1910.

According to reports received from the United States, the situation at the large iron and steel plants is not very encouraging. The orders which are being received are only equal in volume to about half the capacity of the plants so that, should these conditions continue, it would mean that half the plants would be idle. Up to the present, however, the plants are being operated to about 67 per cent. of their capacity, so that their output is in excess of the demands. Prices of steel bars, structural shapes and plates continue at about \$1.40 per 100 lbs., Pittsburg, although some of the smaller concerns are cutting this about \$1 per ton. From all that can be seen at the moment, there is very little railway business in sight, although many manufacturers are looking for them to come into the market shortly. Shipments of steel products for the month of September were just about the same as in August and new bookings, while fairly good in wire sheets and merchant pipe, were light in rails, shapes, plates, etc., this, no doubt, occasioning the cutting referred to.

Sales of pig-iron for delivery next year are commencing, and a number of orders have been taken for the first and second quarters of 1911. Apparently the furnaces have made concessions from their demands of some time since. No doubt they received slightly higher prices than obtained for delivery this year, but it is believed that they accepted less than they were previously asking. It would seem that buyers will need little more iron during the present year, this being a decidedly disappointing development. There has been further cutting in prices, particularly, it is said, on basic iron in the Central West, notwithstanding the relatively low quotations prevailing in this market. Many furnaces consider that still more drastic action must be taken in the matter of prices before the close of the present quarter.

The profits of some of the important iron and steel concerns of Great Britain, as shown in recent reports, indicate that the trade of the past year has been fairly satisfactory as compared with other years. One of these concerns earned £286,000 as compared with £241,000 the previous year, the other earning £348,000 against £371,000, earnings in the case of another concern being £236,000 against £239,000. The earnings of several other concerns have been announced and comparisons show much the same results as the above. The chairman of one of the largest concerns stated that in the opinion of his board, the production of Cleveland iron was in excess of the requirements. He doubted if it was wise for the producers of pig-iron in Great Britain to permit the production to so far exceed demand. Care should be taken to preserve the supplies of ore and coal, as these could not be replaced.

In the local market, there is nothing new of consequence. There is a good deal of enquiry for iron to be delivered during the coming two months, and quite a large tonnage has been booked. The year has been successful, so far, according to all accounts, there being less reason for anxiety in Canada, probably, than in any other country. Prices continue exceedingly steady, there being almost no changes throughout the entire market from week to week.

Antimony.—The market is steady at 8c. to 8½c.