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THE CANADIAN ENGINEER

An Engineering Weekly.

THIRD ANNUAL CONVENTION OF THE CANADIAN CEMENT AND CONCRETE ASSOCIATION.

The third annual convention of the Canadian Cement and Concrete Association opened on Monday, February 6th, with the opening of the Cement Show in St. Lawrence Arena, Toronto.

The Opening of the Show.

Mr. Peter Gillespie, Lecturer in Theory of Construction, University of Toronto, and president of the Canadian Cement Association, introduced the Hon. Mr. Geo. P. Graham,

Mr. PETER GILLESPIE.
President Cement Association.

Minister of Railways for Canada, and Hon. President of the Canadian Cement and Concrete Association, who opened the exhibits. Mr. Gillespie very fittingly introduced Hon. Mr. Graham and during the course of his remarks said: The Canadian Cement Association was formed and now existed for several reasons. Its object was (1) to advance the use of concrete in the community at large; (2) to arrange meetings bearing upon subjects relating vitally to concrete and concrete use, and (3) for the exchange or interchange, as it were, of ideas between those who were experts in the different branches of concrete use for mutual betterment and for the wise scientific usage of concrete. The Canadian Association has some brilliant examples of similar organization in the Concrete Association of Great Britain, with which the names of Sir Edmund Plymouth and Sir Douglas Fox were so closely connected, and in the National Cement Users' Association of the United States, with which Mr. Richard Humphrey was connected and which organization receives $100,000 from the United States Government.

Regarding the present exhibition, Mr. Gillespie said it was a compliment to the manufacturers the manner in which they had displayed their products, and that in this show almost any form of cement product was to be found.

While he did not think it was necessary to introduce the Hon. Mr. Graham to a Toronto audience, nevertheless, he was pleased to do so and to welcome him there as by so doing he welcomed one who had more than a superficial interest in cement matters.

In opening the Cement Show the Hon. Geo. P. Graham most humorously did the honors and yet his remarks went straight to the point and he gave his hearers the impression that so far as he was concerned cement is a live issue. During his speech he passed not a few witty remarks. He said as the cement business was a hard business it was somewhat of a hard matter to speak upon it and, furthermore, he remarked it was doubly hard for a political man to get his speeches down to a concrete form. He jestingly remarked that he did not know just what ingredient was lacking in political mixture, whether it was sand or water or rock, but something, undoubtedly, was lacking, as a good many political speeches were anything but concrete. We presume the Hon. Mr. Graham does not include his speeches in this category, as if this particular speech was a sample, we could hardly accuse them of not being concrete. During his speech the Hon. Mr. Graham said: As the head of a department which uses some 250,000 barrels of cement I am somewhat in touch with concrete affairs. The Canadian product is of the

WM. SNAITH.
Secretary-Treasurer Cement Association.

best and I find it convenient to use much of the Canadian material. The manufacture of cement in Canada has had a remarkable growth. Some ten years ago there were 400,000 barrels of cement manufactured, last year there was 4,700,000 barrels manufactured in Canada. Furthermore, with the evergrowing scope for the use of cement, the supply is not equal to the demand. In this show you see every process of the manufacture and it seems as if there were a large number of processes and that cement is used for nearly

everything now. This fact is indicative of a trend of events which we see constantly. When wood became too scarce for fuel we used coal and already we are beginning to find the use of oil in lieu of coal. Canada is remarkably well supplied. One can hardly call these new inventions, it would, perhaps, be more appropriate to term these movements new uses for old discoveries. In railway work we are bound up, you might say, with cement. Whereas cedar, etc., was used a few years ago for conduits and similar construction upon the railroads and the mere suggestion of using concrete was at first laughed at, now on the contrary it is the recognized material for all railroad conduits, drainage and similar construction.

The progress of cement is not only marked by its use in railway work, but in the towns and villages also. It is a small village, indeed, which has mostly plank walks, concrete is now the recognized material even here. In this connection, however, it is well to note that the public have also learned, through bitter experience in some cases, that while concrete properly put down is the best thing possible for such work, yet if it is poorly made and put down in an ignorant, improper manner, it may result in the worst kind of a mess. Hence the advantage of the experience of scientifically trained men in connection with the successful carrying out of any concrete job. Another sphere where concrete is becoming pre-eminent is in wharf building. The Department of Railways has now some of this work in progress in the city of Halifax, where the wharves will be very largely of concrete even to the piles. In the Quebec Bridge, which is soon to be under way, 5,000 cubic yards of concrete will be necessary in all probability merely to sink the caissons, for this vast structure.

Experiments have been made in the use of concrete for cross ties instead of timber plank, so here is still another possible field for concrete some day. There are truly immense possibilities in Canada in this line with the varied fields that may lie open to it.

It all comes back in a way to proper application, which relies upon the brains of the people. It is the duty of this association to specialize on application. Along this practical line, therefore, the association is equal to a university course. You may have the finest sand and cement, but put a man without experience to work them and he may make a horrible mess. So too much care cannot be exercised and too much information cannot be spread broadcast. A large number of the men in my department have been university men for a greater or a less time and are somewhat experienced in their lines.

It cannot now be said as it was at one time that the university man possessed only book knowledge, they have now a practical knowledge.

It is a pleasure to me to be here to assist in opening the exhibition and so now I declare the exhibition open and wish you all success.

At 2.30 p.m. on Tuesday, March 7th, the annual discussions of the society were opened by the annual address of the president, Mr. Peter Gillespie, which follows:—

MR. GILLESPIE'S ADDRESS.

FAILURES AND THE LESSONS WHICH THEY TEACH.

IT IS A TRUISM often repeated that the public has a short memory. The lessons to be derived from great disasters are soon forgotten except by a very small number. The fatal Iroquois Theatre and Collinwood school disaster of a few years ago, so costly in child life and so much in the public mind for short intervals, showed the necessity of safeguarding the occupants of public buildings. For a time our civic authorities were active in having places of public entertainment carefully inspected. Much was heard for a season about fireproof curtains, accessible exits, fire drill and fireproof schools, but soon the public relapsed into its old ruts. Inspection became less searching and the authorities more forgetful and the public continues to run daily the same risks that the victims of these disasters ran. It sends its children to the same schools and attends itself, the same places of public worship or entertainment, and only becomes conscious as to the chances it is taking when some other horrible calamity occurs. Truly, the public has a short memory.

It is chiefly because humans are humans and not machines that we continue to take chances. A machine can be constructed to do a given thing in a specified way an endless number of times. Whether its work be punching or drilling or cutting, it does it with machine-like precision. It never tires, never grows careless and is never actuated with a spasm of over-zeal or indolence. It is never tempted to scamp its work. It is never influenced by the desire to make excessive profits and never knows the flattery of the multitude or the sting of adverse criticism. It never forgets, never flatters, never tempts, never cajoles, never bluffs and never pleads. But men are differently constituted. They possess the human traits. They are influenced by example, possess passions and emotions, cherish hatred, remember injuries and forget the lessons which great crises in their experience ought to impress on them. The attention of engineers, architects, builders and building departments has been called to the lessons which are taught by the failures of structures designed and erected by them or under their supervision. It is not that the field is a new one that this paper is devoted to so hackneyed a topic, but, to emphasize once again, firstly those elements which have contributed to failures, and secondly those corrective or precautionary measures which will tend to prevent their recurrence.

Especially in the use of reinforced concrete has the general reader's attention during the past five years been called to a rather large list of failures, all of them more or less serious and not a few of them having fatal results Reinforced concrete has been comparatively new in the building art and in its fabrication is very different from other materials with which the constructor is familiar. Unlike steel or wood, its strength increases with age. It is poured into forms, at which time it is plastic, and has to be sustained until it acquires sufficient strength to support itself. It consists of two materials, not one, and since the disposition of these, with respect to each other vitally affects the strength of the product, exercise for great care in this placing is necessary. More perhaps than of any other building material is this true—it possesses great capacity for injury in the making and placing. Following are cited a number of failures of reinforced concrete structures which during the past twelve months or so have occurred, and reference to which in the engineering press has come to the writer's notice. They represent typical cases and an examination of the list will enable us to classify the causes under a few general heads.

The comparatively recent announcement that the great dam across the Colorado River at Austin, Texas, is to be rebuilt has served to recall its failure over a decade ago. It will be remembered that that failure was announced to the world at first as a serious reflection upon the engineering profession because some hydraulic engineers of eminence had been connected with the work. Subsequently, however, when the whole history had been investigated, it was found

that the authority of the engineers had been interfered with to such an extent by the city officials in control, that their responsibility had been practically nullified. Indeed, one prominent engineer had resigned rather than have his name further connected with a work over which he had no control.

On February 28th, 1910, a reinforced concrete arch of three spans over the Flat Rock River at Edinburgh, Ind., collapsed during an unusually heavy flood. The design had been furnished by a well-known bridge company, but the Bridge Commissioners, in their desire to economize and with a wisdom commensurate with their experience in such matters, decided to omit the piling underneath the abutments and to carry them instead to a somewhat greater depth. And so the bridge was built. The materials supplied and the workmanship throughout seemed to be excellent, but in the season of heavy flood the piers were undermined by scouring and the structure collapsed. There does not appear to be any other cause of failure than the insufficiently supported piers, and the responsibility of course must rest on those who ordered the modification of the original plan.

A concrete dam at Fertile, Minn., was washed out by floods early in April, 1910. The trouble is attributed to the fact that the foundations were not laid sufficiently deep to prevent scouring and undermining, and failure ultimately ensued.

The partial failure of the Bayless reinforced concrete dam at Austin, Pa., in January, 1910, exemplifies a trouble of a slightly different character. The dam was completed in December, 1909, at a cost of upwards of $70,000. On completion, it was observed that there was one small crack 1-16 inch wide extending from the top of the dam to the ground level. Subsequently others, similar in appearance, developed, and during a heavy freshet on January 23rd, 1910, a section of the dam between vertical cracks, under the thrust of the impinging water, slid forward some 18 inches. This movement covered a period of some 8 hours and then stopped. Investigation disclosed the information that the failure was due primarily to the fact that the dam was founded upon a bed rock, the successive strata of which were separated by layers of shale or clay. The impounded water, having worked itself under the foundations, had softened the clay, with the result that the upper stratum carrying a portion of the dam had moved forward on the lower. It was stated that the weakness of the concrete was doubtless due to the fact that much of it had been hurriedly placed, part of it in freezing weather. The anchor bolts, which had been grouted into the foundation rock, had moved outward with the rock into which they were anchored.

On April 7, 1910, the collapse of a concrete roof under construction at the new car-barn of the Shore Line Electric Road at Saybrook, Conn., took place and resulted in the death of one man and the injury of two others. The roof was a 4-inch slab of reinforced concrete on girders, about 8 inches on centres and of 37 feet span. The last work had been completed about ten days and the forms were being removed. It was believed that the premature removal of the forms and excessive loading of the green roof slab with roofing material were the joint causes of the accident.

On July 13th, 1910, one of the columns of the concrete groined arch roof to the filter chambers in course of construction at Owen Sound, Ont., collapsed while the centreing beneath was being removed. Two men were quite seriously injured. The accident apparently was due primarily to the early removal of forms, combined with the fact that the 18 x 16 inch columns on two sides of the square roof of the arch were quite incapable in themselves of resisting the arch thrust. The forms were removed in only four days after pouring, notwithstanding the fact that seven days was the minimum specified time for removal.

The upper part of a reinforced concrete chimney under construction at the plant of the American Woolen Co., South Royalston, Mass., collapsed on April 9th, 1910, causing the death of two men. The chimney was to have been 105 feet high with an inside diameter of 4 feet and an outside diameter of 4 feet 8 inches at the bottom, and with walls varying in thickness from 8 inches at the bottom to 4 inches at the top. The forms used in construction were in two sections, each 3½ feet deep. The procedure was to fill the upper form, then to loosen the lower and set it above the upper for filling. This took one day. Next morning, the form in the lower section was loosened and it was placed on top and filled. Thus, the concrete in any 3½ foot vertical section had less than 24 hours in which to set before its side-supporting forms were removed. The accident occurred when a height of about 70 feet had been reached, the section last uncovered, then only 20 hours old, caving in and carrying the workmen to the ground with it. It is reported that the temperature the day before the break had taken a sudden drop, but it was not at any time below freezing. The failure was undoubtedly due to loading a very green concrete before it had acquired sufficient resisting power, as the materials were good and the design and execution satisfactory.

A reinforced concrete grain elevator of typical design failed under a normal pressure of grain at Springfield, Ohio, on October 24th, 1910. As has been rather common in elevator construction where a battery of cylindrical units has been constructed, the unused spaces, external to the cells, but lying within the tangent walls, had been utilized as auxiliary bins. No one saw the beginning of the collapse, so that its exact behavior cannot be stated, but from the appearance afterwards it was evident that the lower section of the wall, where the pressure was greatest, was forced out under the pressure of the wheat. This portion sheared off clear at the line where the straight wall connected with the circular wall of the larger bin. The weak point in the structure was that the horizontal rods in the straight wall were not connected to those in the circular, nor were they tied back for any distance into the concrete of the circular walls. It was stated that the plans showed the rods in the straight walls securely fastened into the circular bins and that the failure to so fasten them was due to the negligence of the foreman.

On November 22nd, 1910, a four-storey reinforced concrete building being erected for the Henke Furniture Co., Cleveland, Ohio, suddenly collapsed, throwing one of the walls over a two-storey frame building next door and so crushing the structure as to cause the death of four of its occupants and the serious injury of seven others. It was of reinforced concrete column and girder construction with hollow tile and concrete floor system, and brick curtain walls varying in thickness from 21 inches at the basement to 13 inches at top floor. A commission of enquiry was immediately appointed, on which were representatives of the Builders' Exchange, the Cleveland Engineering Society and the Cleveland Chapter of American Institute of Architects. This commission was empowered to take evidence, and to consult every available source of information that might explain the cause of failure. After the wreck had been carefully examined, the design checked over and the witnesses examined, the finding was announced. The failure, it stated, was due primarily to the premature removal of forms in the third storey. It fixed the responsibility on the architect, the contractor, the owner and the Department of Buildings for the

city of Cleveland. The architects were adjudged responsible in that they did not give sufficient consideration to the removal of forms, in that they did not give sufficient attention to the materials, and in that they did not give adequate supervision to the work of construction. The contractor was adjudged culpable in that he employed foremen who were entirely ignorant of the intent of plans and specifications or of the nature of the materials they were handling. In consequence, the sand was inferior, the forms were removed prematurely, and that regardless of weather conditions, the green concrete was regularly overstressed, the members were not of the sizes called for in the plans, the concrete composing them was open and porous and sawdust and shavings were found in the bases of columns. In addition, it developed that less cement had been delivered to the building than would have been necessary to construct it had it been built as planned.

I have chosen to classify the causes of failure in the employed a special concrete inspector on the work as required by the building regulation.

The Department of Buildings was held responsible in that it had ignored the requirements of that portion of the building code which makes it necessary that the owner employ a special reinforced concrete inspector. It thus appears that the Building Department rather than the building code was at fault.

I have chosen to classify the causes of failure in the above cited cases as follows:

(1) Interference with a suitable design by those in authority, but not possessing a knowledge of engineering practice.

(2) Defective design.

(3) Inferior materials.

(4) Ignorant or wilful disregard of specifications and plans.

The first of these is unfortunately of too common occurrence. In all human probability the Austin dam and the Edinburgh arch would be standing to-day but for the intervention of the "cock sure aggressive" individual who, when clothed with a little brief authority, becomes a paragon of wisdom on everything under high heaven. This type is found frequently in our municipal councils and it is to be regretted that engineers of wide experience and good judgment sometimes permit themselves to be dominated by them. An engineer's judgment may be in error, but is it not more likely to be productive of good results if it be corrected through consultation with other engineers of equally good standing, than if it be reversed by men entirely untrained in the problems of design and construction?

Fortunately, the day of unsafe design in reinforced concrete is becoming a thing of the past. The design of reinforced concrete, like the design in wood or steel, has been reduced or is being reduced to a standard based on the proportion and strengths of materials which constitute it. There is, therefore, no reason to-day why the average practising engineer should not acquaint himself with concrete designing so that, at least, he can finish his plans with some such detail as he does those for his structures in steel. He may, if he prefers, leave the details to his contractor, who, like the contractor for steel, can make them according to the standards of his practice. He must exert every care in informing himself as to the character of the materials he must employ and of the foundation upon which he proposes to erect his structure. The dams at Fertile, Minn., and at Austin, Pa., furnish illustrations where disaster might have been averted by a careful examination of the underlying strata, prior to construction. The designer must recognize, too, that the safety of his design depends upon the constructor as well as upon himself, since concrete construction is not fixed as is that in steel. An editorial in the "Engineering News," speaking of this phase of a designer's responsibility, asserts that "the design cannot be sent from the drawing table with perfect confidence in its precise reproduction in the structure. It is the joint product of the man in the office and the man in the field, and any design which fails to recognize this is a poor one, no matter how nearly it may conform to accepted standards. No engineer who is not prepared to supervise the construction of a reinforced concrete structure is justified in designing that structure as closely to the safety limit as he is when the construction is to be under his eye."

The prevention of the utilization of inferior material is the work of the engineer, the architect and the inspector. No reinforced concrete work of any magnitude should be constructed without a capable, conscientious inspector. The Henke building suffered from inferior material, as it did from almost every other malady to which reinforced concrete is heir. The remedy for this is vigilant, constant inspection. Failures resulting from the premature removal of forms could invariably have been prevented by the exercise of intelligence and a little precaution. The Henke building disaster, the Owen Sound filtration plant accident, the carbarn roof failure at Saybrook, Conn., and the chimney collapse at South Royalston, Mass., were all preventable if careful examination had been made before stressing the concrete, which, possibly due to temperature conditions, had not yet acquired its preliminary strength. The failure of the grain elevator at Springfield, Ohio, was due to the ignorance of a foreman. Any foreman who appreciated the proportions of the materials he was handling would not make the blunder that was made.

The remedy for these evils is the employment of the experienced, intelligent, painstaking inspector. He sees that the forms are cleaned before the concrete is poured, that the ingredients are correctly proportioned, that the steel is properly placed and in correct amount, that the members are of dimensions called for by the plans, and that the forms are not removed until the material has acquired sufficient strength to be self-sustaining. The capable inspector is essential to safe construction.

JOINT MEETING ENGINEERS' CLUB & CEMENT ASSOCIATION.

The address of welcome to the Engineers' Club was given by Dean Galbraith of Toronto University. In his address the Dean remarked that this seems to be the day of cement. Expansion is marked in every direction we see cement blocks, pipes and, humourously remarked the Dean, "the latest thing we see in cement seems to be cement guns." The club, he said, would be delighted and interested to hear what their guests had to tell them and that its members had been much interested in the proceedings of the last few days.

Mr. J. A. Jamieson, the well known concrete engineer of Montreal, in discussing the subject of "Specifications for Cement Work" remarked on the phenomenal growth of the cement industry during the last two decades. Last year in the United States there were 75,000,000 bbls. produced and in Canada 5,000,000. this all being Portland cement. Although natural cements are still used for some purposes their manufacture has been decreasing. Cement, he said is a good structural material and fireproof if properly used. The outlook for the future is still more impressive than the growth in the past. The quality of cement has furthermore been improved. A principal difference in the present manufacture and the past being probably the endeavor to make an exceedingly fine mixture in the first grinding from which to get the cement clinker. The burning is now practically all done in a rotary kiln. While, however, the process of manufacture is greatly im-

proved cement is still to a large extent a rather crude product. It is probably a safe statement to make that whereas we now have perhaps a tensile strength of 600 lbs., in the future we can expect a cement having double that strength.

The committe, of which Mr. Jamieson is a member, has framed some rules for cement manufacture and usage and are giving the matter considerable attention. Many of our cements will set very rapidly and without a retarder many Portland cements will set nearly as quickly as plaster Paris. No cement should go into a work of any importance without being tested. The specifications are rules by the following of which several individuals working each for himself in making the same test should arrive at approximately the same result. Specifications must not be made so that the manufacturer cannot reasonably follow them. Passing the mixture through a 200 mesh is about the finest practical test. It is found that any residue retained has practically no cementing value. However, a considerable portion of the material which passes through the sieve also has no value as a cement. It is hard to see just where the line of division between valuable mixture and that of no value comes. About one third of the passed raw material has value as a cement in many cases. While specifications will not in some cases allow some manufacturers to turn out as good a product as they are able to, yet, in order to be safe they must lay down certain limitations. The tendency for practical use would be for societies throughout the continent to lay down one code of specifications, said Mr. Jamieson.

With regard to concrete Mr. Jamieson said that concrete and its uses were becoming well known, but that there was a tendency among engineers and practical men to fail to realize that there is much they can learn. An evidence that there is much to be learned is that eminent chemists and concrete specialists disagree in their opinions, and are aware that they at least have much yet to find out about concrete.

All who have to do with the erection of concrete structures should use great care. Many failures in the States have been recorded in the past, due to haste and negligence. The controversy between concrete and clay product interests is no longer vital, each recognizes that there are uses where one can be used to a greater advantage than the other, either from an ecomonical expense standpoint or for physical reasons.

Mr. Richard Humphrey's address on "Building By-laws and Re-inforced Concrete" was most interesting and instructive being given with the aid of some excellent descriptive views of points in the address. Mr. Humphrey said that we were beginning to "put on the brakes" in checking the abuse of our natural resources and that the need was just as urgent for some check on building construction. Fire losses alone in the United States have been enormous through not having proper check on the building of so-called fireproof structures. The terrible disaster following in the wake of the San Francisco earthquake, Mr. Humphrey ascribed to the timber and burnable material used in the structures. Adequate building laws were the result of years of experience, those of Europe were not of sudden growth, but were the result of the experience of centuries, in some cases. Building laws should aim at three ends, especially, viz., (1) to make the structure safe, (2) to make it fire resisting, (3) to make it sanitary.

It is regretted that in the drafting of building by-laws certain interests are favored. In illustration of this point Mr. Humphrey cited an example of one interest in New York, which had given $250,000 to buy votes to protect a code favoring their especial interest, but the mayor fortunately vetoed the bill. Faulty design in concrete structures is the cause of their failing in cases of fire, although the opponents of reinforced concrete point to the material as the cause. The flimsy coating of steel beams with a surface of concrete and a poor design for the expansive forces should be most thoroughly condemned.

The municipal authorities should frame laws to facilitate concrete construction, but should also see to it that laws prohibitory of poor work should also be in force. Although the initial cost of concrete structures in the States have often been 10 per cent. over the same for a frame structure, yet the cost of maintenance in the end has shown a saving in favor of the concrete. Reinforced concrete, said he, is here to stay, and there should be no discrimination in favor of other materials in building. All should be judged entirely upon their particular merits, in any proposed work.

Mr. Frank Barber's excellent paper on the "Adaptation of Concrete for Long Span Bridges" concluded the meeting of the evening. Mr. Barber's paper was well illustrated with aid of the stereopticon and particularly dealt with the stress features in bridge construction. He voiced the opinion of the other speakers that only good concrete be used and that only carefully so.

EXECUTIVE: CANADIAN CEMENT AND CONCRETE ASSOCIATION.

1911 and 1912.

Hon. Geo. P. Graham, Honorary President. Minister of Railways and Canals.

Peter Gillespie, President. Lecturer in Theory of Construction, University of Toronto.

Wm. Snaith, Secretary-Treasurer and Manager of Cement Show. Assistant Engineer, Barber and Young, Toronto, Ont.

T. L. Dates, Mgr. Sun Portland Cement Co., Owen Sound, Ont.

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Ivan S. MacDonald, Editor "Construction" Toronto, Ont.

J. A. Jamieson, Consulting Engineer of Montreal.

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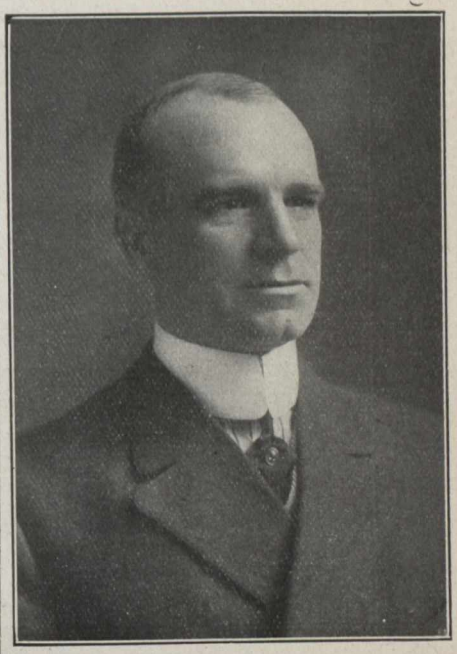


Alfred Rogers,
Member of the Executive.

Kennedy Stinson, Mgr. Stinson-Reeb Builders' Supply Co., Montreal, Que.

C. R. Young, Barber and Young, Bridge and Structural Engineer, Toronto, Ont.

Gustave Kahn, Manager Trussed Concrete Steel Company of Canada.

HIGHWAY BRIDGES FROM THE INVESTMENT POINT OF VIEW.*

By C. R. Young, A. M. Can. Soc. C. E., of Barber & Young, Bridge and Structural Engineers, Toronto.

The duty of the municipality with respect to its bridges is in effect that of a business corporation which is called upon to provide for the public safe and perpetual facilities for the passage of our streams at a reasonable annual cost to its shareholders, in this case, the public themselves. There should be the same effective management as characterizes a high-class private enterprise, and not only should there be the greatest possible amount of return realized on the money invested in the form of service to the people, but provision should be made for adequately meeting the needs of those who will make use of the highways in the future as well as at the present.

This undertaking on the part of a municipality is one of great importance. Many conditions surround the problem and affect the final decision as to the type of structure and the manner of carrying on the work, and since a bridge costs many times more than an equal length of roadway and its construction requires a higher degree of skill and is always attended with more difficulty and a greater element of risk the necessity of going carefully is evident. With the aim of affording some assistance to municipal councillors and bridge commissioners who have the general direction of the bridge work in their municipalities, the speaker proposes to discuss briefly the various conditions affecting the character of the investment of public money in highway bridges. Some typical cases with which the municipal bridge commissioner has frequently to deal will be given special consideration.

Bridge projects generally involve a consideration of the following questions:—

1. The availability of funds for the project in hand.
2. The relative first costs of various types of bridges for the situation in mind.
3. Probable future changes in the traffic requirements of the bridge.
4. The relative length of life of various classes of bridges.
5. Relative maintenance charges on various types of bridges.
6. The provision of a structure of pleasing appearance as well as one possessing strength and permanence.

1. Availability of Funds.

The solution of any bridging problem must always be largely determined by the amount of money available for the constructing of the particular bridge in question. In a sparsely-settled and undeveloped region where the municipal revenues are small, but where certain bridges are sorely needed, or even in an urban municipality where extensive work must be undertaken and but little money is available, it would be unwise to inconvenience the people and retard the development of the community by deferring the construction of bridges until such time as permanent structures could be built. Sound judgment would demand the erection of comparatively cheap bridges to last for a limited term of years and then be replaced by more durable structures. An illustration of this is to be found in the case of a certain Canadian city where a long and high viaduct is required for the proper utilization of its railway facilities, but where the great difficulty of financing the scheme can only be overcome by constructing a comparatively light steel bridge with a wooden floor and then rebuilding and strengthening it when the people have come to appreciate the great value of the service rendered and can no longer do without it. The folly of saddling a community with an expense which it is not at present in a position to bear is apparent to all, but it may be said that the opposite mistake of constructing light, cheap bridges where permanent ones could be afforded and would prove a much more profitable investment, is only too common.

*An address delivered before the Ontario Good Roads Association, Toronto, March 1st, 1911.

2. Relative First Costs.

Naturally the question which looms up largest to the Roads and Bridges Committee in its consideration of a given project is the amount of immediate outlay of funds required—that is the first cost. Unfortunately this element of the investment is often the only one given any consideration, although in the case of well-to-do municipalities such a short-sighted policy is obviously very poor business. A broad view of the problem would disclose some features of quite as great importance as the initial expenditure.

So many factors enter into the determination of the relative costs of different types of bridges, that it is impossible to state figures which can be used for any other set of conditions than those assumed in preparing such statements. The only safe procedure for a municipality to follow if it wishes to secure reliable information as to the relative costs of different types of bridges for a given crossing is to employ an engineer who is able to thoroughly investigate the particular situation and prepare accurate comparative estimates of cost taking into account all the local conditions, prices of material, labor, etc. The following observations concerning the relative costs of different types of highway bridges for Central Ontario may prove of interest for comparative purposes and possibly of some value to those who have to do with bridge work in other portions of the Province where similar conditions obtain.

So seldom is timber now used for highway bridge construction that no consideration will be given to its use for entire bridges, but since the question of building bridges with timber floors instead of those with concrete floors is sometimes brought up, a few words with respect to the latter may not be amiss.

Bridges with timber joists and flooring are, of course, only practicable for comparatively light floor loads, such as a heavily laden wagon or a threshing engine of 7 or 8 tons weight. For 10 and 15-ton road rollers which weigh when carrying their full supply of fuel and water about 11½ and 16½ tons respectively, a wooden floor is expensive to construct and maintain since the wooden joists must be placed close enough together to make practically a solid wooden floor from 12 to 15 inches thick. Assuming traffic light enough to warrant the consideration of a bridge with wooden joists and floor plank, the cost of the superstructures (i.e., everything above the abutments and piers) of steel bridges with wooden floors would be from 50 to 60 per cent. of the cost of the superstructures of steel bridges with concrete floors. It should be pointed out however, that this comparison of cost is not wholly just to the latter type of bridge for the reason that the advantage of its employment does not arise for such light traffic. A small additional expenditure would enable it to accommodate a 10-ton or a 15-ton roller whereas the bridge with a wooden floor could be made to carry heavy concentrated loads only at considerable expense. If the substructure or abutments were included in this comparison, the total cost of complete steel bridges with wooden floors and concrete abutments would be 70 or 80 per cent. of the cost of similar structures with concrete floors. The great advantage which the lighter structure posseses in first

cost therefore largely disappears when the entire bridge is taken into consideration.

A comparison of the first costs of steel bridges carrying concrete floors and all-concrete bridges is of interest, but it should be clearly understood again that these observations do not apply to situations where the local conditions and unit costs are materially different from those in mind in making the comparison. Since concrete is a material possessing a high compressive resistance and of comparative low cost in most parts of Ontario, it is to be expected that in certain forms of structures where it could be extensively employed to take compressive stresses it might reduce the cost of construction below that holding for steel bridge work. The structures in which it may, in general, be economically employed are viaduct posts or bents, beam or girder spans and arches. Thus, in the design for the bents of a steel viaduct with the roadway on an average 48 feet above the level of the ground, it was found by the speaker's firm that the steel trusses could be supported on concrete bents for 70 per cent. of the cost of steel bents. Short girder spans can frequently be constructed of concrete for 10 or 15 per cent. less than of steel with concrete floors, especially if of the deck type, that is where the girders lie wholly underneath the floor. In this case the floor slab performs the double service of transferring the superimposed load to the main girders and of acting as the compression flange for these girders. On account, however, of the fact that the volume of concrete capable of carrying a given load weighs over seven times as much as the volume of steel required to perform the same service, the weight of girder spans becomes very great when they exceed about 50 feet in length and they can no longer be successfully built in competition with steel. The relative costs of steel bridges with concrete floors and concrete arches is to a large extent determined by the character of the foundation materials encountered. If the foundation bed is of soft clay or sand, the special treatment necessary before an arch can safely be built will generally offset any advantage in first cost which the arch might have over a steel span. Assuming that no piling is necessary in either case, however, and also assuming that sufficient rise is available for an arch, the latter form of structure can often be constructed at no greater cost than a steel bridge of the same capacity. Where the length of the span much exceeds 100 feet, the advantage in first cost is generally with the steel structure, though it is but small and the bidding may often result in a lower price for the concrete bridge.

3. Altered Traffic Requirements.

The growth of a community and the reaching out of our towns and cities into the country will, because of the increased traffic demands, often seriously overtax our highway bridges unless they have been built for the future as well as for the present. While heavier road rollers than are now in common use may become quite common, the loading to be most feared in the future is the heavily-laden motor truck. These vehicles are particularly trying on the floor system of a bridge because of the large portion of the load which is concentrated on the rear axle, and since motor vehicles weighing when loaded anywhere from 15 to 40 tons will probably be in common use within a few years, it is seen that the investment of the public money in highway bridges should be to a large extent governed by the future probable traffic of the road. A form of structure which is well suited to resist these increased concentrated loadings is the earth-filled concrete or masonry arch. The kind of loading which taxes this form of arch most severely is a uniformly distributed load covering either a portion of the structure or the entire bridge, depending upon the part of the ring under consideration, and the effect of a 10 or 15-ton roller is ordinarily trifling in comparison with that of the uniform load of 100 pounds per sq. ft. generally assumed in the design of arch bridges for country highway traffic. For this reason, most well-constructed spandrel-filled arches, except those under about 40 feet in span can support heavier rollers or trucks than are in common use at the present time.

In addition to the growth in weight of the traffic, there is also the matter of the increased width of roadway and the provision of sidewalks which may be required in the case of bridges in urban localities or those which from the growth of population may become town or city bridges.

4. Length of Life.

The length of life of a bridge may be determined by its destruction by accident or by the gradual deterioration or corrosion of the material and the loss of rigidity due to the wear and the breaking down of the joints. In the case of structures composed wholly or partially of wood the liability always exists of either total or partial destruction by fire. Structures of all types may also be subjected to the pressure and scour of flood waters and the undoubted ability of a bridge to resist such action contributes a valuable element of certainty to the investment. In soft soils the use of piles, although they increase the cost of the structure considerably, constitutes a justifiable insurance against accident, for the majority of cases of bridge failures due to floods have been due to the short-sighted policy of attempting to do without piling where it was unquestionably necessary. An all-concrete bridge because of its great weight possesses greater immunity from destruction by floods than a steel structure, and if it be built on proper foundations no harm is at all likely to result from flood waters, since it is able to resist water pressure quite as effectively as a dam of the same height with an opening through it.

The length of life of timber in bridge floors varies greatly with the traffic, being as short as a year or two in the case of city bridges carrying a dense traffic and as much as seven or eight years for some country highway bridges which are but little travelled and where the floors are in a dry condition most of the time. Probably the average term of life reached by floor planking and wooden joists in highway bridges in this province would be about 5 years.

Since steel bridges have been in general use only 15 or 20 years, the length of life of steel when exposed to the elements is conjectural and must be based on the durability of the older and similar material-wrought iron. A number of fairly old iron bridges are in existence in the Province and give evidence of doing duty for some time yet. One of these is the Hunter Street Bridge, Peterborough, built in 1875, and two others built in 1877 across the Grand River at Paris, Ont. It must be admitted, however, that steel is not as satisfactory a material as wrought iron in resisting corrosion and therefore a shorter life under service is to be expected of it. However, since wrought iron bridges in this country have defied the elements for from 30 to 40 years with no very serious loss of section, it seems probable that steel structures, if given a fair degree of care in maintenance, will be serviceable for a period of 50 years.

Concrete, like steel, is a material which has had only a few years of extensive use in this country in bridge construction, and its length of life is also a matter of conjecture. In other lands, **plain** concrete has been employed as a material of construction in important works for upwards of 2,000 years. In ancient Rome, concrete bridges and domes built at the beginning of the Christian Era are still standing,

but little impaired by time. **Reinforced** concrete is a comparatively new form of construction having found its first employment in France about the middle of the last century. The first bridge constructed in America of reinforced concrete was an arch span erected in Golden Gate Park, San Francisco, in 1889. It has proved eminently satisfactory and many thousands of the same class of structures have followed it. It may be urged that since this structure is located in a less trying climate than ours, its length of life is no guide to the durability of a similar structure in Canada, but on the other hand, we have ample evidence that structures of stone masonry, a material offering greater opportunity of attack for the elements than monolithic concrete, have been in existence for well over a century in this country. It would seem reasonable, therefore, to predict for well-constructed concrete bridges a life of at least a hundred years.

5. Maintenance.

While the annual outlay for mainenance may not in any case be very large, this element is a very important one, for the total expenditure entailed during the lifetime of the bridge may amount to as much as several times the original cost of the bridge.

In steel bridges carrying wooden floors, a large part of the expense of maintenance arises from the necessity of frequent renewal of the floors. On the basis of a life of 5 years and assuming that the cost of providing and laying timber in floors is $35 per M., the annual outlay on this account would be from 2½ to 6 per cent. of the first cost of the superstructure, that is, of the steel work and the original wooden floor. The higher charge is, of course, for short spans and the low for long spans. If the lifetime of the bridge were 50 years, the expense of renewal of the timber floors for that period would in the average case be nearly 200 per cent. of the original cost of the superstructure, assuming the price of timber were to continue throughout the 50 years the same as at present.

The painting of steel structures constitutes a large item of expense to the muncipality, unless the latter is willing to economize in this direction and meet the correspondingly heavy expense of frequent renewals. Climatic conditions and the proximity to towns and cities where corrosive gases may come in contact with the metal, largely determine the durability of preservative coatings. In most cases a steel bridge requires careful painting every 3 or 4 years, and if the longer interval is adopted, two coats should be applied, preceded by a thorough brushing and scraping to remove all rust and old paint. On the assumption that steel bridges are painted in this way every 4 years, the annual cost of painting would be from 2 to 2½ per cent. of the cost of the superstructure for bridges with wooden floors and from 1½ to 2 per cent of the cost of the superstructure for bridges with concrete floors.

For properly-constructed all-concrete bridges there should be no maintenance charges whatever beyond the gravelling of the roadway over such bridges as carry fills and perhaps the re-caulking of expanding joints at long intervals. These two items combined would constitute but a very small amount of expense per annum, probably not more than ½ of one per cent. of the first cost.

6. Appearance.

But little attention is ordinarily paid to the matter of appearances in highway bridge construction. This is to be regretted for nowhere is there a better opportunity for the expression of good taste and the exhibition of neatness and tidiness in engineering work. A bridge is generally constructed for a long time to come and because of the prominent feature which it forms on the highway, an effort should be made to make each bridge at least a good example of strong, well-proportioned and well-finished construction. It must be remembered also that the traffic over many bridges will have increased many fold before their natural life has expired and in building some attention should be given to the appearance which the bridge should have when the district may have become much more populous than at present.

Some Typical Cases Considered.

Certain type problems from the investment point of view frequently arise in dealing with bridge projects, and a consideration of a few of these may be of interest in illustrating the general principles already discussed.

A simple problem in bridge economics which requires consideration in fixing the lengths of viaducts is the determination of the points where the earth fill should end and the bridging proper should begin. Under ordinary cost conditions existing in Central Ontario, the first costs per lineal foot of earth fill and of steel highway viaduct coincide for a height of about 20 to 25 feet. This does not mean that the economy of employing earth fill ceases when this depth has been reached, however, for the maintenance charges on an earth fill are limited to re-surfacing, while on a steel viaduct they would be considerable as has already been pointed out. Further, the life of an earth fill is perpetual, but that of any form of built viaduct must be of finite duration and of a steel viaduct probably not over 50 years. The limit of economic depth for an earth fill is therefore not 20 or 25 feet but something greater.

The relative advantages of steel superstructures with wooden floors and with concrete floors are often the subject of much serious study by municipal bridge commissioners. Properly, no fair comparison can be made between them since the structure with a concrete floor does not find its economical application in the field to which the bridge with the wooden floor must be confined—light country highway traffic. If a steel superstructure with a concrete floor was therefore designed to provide for only the 6 or 8-ton concentrated load which is the maximum loading which a steel bridge with a wooden floor will ordinarily accommodate it would be found that at the end of the natural life of the heavier structure it might have cost as much as the lighter structure with the wooden floor. Such a development would happen, in general for spans of about 100 feet in length. For shorter spans the lighter bridge would have entailed the greater expenditure in first cost and maintenance at the expiration of 50 years, but for spans over 100 feet the monetary outlay would be greater for the heavy structure. The reason for this somewhat startling fact is that while the cost of renewal of wooden floors in the lighter bridges is very great, the cost of painting the heavier structure is much greater than for the light structure because of the much greater tonnage of steel in the bridge with the concrete floor.

This advantage which the lighter bridge possesses for spans over 100 feet in length is of course only of importance where the bridge will never be required to accommodate rolling loads of greater weight than a heavily-laden wagon or a light traction-engine. Should it be necessary to provide for much heavier loads at the outset, the bridge with the wooden floor would lose any advantage which it might possess when employed in its own particular field.

Within the last few years, the economic problem in highway bridge work which has most frequently presented itself for solution is the question whether a steel bridge with a concrete floor or an all-concrete bridge would be the better investment in a given situation. From what has been said

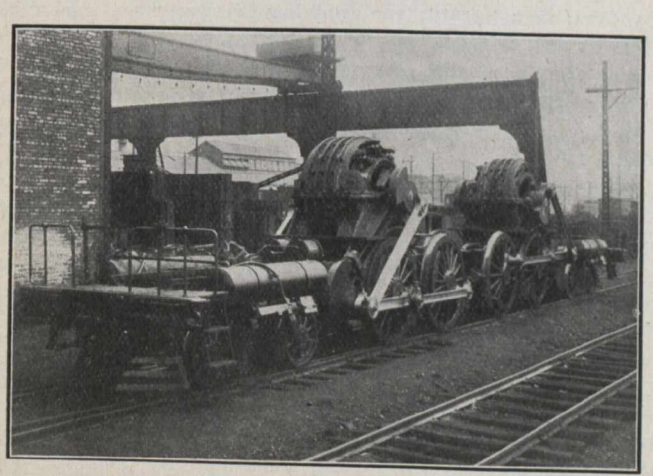
already, it is self-evident that where the physical conditions existing at the bridge site will permit of a concrete bridge and where the first cost is at all comparable with that of a steel structure with a concrete floor, the former is the much better investment. Because of the almost negligible maintenance charges and the much greater life of the concrete structure, the annual cost of perpetually providing and maintaining concrete bridges at any typical crossing, assuming a life of 100 years for these structures, is from one-half to one-third as much as it would be if steel bridges were perpetually employed at the same site.

In conclusion it should be repeated that the determination of the relative advantages of different types of bridges from the investment point of view can only be correctly arrived at by the application of sound technical knowledge and clear business perception to a close study of local conditions and the only one whose qualifications along both these lines entitle him to deal with such a matter is the trained engineer.

PENNSYLVANIA RAILROAD ORDERS NINE MORE ELECTRIC LOCOMOTIVES.

Nine more electric locomotives, aggregating about 40,000 horse-power, have been ordered by the Pennsylvania Railroad from the Westinghouse Electric & Manufacturing Company. The new locomotives will be of the same type as those which are now being operated in the Manhattan Terminal, New York City, and will supplement the twenty-four already in use. The Westinghouse Electric & Manufacturing Company has contracted to have the new locomotives completed by July 1st, 1911.

The cabs, frames, running gear and mechanical parts will be built by the Pennsylvania Railroad at their Juniata shops. The air brakes will be supplied by the Westinghouse Air Brake Company. The electrical equipments will be built and the complete locomotives assembled at the East



1. Pennsylvania Electric Locomotive—Motors and Running Gear.

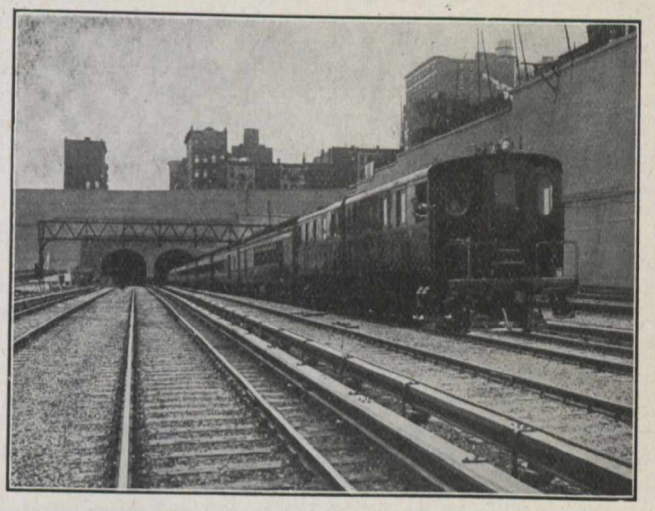
Pittsburg Works of the Westinghouse Electric & Manufacturing Company.

The Pennsylvania locomotives are by far the most powerful ever built. The locomotive is an articulated machine of double cab design. Each half carries its own motor and complete equipment and the two halves are coupled together at their driving-wheel ends. The frames, driving wheels and trucks of the running gear are similar in general character to those of the "American Type" steam locomotive.

The wheel and motor arrangement was decided upon only after careful experiments with several other forms, both of motor drive and wheel arrangement; the governing motive being to secure the greatest possible steadiness at speed.

The coupled ends are fitted with permanent couplings of twin draw bars and Westinghouse friction draft gears, so arranged that the leading half serves as a leading truck and the other half as a trailer in whichever direction the locomotive may be moving.

Each cab is complete with Westinghouse automatic and straight air brake equipment, apparatus for train lighting,



2. Pennsylvania Electric Locomotive and 8-car train at Tunnel Entrance, New York City.

electric head lights, pneumatically operated whistle and sanders, as well as its motor, unit switches and master controller.

The machines are so arranged that, in event of one motor being cut out, the entire machine can be operated from either cab with the remaining motor. The halves are interchangeable and if one is out of service it may be replaced by another half while repairs are being made.

The unit switch field control permits two or more locomotives to be coupled together and all to be operated from either end of any one cab, and affords flexibility of speed regulation. It gives two additional running notches and at the same time economizes power consumption during acceleration.

The following are some of the characteristic features of the Pennsylvania Direct-Current, 600-Volt Electric Locomotives:

Weights and Dimensions.

Weight of locomotive, complete.....156 tons.
Weight on drivers.....200,000 lbs.
Weight on each driving axle.....50,000 lbs.
Weight on each bogie truck.....57,000 lbs.
Total length overall, inside knuckles....64 ft., 11 in.
Rigid wheel base of each half.....7 ft., 2 in.
Total wheel base of each half.....23 ft., 1 in.
Total wheel base of locomotive.....55 ft., 11 in.
Diameter of drivers.....72 inches.

General Capacity.

Contract tractive effort.....60,000 lbs.
Maximum draw bar pull (recorded on test).79,200 lbs.
Normal speed with full train.....60 mi. per hr.

Normal Service.

550-Ton Train to be Started and Accelerated on 2 Per Cent. Tunnel Grades.

Maximum Contract horse-power.....4,000

Motor Data.

Two Direct-Current Interpole Motors—Cast Steel Frames—Directly Connected Through Jack-Shafts and Side-Rods.

Weight of each motor complete with cranks .....43,000 lbs.
Height of motor frame above cab floor..5 ft., 6½ in.
Height of center of shaft above cab floor .....2 ft., 1½ in.

Since the opening of the Manhattan Terminal on November 27, 1910, the entire through passenger traffic of the Pennsylvania Road in its Newark tunnels has been handled by the electric locomotives of this type without a hitch and to the entire satisfaction of the operating force. Very heavy trains far beyond the capacity of the usual passenger locomotive, have been handled over the tunnel grades with ease.

WOOD PRESERVATION.*

By A. L. Kuehn, General Superintendent, American Creosoting Company.

It is quite natural to assume, in view of the great amount of steel and concrete which is taking the place of wood in all manner of structures, that the use of wood is greatly on the wane. It is a startling fact, however, that the actual use of wood is on the increase. The adoption of steel and concrete buildings, steel poles, steel furniture and steel cars seems to be of little avail in materially checking the use of wood per capita in this country. The following information on the consumption of wood per capita was compiled from the United States Census reports and from the National Lumber Manufacturers' Association's report of 1910:—

Year.	Lumber per capita in U.S.
1850	220 ft. B. M.
1860	250 ft. B. M.
1870	340 ft. B. M.
1880	360 ft. B. M.
1890	380 ft. B. M.
1900	460 ft. B. M.

This is also the experience of the older European countries, which have for a century been confronted with a shortage of wood, and, notwithstanding the shortage, have been required to meet an increased use. It is pertinent to state, however, that whereas the present consumption per capita here is in excess of 400 ft. board measure, it is only 60 ft. to 75 ft. board measure in Europe.

In the face of the increasing use of wood, we have a waning timber supply. The annual consumption of lumber is about 40,000,000,000 ft., board measure, cut from about 8,000,000 acres of forest. At this rate the present forest areas are estimated to last variously from forty to sixty years. It is quite evident that the greatest efforts must be made to stop and prevent wastes and to procure the maximum utilization of wood. Wood preservation is playing a highly important part to produce this end, even at the present time, and it will continue to do so to a much greater extent. Wood preservation is generally understood to play its part in that properly treated timber lasts longer than untreated timber. However, its greatest effect lies in the fact that timbers which have had little or only a limited use heretofore are made available.

* Abstract of a paper read before the Central Electric Railway Association, Dayton, Ohio, December 1st, 1910.

The Causes of Decay of Wood.

The decay of wood is due to the growth of fungi, which are plants of low order. They require for their development moisture, air and a proper degree of warmth, but the spores are not killed when kept in low temperatures. When the temperature is raised to 50 deg. Fahr. or 60 deg. Fahr. the latter immediately develop. Generally speaking, fungi and spores are killed by temperatures over 175 deg. Fahr.

The basis of wood preservation is the introduction into the wood of poisonous substances which will kill fungi. Copper sulphate, mercury chloride, zinc chloride and dead oil of coal tar are all poisons which will prevent fungus growth. More than a century ago European countries began to experience a timber shortage and about that time active work was begun to prolong the life of exposed timber. The British were most active, because of their great number of wooden ships. Sir Humphry Davy recommended mercury salts; Thomas Wade, in 1815, recommended copper salts, iron salts and zinc chloride. The early activity was in the use of poisonous salts. By 1840 timber preserving was fairly well on its way in England.

Corrosive sublimate was used in several places for preserving wood in the eighteenth century, but preservation of timber by its use was patented by J. H. Kyan in 1832. It was used for about 50 years to a limited extent.

Preserving timber by sulphate of copper was patented by Margary in 1837, but its use was not very extensive on account of the action of the sulphate on the containing vessels.

The use of chloride of zinc in a wood-preserving process was patented by Sir William Burnett in 1838. The method was called "Burnettizing."

The use of dead oil of coal tar (creosoting) in timber preservation was patented by John Bethell in 1838.

The first methods of applying the preservatives consisted of brushing, painting or steeping. About 1830 M. Breant invented an apparatus for applying preservatives, consisting of a closed cylinder in which the wood was placed, the voids filled with the preserving fluid and pressure applied to inject the fluid into the wood. Bethell adopted the method and from this time the modern timber-preserving practices really date.

The results obtained by corrosive sublimate, sulphate of copper and chloride of zinc in the early stages seem to have been varying, but good enough to warrant their use for some time. However, by 1885 creosote was practically the only preservative in use in England, which is the case at the present time.

The first impetus in America to the demand for preserved wood came after the census of 1880. Previous to this time numerous trials had been made of all the preserving methods heretofore mentioned. Notable among these are the Kyanizing of chestnut track ties by the Northern Central Railroad in 1838, the Burnettizing of track ties by the Cambridge Railroad in 1835, and the Burnettizing of track ties in 1866 by the Chicago, Rock Island & Pacific Railway. A most notable record in this country is that of timber preserved for bridges on the New Orleans, Mobile & Texas Railroad (now the Louisville & Nashville) in 1876, 1877 and 1878. This timber was creosoted at works at West Pascagoula, Miss. A considerable amount of this timber is still in place. At the present time there are 76 wood-preserving plants in this country, of which 46 use creosote exclusively; and of the remainder all but 18 use creosote to some extent.

Wood requires proper preparation before it can be successfully treated. The sap or moisture must be removed to

such an extent as to allow proper penetration of the preservative. In general, the proper method to prepare the timber for treatment is to air-season it. This not only maintains the strength of the timber, but allows a more uniform distribution of the preservative. The sap wood of all timber can be completely penetrated if air-seasoned, but it has not yet been possible to penetrate the heart wood of all timbers. The principal woods treated in this country are: yellow pine; red and black oak and other oaks of these species; beech; elm; fir; red, black and tupelo gum; hemlock; maple and ash. The time required for sufficient air-seasoning to allow proper treatment varies for the different woods. For pine this period is from 4 to 6 months; for oak 8 to 12 months. This time also depends upon weather conditions.

Preservatives Used.

The different woods have various resistances to penetration by the preserving liquid under pressure, and it is necessary that the several species be properly segregated so that each may be subjected to its proper period of treatment.

The preservative used by most wood-preserving plants is creosote. At the beginning of the present era of wood preservation in this country the principal preservative used was chloride of zinc (Burnettizing). This was due, of course, to its cheapness in first cost. The objection to chloride of zinc is that it is soluble in water and will be leached out of the wood. The ordinary solution used consists of 2 per cent. to 4 per cent., by weight, of the chloride of zinc dissolved in water. The strength of the solution is gauged by the amount of solution which is taken up by the timber. The strength must not, however, exceed 5 per cent. as a strong solution will injure the wood. To prevent leaching several methods were used to put a coating, insoluble in water, on zinc-treated timber. Notable among these methods was the Wellhouse process, which consisted in coating the timber with a solution of tannin and glue. This process has now been practically abandoned. The life of timber and ties treated by chloride of zinc is given as from 10 to 14 years.

Creosote oil, which is recognized as the best wood preservative, is the product of distillation of coal tar. It is a by-product in the manufacture of coal-tar pitch. It is pretty well determined that a heavy oil—that is, one in which the light fractions are reduced—is the most desirable. It has been found that when the treated wood is exposed to the air the light fractions rapidly evaporate. The heavy creosote oil, in addition to its antiseptic qualities, carries with it also the property of waterproofing, which is valuable in the prevention of decay. The American Railway Engineering & Maintenance of Way Association has adopted as standard a specification for creosote oil which specifies a heavy oil. The specification is as follows:

"The oil used shall be the best obtainable grade of coal-tar creosote; that is, it must be a pure product of coal-tar distillation and must be free from admixture of oils, other tars or substances foreign to pure coal tar; it must be completely liquid at 38 deg. C., and must be free from suspended matter; the specific gravity of the oil at 38 deg. C. must be at least 1.03. When distilled according to the common method, that is, using an 8-oz. retort, asbestos-covered, with standard thermometers, bulb ½ in. above the surface of the oil, the creosote, calculated on the basis of the dry oil, shall give no distillate below 200 deg. C., not more than 5 per cent. below 210 deg. C., not more than 25 per cent. below 235 deg. C., and the residue above 355 deg. C. if it exceeds 5 per cent. in quantity, must be soft. The oil shall not contain more than 3 per cent. water."

The proper amount of creosote oil to be injected depends upon the use to which the timber is to be put and also upon the kind of timber. In bridge structures and places where the replacement is difficult higher quantities are used than in track ties. In pine timber it is possible to inject more oil than in the red oaks. The customary way to state the quantity of oil is to give the average number of pounds per cubic feet of timber. In general, present practice in this country is to use from 7 lb. to 10 lb. per cubic foot for track ties and from 10 lb. to 18 lb. for poles, bridge and structural timber. In some cases as high as 24 lb. per cubic foot has been used in pine for wharves and piling, which are subject to the attack of marine borers.

The principal object in using large quantities of oil in timber is to obtain depth of penetration. A distinct advance has been made in methods of injecting the oil (which will be described later on) by which depth of penetration may be obtained without the use of such large quantities of oil. However, it is conceded that it is not good practice, even with these methods to go much below 7 lb. or 8 lb. per cubic foot as an average, because in practical operation there will be, even with the greatest care in segregating the species of wood, a great variation in the pieces treated.

Crude petroleum oil is now being tried to some extent where, on account of long hauls, creosote is very expensive. A notable example of this is its use by the Atchison, Topeka & Santa Fe Railroad on its western lines. Petroleum has no antiseptic qualities, so its protection against decay must necessarily depend upon its waterproofing qualities. The examples of this are as yet too recent to justify any general conclusion.

Methods of Application and Processes.

The modern timber-treating methods consist, essentially, in the injection of the preserving fluid into the wood under pressure. Some use still is made of the dipping methods. Notable among these is what is known as the open-tank process of creosoting, in which the timber is placed first in hot oil and then in cold oil. This has, however, only a very limited use, and only wood which is easily penetrated, such as sap pine, can be used. The pressure used in injecting the fluid depends upon the kind of wood. Well-seasoned sap pine can be completely penetrated with creosote oil with pressure as low as from 50 lb. to 60 lb. per square inch. Red oak requires from 150 lb. to 175 lb. per square inch. Proper temperatures are necessary during the treatment. This temperature must be kept low enough to avoid injury to the wood; a good limiting temperature is about 200 deg. Fahr. With creosote oil the element of heat is most important, because the oil becomes more fluid as it is heated.

The method of treating timber with zinc chloride is as follows: The timber to be treated is placed in a closed cylinder or retort. A vacuum is then produced in the cylinder and maintained for 20 to 30 minutes. The chloride of zinc solution is then introduced and the voids in the cylinder are filled. When the cylinder is full, pressure is applied and maintained until the proper amount of solution has been injected. The surplus solution is drained off and the timber removed.

An interesting modification of the zinc chloride treatment to prevent the leaching out of the zinc chloride was developed in Germany some years ago by the Ruetgers Works. This consisted in making an emulsion of the zinc chloride solution and creosote oil. The oil remained on the outside and was to form a protective coating. This process, however, has since been abandoned in Germany, but is being used in this country to some extent in what is known as the

Card process. This consists in keeping the oil and water solution agitated by a centrifugal pump.

The creosoting process which was followed up to about 1904 was exactly that introduced by Bethell in England in 1838. This is as follows: The timber, when air-seasoned, is placed in the retort and a vacuum produced and maintained for 20 minutes to 30 minutes. The creosote oil is then introduced without breaking the vacuum until the cylinder is filled. Pressure is then applied until the proper amount is injected. The surplus oil is then drawn off and the timber removed. When green timber is treated it is steamed before applying the vacuum.

By the Bethell process the portion of the wood which is penetrated is filled with oil as nearly as possible. It has been called "the full-cell creosoting method." In 1903-4 there was developed in this country a method by means of which a portion of the surplus oil in the cells and voids of the wood is removed. This allows a deeper penetration with a given quantity of oil. This is the Lowry process used by the American Creosoting Company. Almost simultaneously a similar method was developed in Germany by Rueping. These methods, on account of the removal of the oil, have been called "the partially filled or empty-cell processes."

In the Lowry creosoting process air-seasoned timber is placed in the closed cylinder and the oil is introduced to fill the cylinder; pressure is then applied until a proper penetration has been secured. The surplus oil is then quickly drained off and a vacuum applied to reduce the oil first injected to the specified quantity. The oil is then again drained from the cylinder and the timber removed. In the Rueping process air pressure is applied before introducing oil into the cylinder. The oil is then introduced without reducing the air pressure and further pressure produced to inject the oil on top of the air pressure. After the injection is completed the pressure is released and the air in the wood forces out the free oil.

Wood-Preserving Plant.

The modern wood-preserving plant consists primarily of one or more impregnating retorts. They are steel-plate cylinders 6 ft. or 7 ft. in diameter and from 100 ft. to 150 ft. long. The ends are fitted with doors which can be tightly closed. The cylinders are fitted with running rails on which are run small tram cars loaded with timber. There are also steam coils in these cylinders to allow accurate manipulation of the temperature. Tanks are provided which are placed either above or near the cylinders connected to them by pipes. The preserving fluid is held in these tanks for charging and filling the cylinder. These tanks are essentially measuring tanks in which the amount of preservative used is measured. The necessary pressure and vacuum pumps are provided for the manipulation of pressure and vacuum. The plant further includes a haulage system for handling the timber and also the necessary power plant. The modern plants, of course, are provided with large seasoning yards. A most important part of the plant equipment consists of proper devices for measurements of the preservative used. This is accomplished by means of tank floats with accurate registering means. In the plants of the writer's company this measurement can be easily made to within one-half of 1 per cent.

DIAGRAM B

Standard Loading of the Ontario Railway & Municipal Board.

Steam Railways, 1910

Class	Weight of Engine and Tender	Feet	8'	5'	5'	5'	5'	9'	5'	6'	5'	8'	3'	5'	5'	5'	9'	5'	6'	8'	5'	Uniform Load
Especial Heavy	lbs 379000		27000	52000	52000	52000	52000		36000	36000	36000	36000	27000	52000	52000	52000	52000	36000	36000	36000	36000	5000 lbs per Lineal foot
Heavy	360050		25650	49400	49400	49400	49400		34200	34200	34200	34200	25650	49400	49400	49400	49400	34200	34200	34200	34200	4750 lbs. per Lineal foot
I	341100		24300	46800	46800	46800	46800		32400	32400	32400	32400	24300	46800	46800	46800	46800	32400	32400	32400	32400	4500 lbs per Lineal foot
II	303200		21600	41600	41600	41600	41600		28800	28800	28800	28800	21600	41600	41600	41600	41600	28800	28800	28800	28800	4000 lbs. per Lineal foot
III	265300		18900	36400	36400	36400	36400		25200	25200	25200	25200	18900	36400	36400	36400	36400	25200	25200	25200	25200	3500 lbs per Lineal foot
Especial Light	227400		16200	31200	31200	31200	31200		21600	21600	21600	21600	16200	31200	31200	31200	31200	21600	21600	21600	21600	3000 lbs per Lineal foot

Electric Railways

Feet	5'	20'	5'	10'	5'	20'	5'	5'	Uniform Load lbs. per lineal ft.
	20000	20000	20000	20000	20000	20000	20000	20000	

Electric Car

	7'	
	20000	20000

Road Roller

	11'	5'	8'	4'
	16000	16000	8000	16000	8000

The Canadian Engineer

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The Canadian Engineer absorbed The Canadian Cement and Concrete Review in 1910.

NOTICE TO ADVERTISERS.

Changes of advertisement copy should reach the Head Office two weeks before the date of publication, except in cases where proofs are to be submitted, for which the necessary extra time should be allowed.

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CONTENTS OF THIS ISSUE.

PUBLIC INTEREST IN THE BED OF NAVIGABLE WATERS.

A bill has been introduced by the Hon. Mr. Cochrane which has for its purpose the defining of the rights of landowners along navigable waters in the Province of Ontario.

As this bill is a government measure it is expected it will become law without much amendment, and as it is a measure which is of considerable interest to hydraulic companies and hydraulic engineers, we publish the two important sections of the bill in full:—

1. It is not now and never was the law in this Province that on a grant by the Crown of lands bordering on any navigable lake, river, stream or other body of water of a like or different description that the grantee thereby becomes the owner of any part of the bed of such lake, river, stream or other body of water of a like or different description, but on the contrary, the law is and always was that until expressly granted by the Crown the beds of all navigable lakes, rivers, streams and other bodies of water of a like or of a different description remain and continue the property of the Crown.

2. Section 1 shall not affect the rights of a grantee from the Crown or any person claiming under him who has previous to the passing of this Act developed a water power or powers thereon under the bona fide belief that he had the legal right to do so, provided that he may be required by the Lieutenant-Governor-in-Council to develop the said power or powers to the fullest possible extent, and provided that the price charged for power derived from such water power or powers may from time to time be fixed by the Lieutenant-Governor-in-Council.

HIGHWAY CONTRACTS.

What we are about to remark is just as applicable to one kind of contract as another, but the most of good roads work coming forward in Canada just now and the necessity for a large part of that work being done by contract and small contractors reminds us of the necessity of specifications and contracts, stating in simple, clear, direct words the purpose of the undertaking.

Officials who have been from time to time preparing specifications have added clause after clause until the contractor becomes lost in the wearied details and sometimes vague meanings which multiplicity of clauses are apt to develop.

An official, in his zeal to protect the public, should not forget that he must be entirely fair and just, and it is not his duty to insert phrases into contracts or specifications that the contractor is apt to misunderstand or neglect. The misunderstanding of the contract will lead to delay and loss, and especially so when the bidding is very close, where the contractor takes chances that are not altogether good business.

In highway construction work it is more difficult to prepare specifications covering every phrase of the work definitely than in most construction. It is, therefore, doubly necessary that the phrasing be clear and comprehensive.

CANADIAN PACIFIC EARNINGS.

The published earnings of the Canadian Pacific Railway for January have caused a good deal of surprise in that the actual decrease amounted to $660,479 in net revenue. This, in spite of the fact that the gross revenue was $5,740,206, an increase of $637,780 over January of a year ago.

General Manager McNichol stated that heavy snowstorms, particularly in the great Western section of the line's territory, were the chief factor in the road's poor net revenue showing.

Canadian Pacific's gross and net for the seven months ended January 31st, 1911, do not compare favorably with the same period in 1910. But the last-mentioned period constituted nearly 60 per cent. of a year in which extraordinary increases in gross and net revenues were recorded. In seven months of that year the road gained 23.2 per cent. in gross and 48.2 per cent. in net, compared with the even months of the preceding year.

Seven months gross this year amounts to $61,527,000 as against $56,029,936 for the preceding period, an increase of 9.8 per cent., while net amounts to $23,272,824 as against $21,386,471, an increase of 8.8 per cent.

The above figures place operating expenses for the seven months at $38,255,031, compared with $24,643,465, an increase of 10.4 per cent., against an increase in gross for the same period of 9.8 per cent. The operating ratio for seven months stands at 62.5 per cent., which compares with 64.38 per cent. for the full operating year ended June 30th, 1910.

With the above figures as a basis, it is estimated that gross revenue for the current operating year will amount to approximately $100,300,000, or, roughly, to $5,500,000 more than last year's. Gross for the last three years was as follows: 1910, $94,989,490; 1909, $76,313,321; 1908, $71,384,173.

Expenses will probably be nearer the 1909 proportion of gross than that of 1910, reaching about 68 per cent., and will leave a net revenue of $32,096,000. Other income, not including proceeds from land sales, will likely increase this latter amount by $3,350,000, making a total income of $35,446,000. Fixed charges will require an estimated $11,500,000, leaving a balance available for dividends of about $23,946,000 compared with $27,258,728 for 1910, and $14,955',028 for 1909.

Dividends of 4 per cent. on the outstanding $55,616,666 preferred stock will amount to $2,214,934, leaving a balance of $21,731,066, equivalent to 12.17 per cent. on the outstanding common stock of $180,000,000. That stock was placed upon a 10 per cent. dividend basis January 10th, this year, by the declaration of a quarterly dividend of 1¾ per cent. from earnings and ¾ of 1 per cent. from land sales. This amounts to a dividend of 7 per cent. a year out of earnings and 3 per cent. a year out of the proceeds of land sales. As the above balance of $21,731,066 is from earnings apart from land sale proceeds, the dividend of 7 per cent. only is properly deductable. This amounts to $12,600,000 and leaves a surplus of $9,131,066. The full dividend of 10 per cent. deducted from the amount available for dividends would leave a balance of $3,731,066.

Thus, while gross earnings will show a good increase over the record gross of last year, Canadian Pacific's current fiscal year will hardly show any of the other great gains and accomplishments that its operations recorded last year. The current year will fall in line with the average performance of the four years preceding 1910.

THE CONSERVATION COMMISSION AND PUBLIC HEALTH.

The Commission for the Conservation of Natural Resources is making itself felt in a practical way in the conservation of public health.

At the time we congratulated the Commission on obtaining the services of one of the most practical and eminent medical health experts on the American continent, viz., Dr. Hodgetts.

An opportunity has occurred for Dr. Hodgetts to exercise his broad administrative knowledge in just the very method by which the Commission can show its public usefulness. The opportunity lies in a thorough epidemiological investigation into the recent and present outbreak of typhoid in Ottawa. Typhoid is known as "a preventible disease." This means that it is acknowledged that typhoid, by the administration of up-to-date health regulations, can be prevented from occurring, at least to the extent of an epidemic. This further means that when an epidemic occurs, there must be in some way or another a laxity either in administration of health regulations, or that there is a decided lack of the necessary regulations to keep within control the causes which produce and continue the epidemic.

It is because it is now publicly and universally recognized that typhoid is the effect of certain causes which are humanly controllable that the public exhibit a certain amount of impatience at its occurrence in the form of an epidemic. It is concluded that some one is to blame, either on account of administrative negligence, or on account of the weakness of the system, which should control the administration.

It is now several years since Sir Spencer Wells declared: **"Typhoid can no longer be looked upon as natural, providential, or unavoidable. The existence of such a 'preventible disease' is a proof of ignorance or negligence, and a disgrace to the country, to the town, to the family."**

If we accept Sir Spencer Wells' conclusion, which is generally recognized now as axiomatic, we must further conclude, that an epidemiological examination can only be efficiently administered by an authority, which is absolutely independent of the permanent administration under which the epidemic has occurred. If a bank fails through want of efficient administration, no confidence would be felt in the conclusions of a board of enquiry composed of the permanent bank staff. So, too, in the case of suspected failure in municipal administration, the public will have little faith in the conclusions of those who are responsible for this administration. We do not wish or intend to make any particular reflections, but only to announce the general proposition, that few men or bodies are to be trusted to form themselves into their own jury and bring in an unprejudiced verdict.

Again, is it fair or proper, that the permanent administration should choose or nominate their own judges? The public are always ready to accept and charge the worst motives. Too often it happens in looking around for expert opinion, it is suspected that the character of the eventual opinion to be given is as fairly assured as an hypothesis.

In Ottawa we have at the present time over 800 cases of typhoid. Ottawa draws its water from a river of great volume, but a river which carries the sewage of several towns and villages. Pembroke and several other large towns pour their raw sewage into this river above Ottawa. Typhoid, known to be a water-borne disease, is naturally put down in this case to the sus-

pected polluted water. For about one month, however, the water has been practically sterilized with hypochlorite, and the epidemic has shown no feature of diminution, but rather otherwise. There appears to be a possible conclusion, that even granting the first cause of the epidemic to exist in a polluted water supply, a further cause exists for its continuance in general lack of efficiency in control in preventing contact cases, by general disinfection, isolation, etc.

It is just here where an independent authority such as is presented by the Health Committee of the Commission of Conservation can prove its usefulness.

Dr. Hodgetts, aided by Dr. Bell and a number of inspectors, are tracing the history as far as possible of every case. The evolution of the epidemic and its continuance is to be laid bare. This is a great work, depending upon exact detail and carefully collected data. The conclusions should be logical deductions and not opinions, and should be of that sort of value to the public of Ottawa, that it will be practically impossible to have a similar recurrence of typhoid in the future.

The Conservation Commission are commencing in Canada to do the work which has been so well done for years by the Local Government Board in England. This central authority takes cognizance of the health of the whole of the country, and no epidemic or zymotic zone escapes their searching and independent enquiry. We look for valuable and practical work in the near future from Dr. Hodgetts' department, and trust that before long it will take the lead in Canada in formulating a general policy relative to health matters. Just as the Local Government Board in England has made itself felt in directing such questions as sewage disposal and efficient and pure water supply, so we trust that the Committee for the Conservation of Health will see their way to bring out and report as to the most suitable methods and requirements in connection with sewage disposal under various conditions. Such a report at the present time, based upon a collection of all up-to-date data and knowledge, would prove invaluable to the many provinces and communities, which are apt to feel that the whole subject has too many loose ends to allow of exact determination.

PURE DRINKING WATER.

We publish herewith a copy of Bill 131, which has been introduced by Mr. Lewis, of Huron, which, if it becomes law, will have a far-reaching effect in sanitary matters. Because of its importance we publish the bill in full, and, although we have not much expectation of its becoming law this session, yet, it is an important measure, and shows clearly the trend of modern ideas of sanitary matters:—

An Act Respecting Drinking Water.

His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. This Act may be cited as "The Drinking Water Act."

2. No corporation shall take any water for drinking purposes from any river or stream which has had sewage or refuse put in it above the intake pipe through which such water is drawn without having such water sterilized before using.

3. Any corporation violating the provisions of Section 2 of this Act shall be guilty of an offence, and liable to a fine not exceeding two hundred dollars for each day during which such violation continues.

4. This Act shall come into force by proclamation of the Governor-in-Council.

THE CANADIAN CONCRETE AND CEMENT ASSOCIATION.

The third annual convention and exhibition held under the auspices of the Canadian Concrete and Cement Association was brought with success to a close last Saturday evening.

Mr. Peter Gillespie, president of the Association, and Mr. Wm. Snaith, secretary, together with the officers and members of the Association, are to be congratulated on the success of the combined events.

Although cement is not a new product in Canada, yet concrete work is but in its infancy. We have been using it for foundation work and on large contracts, but it is just within the last year or so that the smaller user has commenced the purchase of cement. The publicity of the past years is just now commencing to be felt, and while concrete has been used in the past for foundation work, it is now being adapted to every class of construction. New avenues are thus being opened, and we look for great increases in the consumption of cement in the coming year or two.

Although the attendance was not large at the Association meetings, yet the papers and discussions were good and the exchange of ideas in the matter of working in cement will be very beneficial.

The exhibition in the St. Lawrence Arena was the most successful yet held under the auspices of this Association. There was a large number of exhibitors and a splendid attendance of visitors. The exhibits were varied, and those in charge were most courteous in their explanations to the sightseers, as well as to possible customers.

That the visitor might have a directory of the Arena, and to be informed of some of the events that took place from day to day in connection with the exhibition, The Canadian Engineer issued a daily bulletin. It is true it was not a many-paged publication, but it was greatly sought for every morning by those who had seen the previous day's issue, and we believe it served a splendid purpose in adding to the interest and increased the publicity in connection with this very successful exhibition.

EDITORIAL NOTE.

Canadian journalism does not any longer consist in the gathering and distributing of Canadian news only, but the Canadian reader now requires news of an Empire as well as the news of an agent, and the Montreal "Star," Canada's leading daily, wishing to insure the best service to Canadians and to their readers, have recently opened beautiful offices on Trafalgar Square, London, England. They have a centre for the gathering of British news where their staff will be able to keep in close touch with the problems of the Empire. In addition to being a newspaper office, their London office is provided with a writing-room, visitors' register and a reading-room, so Canadians may know where they can make their headquarters while in Britain. The "Star's" staff at London will be always glad to extend a cordial welcome to visitors.

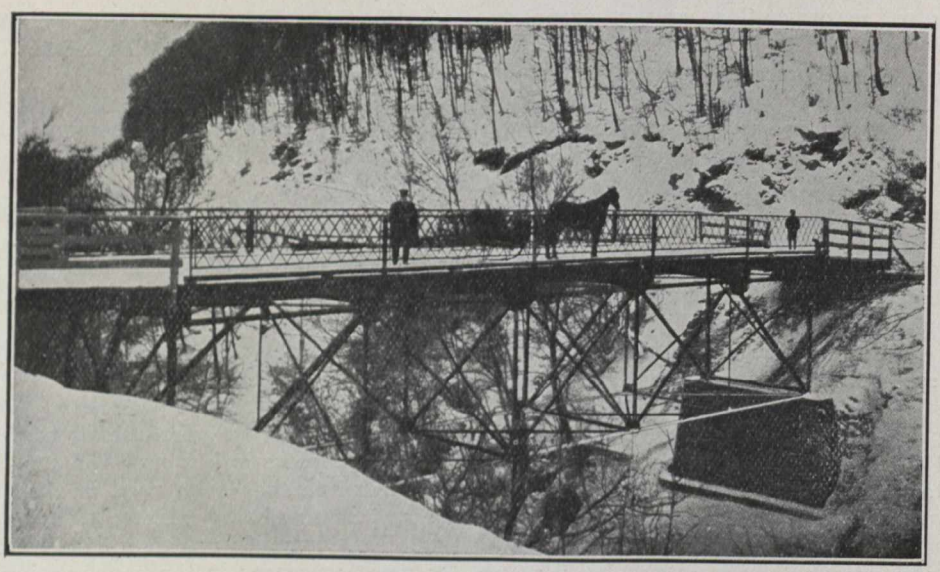
THE BRIDGES OF NOVA SCOTIA.

The Bridge Act of Nova Scotia was first put on the statutes in 1883. This was an Act to provide for the construction of large bridges throughout the province, and already there has been appropriated under this Act $3,088,779.00, and during the fiscal year 1909-10, $68,071.00 were spent.

(b) A bridge shall be held to be built "of permanent materials" when the whole structure except the flooring and railing is of permanent materials.

(c) Larger bridges "include such bridges as would if built of permanent materials, cost not less than $500.00."

(d) Smaller bridges "include such bridges as would cost not less than $30.00, but less than $500.00."



MANAGER'S BRIDGE (ACADIA MINES).

One deck span of iron and steel of 72 feet between end pin centres. Roadway to be 15 feet wide in the clear.

Tenders opened June 30th, 1910.

1.—W. P. McNeil & Co., New Glasgow.. $1,289.00 **2.—John Stewart, New Glasgow..... $1,300.00**

In 1903 the Act was amended and some of the more important sections are as follows:—

Interpretation.

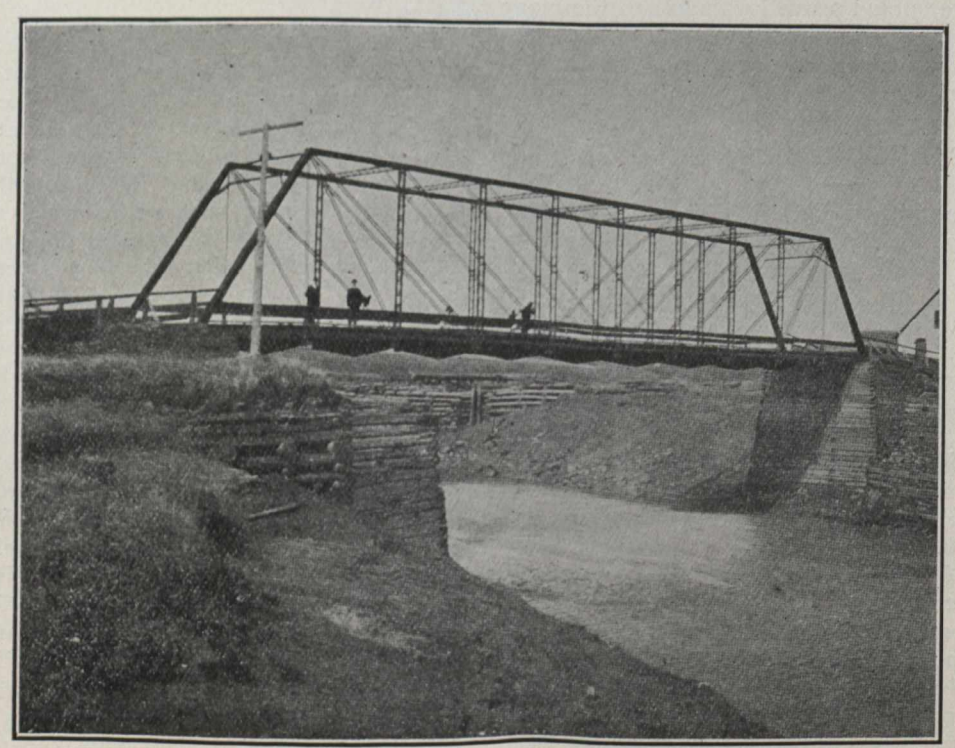
2. In this Act, unless the context otherwise requires:

(a) "Permanent materials" means steel, iron, stone, concrete and other substances of a like lasting character.

Application.

3. All bridges heretofore brought under the provisions of Chapter 20 of the Acts of 1883, entitled "An Act respecting Bridges," and the amendments thereto, shall be subject to the provisions of this Act.

4. All larger bridges constructed under the provisions



RIVER HEBERT BRIDGE, CUMBERLAND CO.

One 140 ft. iron and steel span on closed faced cribwork abutments filled with concrete.

of this Act shall be built of permanent materials, unless the Provincial Engineer recommends otherwise.

Construction of Bridges.

7. Before any larger bridge is brought under the provisions of this Act and before any moneys are expended in connection with the construction of such bridges, the following requirements shall be complied with:—

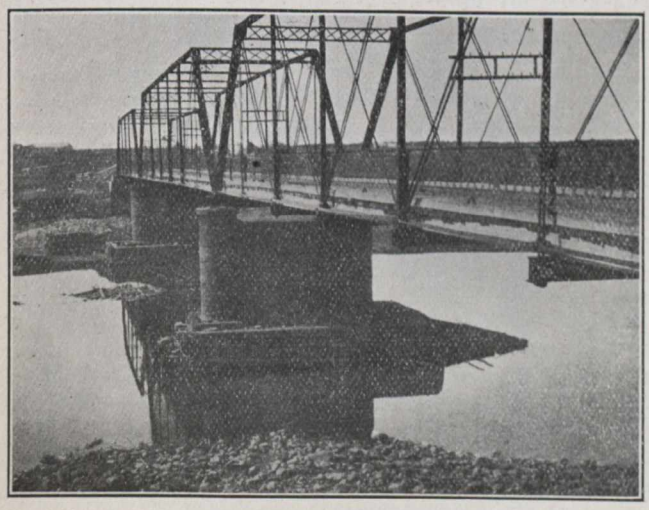
(b) The Provincial Engineer shall make a report recommending the construction of the bridge.

(c) Such report shall be approved by the Governor-in-Council.

(d) The bridge shall be constructed according to plans and specifications approved by the Provincial Engineer.

(e) The due completion of the work, and the fact that the contractor is entitled to the whole part of the payment sought shall be certified by the Provincial Engineer.

11. (2) The Governor-in-Council may from time to time appoint such assistant engineers or other officers as may be required for the carrying out of this Act, and such assistant engineers or other officers, if such are appointed, shall be under the supervision of the Provincial Engineer, and shall act under his instructions.



BOARD LANDING BRIDGE, COLCHESTER CO.
Two steel spans of 100 feet, and one of 120 feet, on steel cylinder piers, filled with concrete, and concrete abutments.

12. No part of the money borrowed under the authority of this Act shall be expended in repairs.

14. An account shall be annually submitted to the Legislature, with statements showing the amounts expended in each Municipality.

Tender and Contract and Inspection.

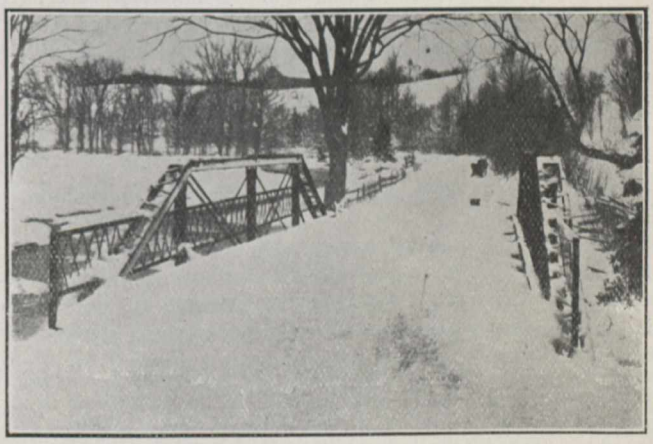
15. All work undertaken in connection with the construction of larger bridges under the provisions of this Act, shall be let and performed under tender and contract, unless a different mode is recommended by the Provincial Engineer, and such recommendation is approved by the Commissioner of Public Works and Mines. In all cases in which the Provincial Engineer recommends a mode other than by tender and contract he shall state his reasons for such recommendations.

16. When the plans and specifications of any work to be performed under the provisions of this Act by tender and contract have been prepared and approved, the advertising for tenders and awarding of contracts shall be in the hands of the Commissioner of Public Works and Mines, and all contracts shall be subject to the approval of the Provincial Engineer before any works are commenced.

17. All contract works carried on under the provisions of this Act shall be performed under the supervision of a competent inspector, who shall be appointed by the Provincial Engineer, but the wages of such inspector shall be paid by the contractor at a rate to be fixed in the contract, and such inspector may be removed from time to time by the Provincial Engineer, and another inspector may be appointed in the place of the one so removed.

At the present time there are probably not more than twenty per cent, of the large bridges of the province which have not been constructed of what is known under the Act of Permanent Material.

The Province of Nova Scotia in this line certainly stands in advance of any Province in the Dominion. Not only on account of being the first one to start the construction of permanent bridges by the Government but also as regards the number of bridges constructed. I think it is safe to say that the Provincial Government of Nova Scotia has built more permanent bridges than the Governments of all the other Provinces have either built or assisted in building. To most people this would seem a very sweeping statement but nevertheless it is true, notwithstanding the fact that in some of the new Provinces such as Alberta, great



DAN McPHERSON'S BRIDGE (McLELLAN'S BROOK).
One iron and steel span of 50 feet between end pin centres.
Roadway to be 15 feet wide in the clear.
Tenders opened June 30th, 1910.
1.—R. Musgrave & Son, North Sydney... $635.00
2.—John Stewart, New Glasgow..... 638.00

progress is being made in this direction.

The bridges last year varied in length from 35-ft. to 130 ft., and all were constructed by the following local Bridge companies:

W. P. McNeil & Co., New Glasgow, thirteen bridges with a total of twenty-one spans.

Robert Musgrave & Son, North Sydney, eight bridges of one span.

John Stewart, New Glasgow, one bridge of two spans.

There is the keenest competition between the contractors, the amount of the tenders in most cases varying by only one or two per cent.

The number and size of the various spans which were let last year were as follows:

Fixed Spans.

Two of 35	feet.	Five of 90	feet.
One of 40	"	One of 92	"
Two of 45	"	One of 100	"
Five of 50	"	One of 105	"
One of 60	"	One of 115	"
One of 65	"	Two of 118	"

One of 72 " Two of 120 "
One of 86 " Two of 130 "

Draw Spans.

One of 100 " One of 112 "

We give herewith illustrations of a few of the types of bridges. Mr. Roderich McColl, M.C. Soc. C.E., is the provincial engineer in charge of bridges.

WATER PURIFICATION.

Sir:—While every effort should be made to secure a reasonable degree of purification of the sewage of the cities of this country, experience clearly shows that the complete removal of sewage pollution is not essential when water purification plants are established. Many cities are taking their water from streams even grossly polluted by sewage, and by applying modern scientific methods of purification and sterilization, have some of the lowest typhoid fever death rates in the country.

The same is true of many cities in England and on the Continent. Purification plants such as those established at Albany, N. Y.; Philadelphia, Pa.; Pittsburgh, Pa.; St. Louis, Mo.; Cincinnati, Ohio; Columbus, Ohio; McKeesport, Pa.; and many others, can no longer be considered as merely in their experimental stages. Proved statistics and scientific analyses are daily showing what these installations are accomplishing in the way of reduced death rates in these cities.

In Germany greater attention is paid to perfection in water supply than to perfection in sewage effluents, and in that country we find the death rate from typhoid fever is 5.3 per hundred thousand as opposed to 45 per hundred thousand in America. Here the distribution of pure water is not considered so essential, judging by experience.

Yet, in spite of all this demonstrated efficiency, engineers are frequently set aside and derided by the appalling ignorance upon these important accomplishments by those in official positions who should know better. When we consider all that has been accomplished by purification installations in the way of reduced typhoid fever death rates in the many cities in this country, the concrete case of ignorance recently encountered by the writer on the part of state officials of Oklahoma seems almost past believing. We will, however, let the written and signed statements of Oklahoma's official scientific authorities upon this matter of water purification speak for themselves.

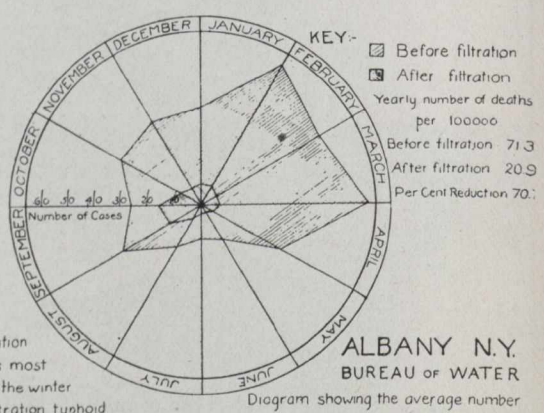
Some six months ago the writer was called in by the cities of Muskogee and Oklahoma City to design for them adequate and improved water supplies, and in the case of Muskogee improved sewerage facilities and garbage disposal. In Oklahoma City the contract included the investigation of every possible source of water supply for that city, and the recommendation of that source and plan which in my engineering judgment seemed wisest, best and most economical for the city to adopt.

Oklahoma City has for many years been obtaining its water from the North Canadian River, the average flow of which throughout the year is somewhere in the vicinity of three hundred cubic feet per second. After a careful consideration of every other possible and impossible source of supply suggested by citizens and other engineers, the plan recommended by the writer included the construction of a dam upon this river, impounding about 8,000,000,000 gallons of water, sufficient to carry the City of Oklahoma over a period of over a year's drought and a complete water softening, purification and sterilization plant.

About one hundred miles up stream, measured along the meanderings of the North Canadian River, is situated the town of El Reno, with a population of about 8000 people; approximately fifty or sixty miles further up is another small town of El Reno, with a population of about 8,000 people; sewerage systems, the average discharge of sewage at El Reno being one-third (⅓) of a cubic foot per second, as compared with an average stream flow of 300 cubic feet per second. The town of Yukon, with a population of 1,000, situated at a river distance of sixteen miles is at the present time installing a sewerage system, including a sewage disposal plant.

Although the plans for the new water system provided for a complete and thoroughly up-to-date filtration and softening plant, including sterilization, the writer took the precaution to point out the advisability of the city's taking immediate action to see to it that the towns above were compelled to adopt some rational method of sewage purification before discharging the sewage effluent into the North Canadian River.

The question of voting a million and a quarter of bonds to carry out the proposed plan for an improved water supply was before the people of Oklahoma City for seven weeks,



NOTE-
Previous to filtration typhoid fever was most prevalent during the winter months After filtration typhoid fever has been most prevalent during the summer vacation period

Diagram showing the average number of cases of typhoid fever for the nine years preceding and the nine years succeeding the introduction of filtered water

and received the endorsement of the City Council, the Chamber of Commerce, a citizens' committee, appointed to investigate the entire proposition, the Oklahoma State Engineering Society, and most of the most reliable men of the community, after each had given the proposed scheme of water supply and purification their careful examination. The need of the city was very great, for during two or three months of the years 1902 and 1903, the river went practically dry, but the population of Oklahoma City at that time was only about 10,000 people, most of whom were supplied from wells. The present population of Oklahoma City is about 65,000 people, and during the past summer the flow of the river was not sufficient to supply the ordinary demands made upon it and for many hours the pumps had to be shut down and the city left without any fire protection whatever. Nor has the city a present supply sufficient to offer water to new industries, or to extend its mains.

Four days before the election certain state officials attempted to coerce the Mayor of Oklahoma City into going before the Legislature, then in session, to secure for them the passage of certain bills proposed by the State Commissioner of Health, which the Mayor had not seen, and which seriously affected every city and town in the state, under the penalty of their opposing the bond issue if their wishes were not acceded to. The Mayor opposed this principle of swapping votes, so to speak.

His statement in the papers regarding this matter was as follows:

"I would rather go down in defeat, than to sacrifice the city of Oklahoma by agreeing to back a bill fathered by Dr. J. C. Mahr, state health officer, and Kate Barnard, state commissioner of charities and corrections, which would require all cities in the state to construct a sewage farm which would mean to Oklahoma City more than two million dollars and to the state more than twenty-five million as a whole." (From the Daily Oklahoman of Feb. 14, 1911.)

This statement was made by the Mayor after the following statements had been made, circulated and published over the signatures of the state commissioner of charities and corrections, the state health commissioner, the state chemist and the state geologist. The campaign of opposition was opened by these state officials in the following published letter:

Kate Barnard Sees Death in Reservoir.

"Editor The Daily Pointer:

It is proposed that Tuesday we shall vote a million and a quarter dollars bond for a water supply, and up to a few days ago the most of us supposed we were going to get water. Since then some frightful facts have been disclosed to us—facts in regard to this water, which means devastation and death unless somebody puts a stop to it, and because nobody else seemed willing to undertake to warn the people, I have accepted this grave responsibility and unpleasant duty.

"Now, Mr. Voter, I wish to ask you some questions. Do you wish to drink liquid sewage? Do you wish to have the offal and filth from the sewers of El Reno and Yukon dumped into the water you drink? Are you willing to feed this liquid poison to your wife and child? Are you willing to vote a million and a quarter of dollars of your hard earned money for a big pond of liquid filth? Do you wish the death rate of Oklahoma City to increase until it drives the tenants from your buildings and frightens investors away? Do you wish to feed them impure liquid poison so you may dig graves for your dead and make a huge cemetery and a small town of Oklahoma City? Do you wish to spread typhoid and epidemics and pestilence through this city we have all labored to build?

"If you do not wish these things, then vote against the water bonds until a law is passed through our legislature compelling El Reno and Yukon to take their sewers out of our proposed water supply. By all means vote against the bond Tuesday and protect your loved ones from this infamous scheme to dam up a big pond of deadly disease germs.

"Oklahoma City wants water; she needs water; she must have water—but she wants WATER, mind you, not a filthy liquid from the sewers of El Reno and Yukon. You have heard much from the engineers who are interested in making a per cent. out of the bonds. Come now and hear from those who are interested in promoting the health and lives and happiness of the citizens of Oklahoma City. These New York engineers may give us liquid sewage at a million and a quarter of dollars, and then they may retire to their beautiful homes on the banks of the Hudson river and drink from their own pure water supply, but we will be left behind to bear the burdens and care for the dying and bury the dead and some of us are quite as much interested in protecting the health and lives of the citizens of Oklahoma City as are certain engineers in making a per cent. on a million and a quarter of our money.

"I am perfectly willing, personally, and I am a taxpayer, to pay twenty dollars a year for forty years for clean wholesome water, but not one cent have I for sewage and filth and while I live it shall be ever my protest that any engineer, for any amount of money, be permitted to feed liquid sewage to the helpless poor.

"All those who are interested in the lives and health of the citizens of Oklahoma will please come to a public meeting at the court house Monday night at 8 o'clock.

Kate Barnard."

Later, the state commissioner of charities and corrections again says over her own name, and published broadcast, the following:

"I thought of the typhoid epidemics in El Reno, the small pox cases and social diseases which infect every city. I thought of the sewage from these sick bodies being treated by chemicals and then given to the mouths of our helpless poor to drink. I thought of the typhoid epidemic we have had in our city and I wrote our State Health Commissioner, Dr. Mahr, and our State Chemist, Dr. De Barr, and asked if in their opinion this sewage would be made safe for drinking purposes by subjecting it to the chemical process?

"I have under seal Dr. Mahr's statement, and also a signed letter from Prof. De Barr in which both say this water 'cannot be made safe for drinking purposes until the sewers are removed from the Canadian river,' which is our water supply."

Again: "I told them if they would wait ten days and pass a law through the legislature compelling the use of SEWER FARMS, such as they have in Europe and many states of America, thus removing the sewers from our water supply, I would then stand for the bonds."

Again, on February 12th, Miss Barnard writes in the Daily Oklahoman:

"Let us extend our main sewer five miles down the river, keeping it well above the water line as it now is, and then let us buy six hundred acres of land and build an incinerating plant. Here we would burn the dry sewerage and pass the liquid through chemicals reducing the odor and with this fertilize, then as Pasadena, California, is doing, we could raise bumper crops of corn and walnuts. All of these sewer farms report them as 'a profitable undertaking.' This is the system America and Oklahoma must come to or we all perish and if Oklahoma City continues her present record for typhoid and other epidemics it will be a land shunned by homeseekers and investors. Who wants to enter an area of great mortality? Would you go this instant and take residence in a town cursed with disease and polluted water?"

The letter of the State Health Commissioner which the Charities Commissioner stated she had was published in the "Daily Times" of Oklahoma City, and again in circulars distributed at the polls, and was as follows:

"Dear Miss Barnard:—Replying to your request for my opinion as a health officer as to whether or not a stream like the North Canadian river, that is now sewerage (sic) polluted are continually receiving every day additional sewerage (sic) pollution, can be dammed up and the water from the same be made a good and wholesome water for domestic purposes and used without endangering the health of those who use it for drinking purposes, I beg to advise that personally my opinion would be that it could not be sufficiently purified, unless the sewers (sic) were removed and the river policed, so as to prevent a continuation of the contamination. In Ohio, Indiana and Kansas an aggressive fight is being waged against the further contamination of the running streams of water now used by municipalities for domestic purposes.

Yours truly,
(Signed) J. C. Mahr,
State Commissioner of Health."

Concerning the El Reno and Yukon sewage entering the river, the State Chemist, Dr. De Barr, made the following statement:

"After entering the stream no treatment that will make the water safe as a drinking water for Oklahoma City can be applied to remove the evil effects of this sewerage (sic). The only way is to not allow this sewerage (sic) to enter the reservoir if you expect a pure water for Oklahoma City."

In view of the above statements, made by the scientists of the State of Oklahoma, it is interesting to remember that the water entering the Columbus, Ohio, storage reservoir is polluted by a tributary population of 70 persons to the square mile, while the tributary population at the proposed reservoir at Oklahoma City is at the present time not more than five (5) persons per square mile. The water shed of the Sciota River from which Columbus draws its water supply is 1,035 square miles, and that of the North Canadian river is 15,000 square miles. In other words, the proportion of pollution in the Columbus reservoir to that of the proposed Oklahoma City reservoir is as 16 to 1.

The State Geologist, Chas. N. Gould, added his word to this controversy over his own signature, as follows:

Speaking of the proposed reservoir and purification and softening plant he says:

"The quality of the water will not be materially improved. The people of Oklahoma City will continue to drink the sewerage (sic) of El Reno and other towns. The dead horses and cattle from the hundreds of farms and Indian allotments in western Oklahoma will still be dumped into the river and many of them will wash down into the reservoir. The water will always be hard and will require the constant use of chemicals.

"According to government statistics on file in the office of the state board of health, Oklahoma leads other large cities in the percentage of typhoid cases. Bacteriologists tell us that no stream or reservoir will purify itself and that no filter so far designed will take out all the typhoid germs. The fact that the people of other cities, such as Pittsburg and Wheeling drink sewerage (sic) and die of typhoid is of itself no reason why the people of Oklahoma City should do the same thing."

Personally, this whole matter would be most amusing if it were not for the fact that these opinions, coming from those who should be leaders of thought among the people, were taken as gospel truth and caused the people to stampede.

Alexander Potter.

A PUBLIC HEALTH EXHIBIT.

A public health exhibit, under the auspices of the Provincial Board of Health of Ontario, will be a feature of the Canadian National Exhibition, to be held in the city of Toronto for two weeks, beginning Saturday, August 26th of this year. This exhibit will consist of public health equipment of every kind and will include also a varied assortment of apparatus, etc., relating to prevention of disease.

In addition, a lecture room is being provided, where lectures, demonstrations, etc., will be given daily. Interest in these lectures will be greatly enhanced by the use of an excellent reflectoscope and several hundred lantern slides.

Firms wishing to contribute to the exhibit are reminded that shipment should be made so that exhibits will reach here **not later than August 20th.** Packages should be marked with the name of the firm and nature of the manufactures, and bear the following address:—

Dr. John W. S. McCullough,
Educational Building,
Canadian National Exhibition,
Toronto, Canada.

When articles to be exhibited are not of Home Manufacture, it will be necessary for the exhibitor to ship such articles **in bond.** At the close of the Exhibition, if not exported, the goods may be sold and the duty then paid.

There will be no charge for space, etc. Intending exhibitors desiring further information will please communicate with

JOHN W. S. McCULLOUGH, M.D.,

ORGANIZATION OF A CONTRACTOR'S FIELD FORCE.

The field and office organization of the Aberthaw Construction Co., of Boston, Mass., has been gradually developed as the amount and variety of the work undertaken by this concern has increased. Their system is designed for the purpose of collecting the most complete data possible on the great variety of concrete and other work undertaken by them, and the tabulating of this data in the office in such a way that it may be readily available both for the adjustment of payments in connection with their contracts and with a view of its availability for use in connection with the preparation of bids on new work.

The organization is planned with the object of keeping the home office in daily contact with the amount and direct cost of all work on all contracts. In this way each piece of work has the benefit of the very best brains and knowledge at the command of the company. In the home office is located the president, the secretary, the chief engineer, the general superintendent of all work, the estimating department, and the necessary staff of draftsmen, clerks, etc. Each job is directly in charge of a general superintendent who sends a daily report to the home office, showing the number of men employed on each class of work, the amount of each man's pay, the class and quantity of work done, the materials received and used. The general superintendent has the following organization under him:—

1. **Clerical Force.**—Timekeeper, stock clerks, etc. Responsible for keeping time of all labor; for keeping the correct distribution of labor on various classes of work. Checking all materials received and used, etc.

2. **Labor Boss.**—In charge of all common labor gangs, each gang being in charge of a gang boss. Does all excavating, mixing and placing of concrete; unloading of materials; and when necessary assigns labor gangs to assist carpenters, etc.

3. **Steel Boss.**—In charge of all reinforcing work. Force divided into gangs each in charge of a gang boss.

4. **Carpenter Boss for Concrete Work.**—In charge of preparing material and erecting forms for concrete work and tearing them down again when concrete work is finished. Force divided into gangs, each in charge of a gang boss.

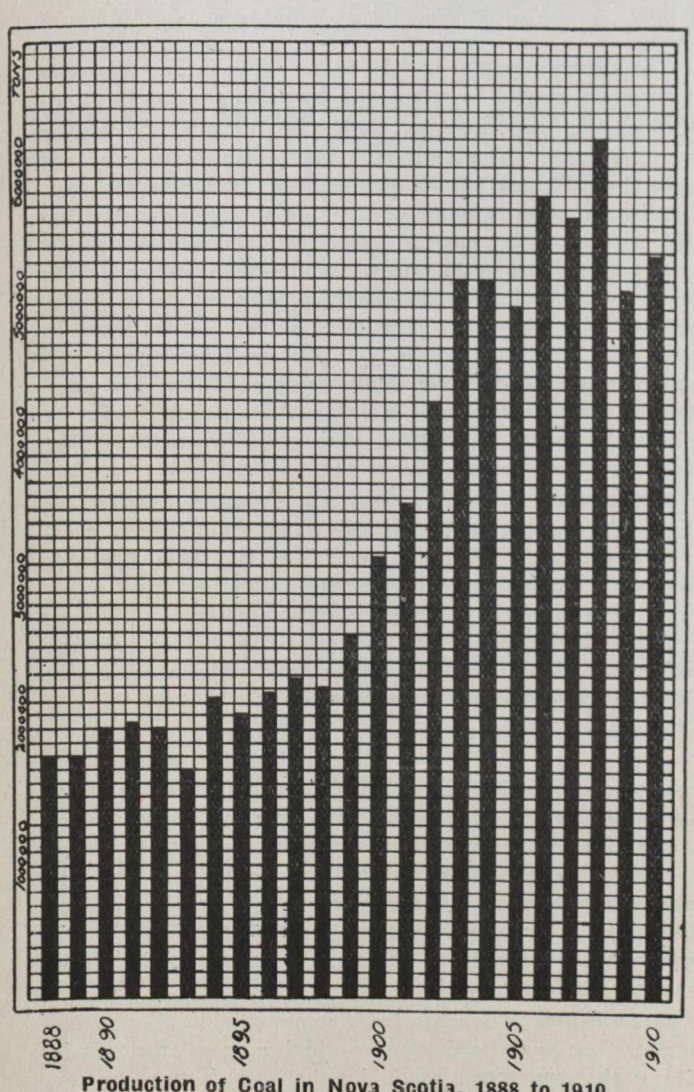
5. **Carpenter Boss for Mill Work.**—In charge of erecting all mill work, putting down floors, etc.

In all instances each gang boss is responsible to the general boss or foreman having supervision over the particular class of work on which he is employed. These foremen are responsible to the general superintendent, who, in turn, is entirely responsible to the home office for the proper conduct of the work. All instructions from the home office, from the owner or from the architect, must pass

through his hands. In no instance should any directions ever be given except in case of emergency, to any foreman, sub-foreman or laborer, except by his immediate superior.

The chief clerk, although responsible to the general superintendent, is supreme in his domain as far as keeping track of all materials received, moneys expended, distribution of labor costs, etc. Under him are the timekeepers, stock clerks, receiving clerks, distributing clerks, etc., the number being commensurate with the size of the job.

The policy of the Aberthaw Company is to furnish each job with a first-class clerical force, thereby relieving the home office from as much detail clerical work as possible. There is a two-fold object in view in doing this, first, it is much easier to charge the clerical force to the job when they are actually on the work than when located in the home office—an important item on cost plus fixed sum contracts; second, it enables them to conduct a very large business with a comparatively small home office, so that the overhead charges will be much lighter when work is slack. The sheets (Fig 1.), are made out in detail on the job and a carbon copy kept there for filing. The original is mailed to the home office on Thursday night, the end of the pay roll period, with all the extensions figured. The only work of the home office is the checking of the extensions, the putting up the money in the envelopes and shipping back to the job on Friday, so that the men can be paid off on Saturday. Carbon copies of the daily report sheets for both regular and extra work are also kept on the job, the originals being filed in the home office.



Production of Coal in Nova Scotia, 1888 to 1910.

Fig. 1 is known as the Period Time Sheet and will serve for any pay roll period up to three weeks.

Fig 2 is the daily labor distribution sheet on which the time of each workman or each class of work is entered each day. The total of these sheets must check with the total of the corresponding day on the time sheet as indicated at the bottom of each column. A menomic system of symbols has been devised to indicate the various classes of work which furnishes a very convenient method for entering up the quantities on the daily sheets. The key letters are inserted at the top of each vertical column.

TESTING STEAM TURBINES AND STEAM TURBO-GENERATORS.*

By E. D. Dickinson and L. T. Robinson.

Of late years an increasing amount of consideration is being given to the economic production of power, and as the cost of coal in a steam power station is the largest item of expense, it naturally follows that the efficiency of the apparatus for generating power should be high. In order to determine these efficiencies, certain accurate measurements, or tests, are necessary, and it is the intention to outline what precautions must be taken in order that the results may not be misleading, and also to consider the relative degrees of accuracy of different methods.

The term efficiency is a fruitful source of misunderstanding. The only meaning which is of any commercial significance to the operating engineer is that which gives the ratio between the energy in the form he desires, to the energy available in the fuel. In other words, what he wants to know is, how much is he getting out for what he puts in.

There is one point that must at all times be kept in mind, and that is, that all tests, even when accurate, are at best but an indication of what may be expected in the over-all economy of the station. A specific example of this is a certain European power house, which contained several engines of the best makes. When steam turbines were installed the coal consumption was decreased about 20 per cent., though the test efficiency of the turbines showed no such marked superiority over that of the engines.

In the manufacturing of steam turbines a great amount of testing is necessary, to determine the effect of making changes in design or to verify theories and formulae which cannot be established by calculation; much of this is of an experimental or laboratory nature. There is also a large amount of testing done, in order to establish the over-all economy of the complete unit. This latter is all that is of commercial value to those operating steam turbines. The actual efficiency of the turbine alone is of some interest, but can only be determined by measuring the power delivered by the shaft to some form of brake, or to a generator of known efficiency. Any testing by allowing for the different losses, by the methods often employed for electrical apparatus is impractical and should not be considered.

In this paper it is not the intention to elaborate all the numerous details which must be carefully taken care of when tests are being made. Many points of importance are only touched upon. Every test must be given special consideration, and the necessary precautions to be taken will depend on local conditions.

Measurement of the Steam Input.

Weighing Condensed Steam. The one positive method of testing a turbo-generator is to measure the steam that goes

*Paper read before the American Institution of Electrical Engineers.

in through the throttle valve, and the electric energy delivered at the terminals of the generator. The surest method of determining how much steam enters the turbine is to collect and weigh all the steam after it has been condensed. This necessitates the use of a condenser of the surface type. In making such a test two things are essential: First, that all the steam used on the turbine be condensed and measured; and second, that no steam or water, not used in the turbine, be allowed to enter the condenser. Should the condenser not be perfectly tight, some of the cooling water will be drawn into the condenser, and mixed with the condensed steam; this is a common source of error. The condenser should have leakage checked, before and after each test. With all steam turned off the turbine the condenser should be run for some time with full vacuum, and the discharge from the hot well pump very accurately measured.

Split condenser tubes will sometimes cause leakage which is extremely difficult to locate, and cannot always be determined by measuring the leakage. This is the case when the split opens up only when the condenser is heated with large flows of steam. This action will generally give erratic results, and no tests should be considered that do not show consistency with other tests on the same machine.

Measuring Condensed Steam. The most accurate method of measuring the condensed steam is by the use of tanks, so arranged that all the water can be weighed at equal time intervals during the test. The pump, piping and tanks must be so arranged that the water will continuously flow to the pump, this is essential in order to get accurate results.

Weighing Water Fed to Boilers. This method is quite frequently resorted to when the condensed steam cannot be measured, as is the case when the turbine is operating non-condensing, or when the condenser is of the jet type, in which the cooling water is mixed with condensed steam. In making such tests, the liability to error is very great, and every precaution must be taken in order that the results may be considered reliable within any degree of accuracy.

The steam piping connecting the boilers and turbine must be disconnected from all other piping, and all openings must be blanked off; valves must not be relied on. All blow off and drain valves must have their outlets visible. All piping between boiler feed-pumps and boilers must be exposed, and have no branches. Leakage of the boiler itself is the most difficult to locate, as all water or steam escaping is vaporized and carried up the stack. The boiler leakage should be checked before and after each test by closing the throttle to the turbine, or if necessary blanking the pipes at the turbine and running a test measuring the amount of water required with full steam pressure on boilers and piping. The feed water used should be weighed, and not measured by meters.

Tests which have come under our observation have shown boiler leakage of 10 to 12 per cent. of the water weighed into the boilers, and one particular case showed a leakage of over 20 per cent.

Test by Heat Balance. This method of testing is based on measuring the amount of heat transferred to the cooling water from the condensed steam. It is extremely inaccurate and unreliable, and at best can give but an approximate idea of the quantity of steam being condensed. The quantity and temperature of cooling water and the temperature of the outgoing water, carrying with it the condensed steam, are measured as accurately as possible. The reason for inaccuracies is the difficulty of measuring the quantity of cooling water and its true average temperature change. The temperature of the cooling water may vary at different sides of the pipe, and small discrepancies in the reading will show large variations in the estimated steam consumption of the turbine, since the temperature rise is small.

Duration of Tests. In order to establish accurately any given point, all tests should be run with fixed conditions after a state of equilibrium is established and things are constant for an appreciable length of time. The time required will depend on the nature of the test being made. In general, when small amounts are being measured, the duration of the tests should be somewhat greater; for example, when measuring the condenser leakage, this test should be run for a sufficiently long period in order that the small quantity of water which will come through may be accurately weighed.

Efficiencies. The net over-all efficiency expressed by the ratio between the kilowatt hours output of the generator, and the available energy in the steam, is the only one of any particular commercial value. The comparison of efficiencies of different machines is the most satisfactory way of considering their relative merits. To determine the available energy in one pound of steam it is necessary to know the pressure in pounds per square inch, the quality and the temperature of the entering steam; also the pressure at the turbine exhaust. To measure the exhaust pressure, or vacuum, a gauge should not be relied on. The most accurate means is to use a full length mercury gauge, and subtract the readings by this, from the atmospheric pressure at the time the test is made. If the steam be superheated, since there is some difference of opinion concerning the specific heat of superheated steam, the figure assumed must be given.

In testing turbines consisting of several stages, the pressures in the different stages should be measured, this affords a check, and should show any abnormal conditions existing in the interior, which might not otherwise be observed.

The kilowatt output should be net, that is, the kilowatts for excitation should be subtracted from the generator output.

Checking Instruments. All instruments, including meters, gauges, thermometers, and scales must be very accurately calibrated or checked before and after the test. Small inaccuracies in some of the readings may entirely discredit tests which have cost a great deal of money to make.

Inspection and Adjustment. Before tests are made the turbine should be inspected to see that all parts are in proper condition. If necessary the interior should be examined to see that the buckets have not been damaged by foreign substances, and all necessary adjustments made at this time. After the tests have been completed, the machine should be ready for commercial service, and no adjustments of the turbine should be made.

Corrections. Whenever possible, turbines should be tested under the conditions for which they were built to operate. Correcting for different conditions is always liable to throw some doubt upon the accuracy of the test, and therefore on the efficiency of the machine being tested. Different machines will have different correction factors for varying conditions, and for this reason it is impossible to arbitrarily fix the allowances that should be made.

In general, the corrections for steam pressure, moisture, or superheat are less liable to be misleading than that for varying vacuum, for the reason that comparatively large changes in any one of the first three, will but slightly affect the conditions in the machine; whereas, a slight change in the vacuum makes an enormous change in the available energy and volume of the steam in the low pressure end of the turbine. A turbine may show a splendid efficiency with poor vacuum, but unless it be properly proportioned, it may give a poor efficiency with a good vacuum.

Test Results. The majority of commercial tests on turbo-generators are made to determine whether or not the unit is fulfilling the guarantees made by the manufacturer of the

apparatus. The steam turbine differs from the reciprocating steam engine, in that it is impossible to take any readings that will give a direct indication of the power being developed. The designing engineer with all the necessary data, can estimate very accurately what power the turbine is developing under any given set of conditions. But the operating engineer has not the time, nor is he interested in making such calculations.

It will be apparent from the foregoing, that the complete test of a unit necessitates taking a large number of measurements and small inaccuracies in taking many of the readings are liable to affect considerably the final results. For this reason, it is obvious that no machine should be discredited on account of small variation in the final results.

With the high efficiencies now being obtained, small inaccuracies in readings will show a relatively large per cent. variation in the steam consumption. It is for this reason that manufacturers guarantee an efficiency which is not quite so good as may be expected from the unit. Another method is to guarantee the efficiency that may be expected, with an allowance to cover permissible inaccuracies in making tests.

The Steam Flow Meter. Under suitable circumstances, thoroughly accurate tests may be made by measuring the steam with a meter. Such tests will be more convenient than those made by any other method. Certain precautions are necessary, but there should be small expense in providing conditions that will insure reliable results with the best meters.

Even where other methods of measurement are used the steam flow meter will always be a valuable adjunct since its readings are accurately proportionate to flow and show the conditions instantaneously.

Measuring the Electrical Output in Connection with Turbine Tests.

The output of the turbo-generator may be either direct current or alternating current. We will consider first the measurement of direct-current output. Usually, station instruments in connection with generator switchboard have been provided, but unless temperature conditions can be very accurately controlled and the instruments can be checked under operating conditions they should not be used. The station voltmeters may sometimes be satisfactory but it is the usual practice to supply direct current station ammeters to operate from shunts of approximately 60 millivolts drop which requires that the indicating part of the ammeter be largely a copper circuit; therefore the whole combination is subject to considerable error due to variations in room temperature, and with some shunt arrangements, to variations in the current to be measured as well. For the precise measurement of direct-current output portable indicating ammeters should be used having 200-millivolt-drop shunts,* and, therefore, permitting the use of indicating millivoltmeters whose circuit consists largely of resistance material having practically no temperature coefficient. It is also desirable, when possible, to measure the volts by similar portable voltmeters.

When using either switchboard or portable instruments the influence of any stray fields should be investigated and arrangements made whereby these stray fields will not affect the measured output. Special caution must be observed in this respect if the instruments are not of a shielded type. If the influence of stray fields is very small it may be eliminated from the final result by periodically turning the instruments between successive readings. There is also another point in connection with the measurement of amperes, especially when testing large units, which is important, namely, care should be taken to correct the observed indications of the millivoltmeter for any electromotive forces that may appear in the shunt or leads due to thermoelectric effects. The amount of error due to this cause may be observed by reading the millivoltmeter at the close of the test with no current flowing in the main circuit. There may then be observed a small positive or negative indication, which should be applied as a correction to the observed ampere readings. Of course, to have this correction constant throughout the test the entire arrangement should be run under the test load until final temperature conditions in the shunt have been established. These precautions need not be observed in connection with standard precision shunts having 200 millivolts drop.

Referring again to the station type of shunts, unless the ammeter is checked with the shunt connected into the busbars, great care should be taken to know that the distribution of current flow through the shunt is the same when the ammeter is used as when it was tested. It is quite possible to have large errors due to this cause

Measurement of Alternating-current Output. If the output is small—less than 20 or 30 kw.—wattmeters, ammeters and voltmeters without current or volt-multipliers may be used The same remarks with regard to disturbing influences, which apply with direct current instruments, apply with even greater force to instruments for alternating current. They are not usually much affected by steady magnetic fields but in many locations where large generators must be tested there may be fields which would have an appreciable effect on the indications of the instruments and which would alternate with the same frequency as the circuit to be tested. The current leads of the circuit under test may become a source of error. Such fields require the use of shielded instruments or the careful handling of those of the unshielded sort to eliminate any possible errors.

After all questions in connection with the instruments themselves have been disposed of it is necessary to consider the proper use of the instrument transformers which provide usually the only means of enlarging the capacity of the instruments to meet ordinary requirements.

The station equipment provided for use with the generator can be checked carefully and both the instruments and transformers employed for the precision test, but this is not usually as convenient as to insert transformers specially tested for the work. Of course, if the constructors of the plant have the foresight to install tested transformers these are, at any time, available for precision testing. Makers of instrument transformers can supply them with certificates showing performance under any specified conditions when requested.

In using instrument transformers it is necessary to observe the precaution to have the secondary connected load the same as that which is on the transformers when they were tested for the certificate. It is also necessary if the test is to be made under conditions that will give low power-factor on circuits to at least know that the phase displacements in the instrument transformers are not large enough to appreciably affect the results. It is also well to observe the precaution not to use instrument transformers with interconnected secondaries except for the common ground connection which should be employed as a safety precaution.

If possible, a test should be made on non-inductive load. If this is done the indications of the voltmeters and ammeters may be used to check the indications of the wattmeters. If all the test arrangements have been satisfactorily attended to the apparent power as showed by the volts and

*This is not an arbitrary value but has been chosen by several makers as giving the best compensation of all temperature errors.

amperes should agree within one per cent. with the watt-meter indications and the watts indicated should be taken as the true output. If the test cannot be made at unity power-factor the voltmeters and ammeters should still be included so that the general conditions of distribution of load, etc., may be known throughout the test. For this purpose the station instruments would be satisfactory.

The use of watthour meters for this class of testing should be avoided wherever possible. There are watthour meters for direct-current and for alternating current circuits, and under both of these headings there are those which might be classed as accurate and those which could hardly be so described. Still the very best watthour meters that can be made are inferior in performance to the best portable indicating instruments. Watthour meters are slightly affected by changes of voltage, frequency, wave shape, etc., and by the amount of load current which is being measured. Sometimes if the load is very fluctuating and the test must be made under service conditions, the output may be more accurately determined by watthour meters than by indicating instruments, but this would represent extreme conditions, and would not usually be true.

Watthour meters should never be used unless checked in place at the frequency, voltage, wave shape, etc., which are to be used in testing. If it is not possible to run a complete test on a fairly steady load it is usually possible to make a few runs on the watthour meter under load conditions and to use this check as a basis for determining the output by means of the watthour meters during the test run on unsteady load. It is still advisable to read the indicating instruments at short intervals so that their indications may be made use of in computing the final result. The fluctuations shown by the recorded values will determine how much weight should be given to the indicating instruments.

Checks of watthour meters should not, for precision purposes, be made with the meter subjected to other than exact load conditions and on the same circuit. Compromise methods of testing watthour meters, similar to the usual test of a three-phase two-element meter on a single-phase circuit, should not be used.* This is because the accuracy demanded is better than that in ordinary metering and does not mean that the compromise test is not perfectly satisfactory for ordinary service for meters known to be without interference between elements. If watthour meters are tested in place, using the above precautions, and indicating instruments are employed and read at frequent intervals during a test run of three to five hours, the watthour record should agree with the output as determined by the indicating instruments within one per cent. on fairly steady commercial loads with the chances largely in favor of the indicating instruments being correct. Single-phase indicating instruments for polyphase service are to be preferred for precision work to polyphase instruments, for the obvious reason that indications of a polyphase instrument are made up by the two elements in such a way that it is not possible to apply corrections to either element to get the true total result unless the division of load is known by single-phase instruments; and if the single-phase instruments are required for this purpose they may as well be of the precision class and used for the actual determinations, and the polyphase instrument omitted.

To accurately and positively determine the efficiency of a steam turbine, great care must be taken in making the tests. If all necessary precautions are not taken the results are liable to be misleading, and will in all probability be absolutely valueless so far as determining the actual economy of the unit.

The modern steam turbine, unlike the reciprocating engine, should require no adjustments before making economy tests, that is, after it has been adjusted, any turbine should be able to stand all the sudden variations of load and steam conditions occurring in commercial operation. The turbine should be tested with the adjustments that are normally maintained. After tests have been made to establish the economy of a turbine, no adjustments should be made, that may affect the efficiency. Any such adjustments may discredit the entire test.

The testing of steam turbines in some respects resembles the testing of water turbines, and it is recognized what precautions have to be taken in testing them in order to avoid misleading results. The testing of steam turbines demands even more care, owing to the greater number of conditions which have to be maintained and accurately measured.

With the ever increasing search for higher economies in the production of power, the efficiency of every piece of apparatus that forms a link in the chain between the coal pile and the switchboard must be maintained at its best, and in a turbine power station it is not sufficient to know the efficiency of the turbine alone, but every source of loss should be run down and eliminated or reduced to its minimum. Several small losses may in the aggregate be sufficient to cause an otherwise economical plant to make a very poor showing.

*Meter Code VII. J. 88, I and II.

PRECIPITATION FOR FEBRUARY.

The amount of precipitation recorded in Canada during February was generally below the average, and in many districts considerably so. Very locally in the vicinity of Calgary, Central Ontario, the Ottawa Valley, and in the neighborhood of Halifax the precipitation slightly exceeded the normal.

Although the snowfall was nowhere excessive, high winds in many districts caused much drifting which seriously interfered with the operation of railroads, as well as blocking country roads, more particularly during the first two weeks.

Depth of Snow.

At the close of the month the ground was snow covered throughout Canada except on the coast and lower levels of British Columbia, and also in the Peninsula of Ontario. Northern Ontario and Quebec was covered by about five feet of snow. In the Maritime Provinces a depth of two inches at Halifax increased to about three feet in Northern New Brunswick. A large amount of snow was present on the higher levels of British Columbia, while in the Western Provinces a depth of from three to nine inches in Alberta increased to ten and twenty inches in Manitoba.

Thickness of Ice.

Thickness of ice has been reported as follows:—

Western Provinces.—Battleford, 25 inches; The Pas, 21.5; Medicine Hat, 30; Swift Current, 37; Moose Jaw, 30; Qu'Appelle, 18; Minnedosa, 30.

Ontario.—Port Arthur, 22 inches; Southampton, 10; Port Stanley, 14; Kingston, 25.5; Toronto, 18; Barrie, 22; Ottawa, 30.

Maritime Provinces.—Chatham, 18 inches; Fredericton, 27; Yarmouth, 16; Sydney, 30; Charlottetown, 25; Point Le Preaux, 18.

The table shows for fifteen stations included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for February, 1911.

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

Station.	Depth in inches.	Departure from the average of twenty years.
Calgary, Alta.	0.6	+ 0.05
Edmonton, Alta.	0.3	— 0.44
Swift Current, Sask.	0.3	— 0.35
Winnipeg, Man.	0.8	+ 0.11
Port Stanley, Ont.	2.9	— 0.08
Toronto, Ont.	2.12	— 0.20
Parry Sound, Ont.	1.6	— 1.63
Ottawa, Ont.	2.7	+ 0.20
Kingston, Ont.	1.3	— 0.79
Montreal, Que.	2.9	— 0.33
Quebec, Que.	1.9	— 1.16
Chatham, N.B.	1.0	— 1.79
Halifax, N.S.	4.8	+ 0.32
Victoria, B.C.	1.0	— 2.57
Kamloops, B.C.	0.2	— 0.61

WORKMEN'S COMPENSATION IN SASKATCHEWAN.

Bill Introduced in the Provincial Legislature—Application of Act Will Not be Restricted by Height of Buildings.

A bill respecting compensation to workmen for injuries suffered in the course of their employment has been reported in the Saskatchewan Legislature. The attorney-general explained that the bill was modelled on the English act of 1897, which was the case with most of the compensation acts passed by Canadian provinces. The English acts of 1900 and 1906 went much further, the latter act extending to all employments. The words "in, on or about" in the case of factories, workshops, etc., had reference to locality and did not permit of a wider interpretation. In one particular the bill before them proposed to go further than the British Columbia and other Canadian acts in that its application was not limited to buildings over 30 feet in height. There was no restriction in the matter of the height of buildings on which accidents occurred, nor did the bill stipulate that mechanical power must be in use.

As to Agricultural Operations.

Mr. Wellington thought that the bill provided class legislation in view of the fact that mechanics working on threshing machines, crushers, etc., on farms were exempt. The need of such mechanics was as great as that of any other class of workmen. Quite a number of those employed to look after threshing and other farm machines were not capable mechanics.

On the suggestion of the attorney-general the discussion on this point was postponed until the clause exempting agricultural operations from the scope of the bill came under consideration.

An interesting discussion as to what constituted an accident took place. The attorney-general stated that under the English act it had been held that the catching of anthrax by a wool-sorter from an anthrax germ in wool was a case of accident. On the other hand it had been held that the slow poisoning of a worker in a factory where white lead was used did not constitute an accident.

Mr. Haultain read to the committee the following definition of an accident:—"An unlooked for mishap or untoward event which is not expected or desired."

Duration of Compensation.

On the motion of J. F. Bole, Regina City, the clause providing that an injured workman should not be entitled to compensation unless such injury prevented his following his occupation for at least two weeks and from earning full wages during that time was amended by the substitution of one week for two weeks and further by striking out the word "full." Mr. Bole contended that a week in the West, owing to the short season of several trades, might be as important to a workman as two weeks elsewhere.

In answer to Mr. Gillis the Attorney-General thought that procedure through the districts courts in the fixing of compensation would be cheaper and more expeditious than by the method of arbitration.

The clause providing that compensation should be paid to an injured workman even if such injury were due to his own negligence passed the committee. The Attorney-General explained that under the English act "serious and wilful misconduct" vitiated a claim for compensation unless the workman was either permanently injured or killed. The only difference between the bill before the committee and the English was that the former granted compensation in any circumstances. In England litigation over the question of wilful or serious misconduct was endless as each case had to be examined on the question of fact.

Effect of a Clause.

G. B. Johnson, Kinistino, did not think a workman who did something he was told specifically not to do was entitled to compensation. A workman in a shingle mill was apt to use his hands instead of the mechanical cutter, or a workman on construction might step on a scaffolding forbidden him.

Mr. Langley thought there should be no unsafe scaffolds.

Mr. Haultain was of the opinion that the effect of the clause would simply be to add to the cost of production the insurance of the workman against accident. The clause under discussion was more for the benefit of the workman's dependents than for himself. At first sight the clause had shocked his sense of justice and he was still uncertain whether it would work out all right. It was certainly encouraging careless, negligent or disobedient workmen to take further risks.

LARGE STEEL INCORPORATION.

British Columbia Steel Corporation with Capital of Ten Million Dollars Chartered—Seventy-five New Companies.

Seventy-five companies were incorporated during the past week with a total capitalization of $29,507,500.

The foundations of what will likely prove a large and important industry in British Columbia are being laid. The British Columbia Steel Corporation, with a capital of $10,000,000, has been granted a Dominion charter and will establish a large steel plant near Vancouver. The head office of the company will be in Toronto. American capital is considerably interested in the venture. As is usually the case with a steel plant, its establishment in the Pacific coast province will attract several similar industries. A communication has been received by the promoters from the American Car and Foundry Company, in which they signify their intention of establishing large works in connection with the Steel Corporation. Mr. N. Thompson, of Vancouver, recently obtained a $2,000,000 subsidy for the construction of a drydock at Burrard Inlet. He will act as a director of the British Columbia Steel Corporation and build his drydock contiguous to their plant. Others interested in the scheme are Mr. A. P. Gillies, Tacoma, who appears to be the leading spirit; Mr. Henry Hewitt, Jr., interested in timber and mining; Mr. C. T. McAllister, president Golden West Land and Building Company, Calgary; Mr. Edmund Francis, of Vancouver, consular agent for France, who will be one of the directors; and Mr. L. O. Hedden, president Messrs. V. J. Hedden & Sons, Company, New York. This firm built the Traders Bank Building, Toronto. The engineers will probably be Messrs. F. M. Andrews & Company, of New York.

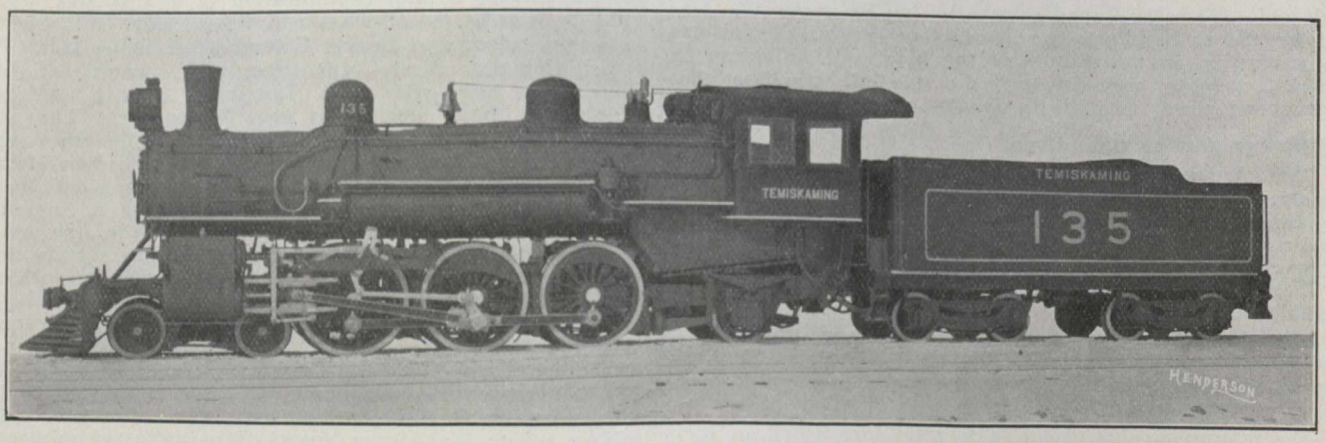
May Locate at Port Mann.

It is probable that the British Columbia Steel Corporation plant will be located at Port Mann, the proposed Canadian Northern terminus. At the instance of Sir William Mackenzie, a conference will be held on this matter at the Canadian Northern head office when there will be present a delegation from New York.

The incorporation of the Lake Superior Paper Company, Limited, with a capital stock of $8,000,000 and head office at Sault Ste. Marie, Ontario, seems to indicate that the proposal to establish a plant there by the Lake Superior Corporation and certain American publishers, has been accepted. During October negotiations were carried on by the Lake Superior Corporation with a syndicate of American publishers, when it was suggested that a paper manufacturing plant be erected at a cost of approximately $1,000,000. The Lake Superior Corporation is now operating a pulp mill, which is manufacturing 100 tons of pulp daily. The whole of the output is shipped to the United States. Near this mill is a large sulphide pulp mill, a plant with a capacity of 70 tons a day, but which is at present idle. As is known, sulphide pulp is used as the outer layer in the manufacture of certain grades of paper. A mill with the capacity such as possessed by the Sault mill, will supply enough sulphide pulp to keep pace with a pulp mill of 200 tons output. Mr. W. C. Franz, general manager of the Lake Superior Corporation stated in October, that the sulphide pulp mill would be reopened. As there are approximately a million acres of spruce land surrounding the corporation's property, it was thought the reopening of the mill is a step towards the construction of a paper plant, in which the American newspaper interests are expected to take an interest. Mr. Franz stated that the Lake Superior Corporation intended to retain control of the pulp plant.

A LARGE LOCOMOTIVE.

The Canadian Locomotive Works, Kingston, Ont., have recently turned out some large locomotives of the latest and most approved type. Among the latest ideas for engine efficiency which they include in their construction are the Walxhaert valve gear, the Vaughan trailing truck, and the electric head and cab lights. These engines are for the Temiskaming and Northern Ontario Railway, the Ontario Government road, of which Mr. J. L. Englehart is chairman. The Temiskaming and Northern Ontario Railway has done much recently to improve its rolling stock and other equipment. The engine, a photograph of which is here reproduced,



is the latest and best product of the works. The engine is of the type "Pacific," or 4-6-2. The weight in working order of the engine is 207,000 lbs., and of the engine and tender 337,000 lbs. The size of the cylinders is 21 x 28 inches. The diameter of driving wheels is 69 inches, the size of the fire box 95¼ in. x 69¼ in.; the number and size of the tubes is 272-2 in. x 19 ft., and the total heating surface is 2,867 square feet. The steam pressure is for 200 lbs., the tractive force 30,400 lbs., and the driving wheel base is 12 ft. 7 in. The total base of engine is 31 ft. 6 in., of the engine and tender 57 ft. 10½ in., and of length over all engine and tender is 72 ft. 0 in.

WASTE OF WATER.

Commenting on an article in The Canadian Engineer The Surveyor Engineer, says: The daily consumption per head in Toronto is about 120 gallons, and it is assumed, not without reason, that a very large proportion of this is due to waste. All such water has to be filtered and pumped, after which it must find its way into the sewers and materially increase the volume of sewage to be treated. Thus the sum of money represented by the annual cost of all this work capitalized at, say, 3½ per cent., would possibly be far greater than the cost of carrying out such work as is required in order to prevent the waste. It is pointed out that in Great Britain the domestic water supply is much less per head than in America, not because the use of water is restricted, but owing to efficient administration and drastic action when users neglect the necessary precautions against leaks and imperfect water fittings.

The example of London, where the supply required per head has been reduced owing to improved methods of waste prevention, shows the possibility of dealing successfully with the waste problem on the largest scale, and one may well believe that in Toronto an enormous saving of water could be effected. It is, however, a new idea that the comparatively larger quantity of water consumed per head in American and Canadian cities is due to waste. In England from 20 to 30 gallons per head is considered a reasonable allowance, but in America the figures are very much higher, and the consumption at Toronto is not unusual elsewhere. It is difficult to compare the figures justly with those of cities in this country owing to differences of climate, differences of habit, and other conditions.

The waste of water at many places in England, and particularly in the case of small town supplies, is enormous. A loss of 50 per cent. may take place, and may go on for years without being discovered or considered. It will sometime cause less friction to duplicate the pumps and reservoirs than to insist upon proper care in the use of water and proper plumbing work throughout a district. The case of a town duplicating its waterworks instead of attending to its leaking mains and fittings is by no means unknown, while the installation of a Deacon recording meter on a trunk main has been known to cause the authorities so much alarm at the first reading, that they had the meter removed at once and tried to forget the awful revelation. The detection and prevention of waste are matters which need close and constant attention, and a great many may be effected thereby not only at Toronto, but at every other place where waterworks exist.

CANADA'S MINERAL PRODUCTION

At a time when the Dominion is making renewed spurts in mining development it is interesting to note past achievements. In 1886 Canada's mineral production was valued at $10,221,255. Last year those figures had increased to $105,000,000. That was a gain over 1909 of $13,000,000, or 14 per cent. The increase was well distributed among many important ores and minerals. Every province did its quota in compiling the gratifying figures. These statistics are of real mining. They are an index to an industry—an index far removed from the unsubstantial figures of mining exchange records. The development of a new mining camp is invariably linked with a stock selling campaign undertaken by brokers, promoters and the flotsam and jetsam of the financial world. They have no interest in depth of ore bodies, character of veins, conservative engineers' reports. Such information is sometimes gathered, distorted and exaggerated for publicity purposes. This week has been the first of a Porcupine stock boom. Already shares of certain corporations have advanced far above legitimate values, considered in the light of actual development. Two shares led the way, a third jumped in, and these three will be followed by new companies as quickly as preliminaries can be completed. One might as well try to stop the ocean's flow as to shove back a boom in mining stocks. The Porcupine stock market is being grossly manipulated. Many of those purchasing shares are doing so without any knowledge of conditions, but solely with the hope of making profits in hazardous speculation. Some will achieve that result, but the majority will be left high and dry on the beach of low prices when facts cause the frothy sea of stock gambling to recede.

GREAT VARIETY OF MINERALS

Contributed Last Year to the Growing Industry of Mining—Every Province is Helping to Make New Records.

The total value of Canada's mineral production last year exceeded $105,000,000. This production is made up from such a great variety of well established mining industries that the record should be particularly gratifying not only to those who are directly interested in the development of the mineral resources of the country, but also to the public at large who indirectly profit thereby.

Not only is the increase over the production of the previous year a large one, having amounted to $13,209,517, or over 14 per cent., but an examination of the details of production shows that the increase has been fairly well distributed amongst the more important ores and minerals produced in Canada.

Increases Over Last Year.

The following table gives some details for 1909 and 1910. They are taken from the admirable preliminary report on the mineral production of Canada prepared by Mr. John McLeish, B.A., Chief of the Division of Mineral Resources and Statistics.

	1909. Value.	1910. Value.	Increase (+) or decrease (—) in value.
Copper	$ 6,814,754	$ 7,209,463	+ $ 394,709
Gold	9,382,230	10,224,910	+ 842,680
Pig iron	9,581,864	11,245,630	+ 1,663,766
Lead	1,692,139	1,237,032	— 455,107
Nickel	9,461,877	11,181,310	+ 1,719,433
Silver	14,178,504	17,106,604	+ 2,928,100
Other metallic products	405,122	559,186	+ 154,064
Total	51,516,490	58,764,135	+ 7,247,645
Less pig iron credited to imported ores	7,359,649	9,594,309	+ 2,234,660
Total metallic	44,156,841	49,169,826	+ 5,012,985
Asbestos and asbestic	2,201,775	2,476,558	+ 274,783
Coal	24,781,236	29,811,750	+ 5,030,514
Gypsum	809,632	939,838	+ 130,206
Natural Gas	1,207,029	1,312,614	+ 105,585
Petroleum	559,604	388,550	— 171,054
Salt	415,219	409,624	— 5,595
Cement	5,345,802	6,414,315	+ 1,068,513
Clay products	6,450,810	7,600,000	+ 1,149,190
Lime	1,132,756	1,131,407	— 1,349
Stone	3,127,135	3,499,772	+ 372,637
Miscellaneous non-metallic	1,642,602	1,886,704	+ 244,102
Total non-metallic	47,674,600	55,871,132	+ 8,196,532
Grand total	91,831,441	105,040,958	+ 13,209,517

How the Provinces Contributed.

There has been an increased production in nearly every province, the only falling off being shown by New Brunswick, in which the gypsum production, and some of the structural products, showed a slight decrease.

In Nova Scotia there was a largely increased production of coal and gypsum. In Quebec the principal increases were in cement and asbestos. Ontario's increases are principally in the metals copper, nickel and silver.

Manitoba shows an increased production of gypsum and clay products; while in Alberta clay products, cement, and particularly coal, contribute the chief gains. In British Columbia the increase is mainly due to the coal industry, while the Yukon not only shows a gratifying gain in gold production, but a growing shipment of copper and silver ores.

Of the total production in 1910, $49,169,826 or 46.8 per cent. is credited to the metals, and $55,871,132 or 53.2 per cent. to the non-metallic products. Amongst the individual products, coal still contributes the greatest value, constituting 28.4 per cent. of the total. Silver is next with about 16.3 per cent.; nickel third with 10.6 per cent.; gold, 9.7 per cent.; clay products, 7.2 per cent.; copper, 6.8 per cent., and cement, 6.1 per cent.

Much Monel Metal Made.

In valuing the metallic production, the same general practice has been followed as in past years, with one or two slight modifications. Instead of valuing lead at the New

York price, the average price at Toronto has been used. This is somewhat lower than the New York price, but higher than that in London.

Nickel has been valued at an average price of 30 cents per pound, although the minimum quotation for the metal in large lots was 40 cents. Considerable quantities of monel metal are now made, the production of which does not require the separation of the nickel metal, and the price of 30 cents is equivalent to valuing two thirds of the production at 37½ cents, and one-third at 15 cents.

Notes of Cold Production.

While statistics of gold production are as yet incomplete, a preliminary shows a production of approximately $10,224,910, an increase of about 9 per cent. over the 1909 production. The production of the Yukon is valued at $4,550,000, the total exports, on which royalty was paid during the calendar year according to the records of the Interior Department, being 275,472.51 ounces. The Yukon production in 1909 was $3,960,000, the exports being 239,766.35 ounces. The British Columbia production in 1909 was placer gold $477,000; bullion from free milling ores, $329,655; smelter recoveries $4,367,924. In 1910 the placer production is estimated by the Provincial Mineralogist as $482,000. An estimate of free milling bullion shipments and smelter recoveries is made of $4,950,000, or a total production for the province of $5,432,000. The Nova Scotia production shows a falling off of about $20,000, while Ontario will probably show a slight increase on account of the gold recovered in development work at Porcupine, of which a record has not yet been received.

Silver Shows Big Gain.

The silver production of Canada in 1909 showed an increase of 24.5 per cent. over that of 1908 following a series of large increases during the three preceding years. It is very satisfactory, therefore, to be able to report a further increase in 1910 of about 16 per cent.. The total production last year including that produced as bullion and the metal estimated as recovered from ores sent to smelters or otherwise treated was approximately 31,983,328 ounces, as compared with a production of 27,529,473 ounces in 1909.

The increase is again chiefly credited to Cobalt and adjacent mining districts of Ontario. There was a slight falling off in the silver production of British Columbia as a result of the decreased production from the silver lead ores of the province.

For the province of Ontario, complete returns have been received from all the larger operators, while estimates based on railway shipments have been made for two or three of the smaller mines. The net production of recoverable silver is estimated at 29,375,000 ounces, that is after deducting 5 per cent. from the settlement assays of ores sent to smelters to allow for smelting losses. At the average price of silver for the year this has a value of $15,711,513.

Shipped As Bullion.

The production similarly estimated for 1909 was 24,822,099 ounces, thus showing an increase in 1910 of about 4,552,901 ounces, or over 18 per cent. The total shipments of ore and concentrates were about 34,580 tons, containing approximately 29,931,678 ounces of silver, in addition to which somewhat over 940,000 ounces were shipped as bullion. The average silver content of ore and concentrates shipped was thus about 865.57 ounces, or $462.96 per ton, as compared with an average of 840 ounces in 1909.

The shipments during 1909 were 27,835 tons of ore, containing 22,349,717 ounces of silver, or an average of 803 ounces per ton; 3,059 tons of concentrates containing 3,627,819 ounces, or an average of 1,186 ounces per ton, and bullion containing 143,440 fine ounces. The exports of silver in ore, etc., as reported by the Customs Department were 30,699,770 ounces, valued at $15,649,537. The price of refined silver in New York varied between a minimum of 50½ cents per ounce on March 2nd and a maximum of 56¾ cents on October 19th, the average monthly price being 53.486, as compared with an average monthly price of 51.503 cents in 1909.

COBALT ORE SHIPMENTS.

The following are the shipments of Cobalt ore, in pounds, for the week ended March 3rd: Cobalt Lake, 397,750; Coniagas, 178,240; Nipissing, 99,500; McKinley-Darragh, 118,360; Beaver, 119,717; Kerr Lake, 60,173; Standard Cobalt, 44,813;, Hargraves, 41,100; Temiskaming, 80,224; Crown Reserve, 52,900; Buffalo, 63,800; La Rose, 86,800; City of Cobalt, 60,000; Silver Cliff, 50,260; total, 1,453,637 pounds or 726.8 tons. The total shipments since January 1st are now 9,643,937 pounds or 4,821.9 tons.

In 1904 the camp produced 158 tons, valued at $316,217; in 1905, 2,144 tons, valued at $1,437,196; in 1906, 5,129 tons, valued at $3,900,000; in 1907, 14,040 tons; in 1908, 25,700 tons; in 1909, 29,751 tons; in 1910, 34,041 tons.

MONTREAL STREET RAILWAY

Company Concede Demand for Perpetual Franchise—Number of Outstanding Difficulties.

The Montreal Tramways Company's bill is still occupying much attention, and a compromise may be reached on most points. The committee will report their work in a few days, and the bill will then come before the Lower House. When the matter came up for discussion on Tuesday and Wednesday representatives of the company conceded several of their demands, the most important being an exclusive and perpetual contract. The company will evidently be satisfied with a 50-year contract, and eventually a contract of from 30 to 50 years will be granted, or it might be for 40 or 42 years, inclusive of the 12 years the present contract has yet to run.

Permission to acquire the various subsidiary companies mentioned in the application, and which have hitherto been operated in connection with the street railway, has been granted. Also to operate these roads over the territory requested. Considerable discussion developed over the clause by which the company was to have been given the right to take over any possible franchises and to carry on any business which might be to its advantage.

Street Railway and Canadian Power Company.

Doubtless those clauses have reference to the proposals which were discussed last year by which the amalgamation was to be effected between the Street Railway and Canadian Light and Power Company.

The bill, as it is finally passed, will give the Tramways Company the right to acquire the Canadian Power Company and the terms which were spoken of last summer will be carried out. These were, that in exchange for each $100 share of street railway stock (present value $230) would be given $250 in 4½ per cent. debenture bonds, together with half a share of the new stock; and for each share of the Canadian power stock would be given one and a half shares of the new stock.

The feeling here is that the Tramways Company, by conceding its demand for an exclusive and perpetual franchise and being content with a 30 to 50 year franchise, together with other arrangements, which will permit it to carry on its operations in a remunerative manner, has acted wisely. The city apparently desires to block the company in its effort to settle points of dispute at Quebec rather than at Montreal.

Number of Outstanding Difficulties.

Without disputing that corporations, as a general thing, are not giving to the different municipalities and governments an adequate quid pro quod for the advantages which they receive, it cannot be denied that the corporations are opposed at every turn by the various sectional interests. There are a number of outstanding difficulties, such as the building of lines, the application of the company to extend its lines on certain streets having been refused. Yet notwithstanding this refusal, the company is blamed for congestion. Discussions are constantly going on and something should be done to compel the representatives of the company and those of the city to act more harmoniously in the interests of the citizens as a whole. Both sides show a reasonable amount of willingness to leave disputes to the Public Utilities Commission, so that from this forward there will be less conflict and more execution. By the end of this week the basis for the Tramway bill may have been settled at Quebec.

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.
Brandon, Man., waterworks supplies	Mar. 17.	Mar. 9.	420
Brantford, Ont., school building	Mar. 18.	Mar. 9.	419
Calgary, Alta., one or more stations	Mar. 22.	Mar. 9.	420
Calgary, Alta., concrete walks	Mar. 15.	Feb. 23.	54
Calgary, Alta., machinery and plant	Mar. 22.	Feb. 23.	69
Chapleau, Ont., engine and boiler	Mar. 27.	Mar. 9.	419
Fork River, Man., bridge	Mar. 18.	Mar. 9.	420
Gleichen, Alta., waterworks and sewers	Mar. 16.	Feb. 16.	69
Guelph, Ont., pavement	Mar. 30.	Mar. 9.	66
Haileybury, Ont., erection of college	Mar. 15.	Mar. 9.	419
Leeville, Sask., schoolhouse	Apr. 15.	Mar. 9.	420
Minnitonas P.O., Man., bridge and piers	Apr. 15.	Feb. 23.	70
Moose Jaw, Sask., sewer and water extensions	Apr. 10.	Mar. 2.	70
Moose Jaw, Sask., main drainage works	Apr. 10.	Feb. 23.	66
New Liskeard, Ont., pumps and motors	Mar. 20.	Mar. 9.	70
Niagara Falls, Ont., bridges and roadway	Mar. 28.	Mar. 9.	64
Oak River, Man., debentures for hall	Mar. 29.	Feb. 23.	54
Ottawa, Ont., timber and plank	Mar. 20.	Mar. 2.	70
Ottawa, Ont., oil and oil fuel	Mar. 20.	Mar. 2.	389
Ottawa, Ont., breakwater	Mar. 21.	Mar. 2.	389
Ottawa, Ont., concrete bridge	Mar. 31.	Mar. 2.	390
Ottawa, Ont., breakwater	Mar. 15.	Feb. 23.	360
Ottawa, Ont., motor trucks	Mar. 17.	Feb. 9.	300
Oshawa, Ont., asphalt block pavement	Mar. 18.	Feb. 23.	69
Ottawa, Ont., hot water heating apparatus	Mar. 15.	Mar. 9.	419
Ottawa, Ont., station at Campbellton	Mar. 25.	Mar. 9.	419
Ottawa, Ont., wharf	Apr. 4.	Mar. 9.	419
Rouleau, Sask., mains, valves, etc.	Apr. 4.	Mar. 9.	64
Saskatoon, Sask., electrical unit	Mar. 27.	Mar. 9.	64
Saskatoon, Sask., intercepting sewer	Apr. 14.	Mar. 9.	66
Saskatoon, Sask., water filtration plant	Mar. 31.	Mar. 9.	66
Saskatoon, Sask., franchise for street railway	Apr. 3.	Mar. 2.	70
Saskatoon, Sask., municipal commissioner	Mar. 17.	Feb. 23.	67
Souris, Man., laying pipe	Mar. 20.	Feb. 23.	69
South Middleton, Ont., schoolhouse	Mar. 15.	Jan. 12.	163
St. John, N.B., debentures	Mar. 18.	Mar. 2.	389
Swan River, Man., steel bridge	Apr. 15.	Feb. 16.	66
Toronto, Ont., right to cut pulpwood	Apr. 10.	Jan. 19.	203
Toronto, Ont., rails and ties	Apr. 4.	Mar. 2.	64
Toronto, Ont., reinforced concrete pipe	Mar. 14.	Feb. 23.	66
Toronto, Ont., electric vehicles	Mar. 14.	Mar. 9.	64
Toronto, Ont., pipe fittings	Mar. 14.	Mar. 9.	64
Toronto, Ont., extensions for manholes	Mar. 28.	Mar. 9.	66
Toronto, Ont., engine house	Mar. 25.	Mar. 9.	66
Underwood, Ont., telephone system	Mar. 18.	Mar. 9.	420
Vancouver, B.C., supply of pipe, valves, etc.	Mar. 22.	Feb. 23.	54
Vancouver, B.C., clearing right of way	Mar. 15.	Mar 2.	390
Winnipeg, Man., cast iron pipe	Mar. 29.	Mar. 9.	420

TENDERS.

Ottawa, Ont.—Tenders will be received until March 28, 1911, for the construction of an extension to public wharf, an approach and dredging, at Richibucto, Kent County, N.B. Plans and specifications can be obtained at the offices of E. T. P. Shewen, Esq., district engineer, St. John, N.B.; Geoffrey Stead, Esq., district engineer, Chatham, N.B.; R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until April 4th, 1911, for the construction of a hot water heating apparatus at the new public building, Battleford, Sask. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders will be received until April 3rd, 1911, for the erection of a public building at Portage la Prairie, Man. Plans and specifications can be had on application to Mr. J. E. Cyr, superintendent of public buildings for Manitoba, Post Office Building, Winnipeg, and at the post office, Portage la Prairie. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders will be received until April 5th, 1911, for the construction of an armoury, at Levis, P.Q. Plans and specifications can be obtained on application to Mr. A. R. Decary, district engineer, Quebec, P.Q., also at the office of R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Kingston, Ont.—Sealed tenders will be received by registered post only, until April 5th, 1911, for the supply and erection in place of a steel truss draw bridge. H. B. R. Craig, city engineer, Kingston. (Advertisement in the Canadian Engineer.

Welland, Ont.—Tenders will be received until April 3rd, for the construction, delivery and erection in place in Welland, Ont., of one unit of water power driven waterworks pumps. Wm. Kennedy, jr., consulting engineer, Montreal; R. Cooper, chairman Water Commissioners, Welland. (Advertisement in the Canadian Engineer).

Brantford, Ont.—Sealed tenders addressed to Dr. W. B. Linscott, will be received until noon, March 25th, for the erection and completion of a new residence. Geo. W. Hall, architect, Brantford.

Brantford, Ont.—Sealed tenders will be received until April 3rd, 1911, for the construction of four concrete bridges for the municipality of the township of Brantford. J. A. Smith, clerk of the Brantford Township, Court House, Brantford.

Brantford, Ont.—Tenders will be received until March 30th, 1911, for the construction of a pavement on South Market Street. T. Harry Jones, city engineer, city engineer's office, Brantford. (Advertisement in the Canadian Engineer.)

Hamilton, Ont.—Tenders addressed to Geo. H. Lees, mayor, chairman Board of Control, City Hall, will be received until March 22nd, for the following works at the

House of Refuge: Painting, kalsomining and plastering, inter-communicating telephones, tiling and metallic ceiling. Specifications to be had from the superintendent, House of Refuge. S. H. Kent, city clerk, City Hall, Hamilton.

Winnipeg, Man.—Tenders will be received until March 15th, 1911, for the supply of hardware and rubber goods required for the season of 1911. M. Peterson, secretary, Board of Control office, Winnipeg.

Winnipeg, Man.—Tenders will be received until March 15th, 1911, for the supply of steel vault fittings for the city clerk's office, City Hall. M. Peterson, secretary, Board of Control office, Winnipeg.

Winnipeg, Man.—Tenders will be received until March 16th, for the supply of sectional steel vault fittings for the city engineer's office. M. Peterson, secretary, Board of Control office, Winnipeg.

Winnipeg, Man.—Tenders will be received until March 20th, 1911, for the erection and completion of a municipal hall, at Winnipeg Beach. J. D. Forster, secretary-treasurer, Winnipeg Beach, Winnipeg.

Winnipeg, Man.—Tenders will be received until April 4th, 1911, for the supply of cast iron manhole frames and covers. M. Peterson, secretary, Board of Control Office, Winnipeg.

Ninette, Man.—Tenders will be received until the 20th day of March, 1911, for supplies to the sanitorium. D. A. Stewart, medical superintendent, Ninette, Man.

Calgary, Alta.—Tenders will be received until March 15th, 1911, for the construction of curb and gutter on the various streets along the boulevards for the year 1911. W. D. Spence, city clerk, Calgary.

Saskatoon, Sask.—Tenders will be received until March 24th, 1911, for material for connections, Contract No. 85, tile, pipe and specials, etc. Jas. Clinkskill (Mayor), W. B. Neil, city commissioners, Saskatoon. (Advertisement in the Canadian Engineer.)

Moose Jaw, Sask.—Proposals will be received until March 25th, 1911, for a wholesale warehouse, to be built at Weyburn, Sask., for the Weyburn Grocery Company. Plans are on file at the office of the Moose Grocery Company, Moose Jaw; General Brokerage Company, Grand Forks, N.D.; Moose Grocery Company, Moose Jaw, Sask.

Saskatoon, Sask.—Tenders will be received until March 27th, 1911, for the following: (a) 750 K.W., 2,200 volts, 60 cycle, 120 R.P.M., 2-phase generator, exciter, switchboard and exciter switchboard exciter; (b) 1,250 h.p., 120 R.P.M., vertical cross compound Corliss engine; (c) direct connected exciter engine to run exciter for 750 K.W. generator; (d) one steel smoke stack with a height of 100 feet, and inside diameter of 80 inches, together with corresponding connection to boilers, each installed complete. Plans and specifications may be seen at the office of The Canadian Engineer, 404 Builders' Exchange Building, Winnipeg. Jas. Clinkskill, mayor, W. B. Neil, city commissioners, Saskatoon. (Advertisement in Canadian Engineer.

Saskatoon, Sask.—Tenders will be received until March 20th, 1911, to supply all labor and material, and to complete all work for any and all of the following buildings: Baggage and express room, Moose Jaw; freight shed, Regina; extension to freight shed, Moose Jaw; Standard Car Repair Shop, Moose Jaw; station buildings and section houses; extension to the machine shop, and addition to engine house at Sutherland; six double cottages at Sutherland; dining car stores building at Saskatoon. Plans and specifications can be seen by applying to the assistant chief engineer, Winnipeg; division engineer, Moose Jaw; resident engineer, Moose Jaw; and resident engineer, Saskatoon. T. Martin, division engineer, Saskatoon, Sask.

Regina, Sask.—Sealed tenders will be received until the 24th day of March, 1911, for the erection of a new church building on Victoria Avenue. H. A. Couse, secretary, building committee, Regina.

Prince Albert, Sask.—Tenders will be received until the 15th day of April, 1911, for the construction of a main intercepting sewer. Plans and specifications may be seen at the office of the city engineer, also at the office of The Canadian Engineer, 404 Builders' Exchange Building, Winnipeg, Man., after April 1st. Andrew Holmes, C. O. Davidson, F. A. Creighton, city commissioners, Prince Albert, Sask. (Advertisement in the Canadian Engineer.)

Calgary, Alta.—Tenders are invited up to April 1st, 1911, for the erection of six chalets of Swiss design, at the C.P.R. Swiss village "Edelweiss," near Golden, B.C. J. S. Dennis, manager irrigation, Alberta and British Columbia Lands, C.P.R. Company, Calgary.

Calgary, Alta.—Tenders will be received until the 24th day of March, 1911, for vitrified sewer pipe and conduits. Specifications can be procured from the city commissioners' or city engineer's office. W. D. Spence, city clerk, Calgary.

Calgary, Alta.—Tenders will be received until March 22nd, for an extension of 116 feet and changes to brick and stone station at Medicine Hat. N. E. Brooks, division engineer, Calgary, Alta.

Victoria, B.C.—Tenders will be received until March 29th, 1911, for the erection and completion of a small one-room school building at Otter Point in Esquimalt Electoral District. F. C. Gamble, Public Works Engineer, Department of Public Works, Victoria.

CONTRACTS AWARDED.

Fredericton, N.B.—Contract has been awarded W. R. Fawcett, Temperance Vale, Gork County, N.B., for building the concrete substructure and approaches of Tracy Station bridge over the N. W. Oromocto River, the contract price being $4,450.

Montreal, Que.—The C.P.R. has awarded a contract for 10,000 tons of rails to the Dominion Steel Corporation and another for 100,000 tons to the Lake Superior Corporation.

Kingston, Ont.—A contract for the erection of the Nicol Metallurgy building for Queen's University was recently awarded. The masonry and carpentry will be done by Michael Sullivan of Kingston. The contracts amount to $45,000. The total cost and equipment of the building will reach $55,000.

Brantford, Ont.—The Hamilton & Toronto Sewer Pipe Co., Hamilton, Ont., has been awarded the contract for the supply of sewer pipe.

Toronto, Ont.—The Board has awarded the contract for the supply of 20-inch cast iron water pipe to the Canada Foundry Company, price being $39.95 per 12 feet lengths.

Toronto, Ont.—The city engineer reports having received the following tenders for a supply of twenty-seven rubber sleeves for the three sand dredges operated by the city:—

Number.	Size, etc.	Tender No. 1. Each.	Tender No. 2. Each.	Tender No. 3. Each.
10.....	16 in. x 48 in.	$44.00	$32.50	$38.88
10.....	16 in. x 36 in.	34.00	25.00	31.59
6.....	15 in. x 20 in.	24,00	12.25	20.31
1.....	14 in. x 60 in.	56.00	33.00	43.21

The Board accepted tender No. 2, being the lowest throughout, and in accordance therewith awarded the contract to the Canadian Consolidated Rubber Company, Ltd.

Sault Ste. Marie, Mich.—Announcement has been made here that the Canadian Pacific Railroad has contracted for 100,000 tons of steel rails to be made in Sault Ste. Marie, Ont., at a contract price of $3,000,000.

Winnipeg, Man.—The C.P.R. Construction Department has awarded contracts for grading, concrete, culvert and bridging on new branch lines and second track on main lines for 344 miles of work as follows:

To Foley, Welch & Stewart, two lines out of Swift Current, 80 miles; one line out of Moose Jaw, 35 miles; one line east from Lacombe, 60 miles.

To W. A. Dutton, three branches out of Wilkie, 82 miles.

To Janes, Macdonald & Co., two lines in British Columbia, 54 miles.

To J. G. Hargrave, second track from Moose Jaw west, 23 miles, east from Moose Jaw, 10 miles.

Winnipeg, Man.—The Carter Halls Abinger Company of Winnipeg has been awarded the contract for the new Manitoba agricultural college, their bid being $229,000.

Winnipeg, Man.—The Canadian Pacific Railway recently let the contract for four hundred miles of grading work on branch lines in the West. Messrs. Macdonnell & Co., of Calgary, Alta., will build the Kootenay Central, running south from Golden forty miles. This firm is constructing the extension of the E. & N. Railway from Parksville to Alberni, on Vancouver Island. Messrs. Foley, Welch &

Stewart will build two branches running out of Swift Current, Sask., eighty miles, one southwest and other northwest of the town, also a branch thirty-four miles southwest from Moose Jaw, also sixty miles east from Lacombe, Alta. Contract also to J. G. Hargrave Company, Limited, Winnipeg, second track 23 miles west of Moose Jaw and 10 miles east. Mr. W. A. Dutton will build two branches out of Wilkie, Sask. All the work is to be finished by October 1st.

Winnipeg, Man.—The contract for the erection of the public bath house was awarded by the Board of Control, to Messrs. H. Bruce and A. Bostrom, the amount of contract being $44,880. Mr. William Bruce is the architect for the plans and supervision.

Warren, Man.—A contract for the erection of a school building has been awarded to M. S. Peacock, Hanlon P. O., for $8,100.00. Other tenders were from Malcolm Link, 420 Sherbrooke St., Winnipeg, price being $8,222.00, and T. Thomson, Winnipeg, price being $8,125.00.

East Calgary, Alta.—Messrs. Zang & Musgrave have been awarded the contract for the erection of St. John's Church in East Calgary, the contract price being $14,000. Messrs. Lang & Major are the architects in charge of the work.

Bassano, Alta.—A contract for a schoolhouse has been awarded to M. C. Sackrider & Firegus, Medicine Hat, for $15,400.00. Other tenders were received from A. P. Burns, Medicine Hat, price $15,963.00; Geo. Wakefield, Gliechen, price $16,650.00, and D. McDonald, Calgary, price $18,563.00.

Lethbridge, Alta.—The Lethbridge Iron Works received contract for supplying manhole covers at $3.20 per 100 lbs. The price was 10c. a cwt. higher than the Canadian Iron Corporation, but as they delivered them to any part of the city they were given the contract, the difference on the whole contract of $898.56 being only $28.08.

Calgary, Alta.—The city commissioners recently called for tenders for switchboard and apparatus for the new power station, and below is list of tenders received: Canadian Fairbanks Co., (1) $4,804, (2) $6,053; Allis-Chalmers-Bullock, $5,200; Canadian General Electric, $5,700; Canadian Westinghouse Co., (1) $3,845, (2) $3,650. Tender (2) of the Canadian Westinghouse Co. was accepted.

Calgary, Alta.—The commissioners have received tenders from various companies for ornamental street lamps, and recommended that 100 more or less of the Toronto type be purchased from the Canadian Equipment & Supply Co., for the sum of $50.50 each, f.o.b. Calgary. This price includes all globes, sockets and cutouts and the wiring up of the posts. They also recommend that 100 more or less be purchased from the Canadian General Electric Co., for the sam type of post, all complete as above, for the sum of $56.70, f.o.b. Calgary.

Vancouver, B.C.—The contracts for street paving were awarded to the lowest bidders as follows: Fourth Avenue, Granville to Cedar, Christian, Hartney & Christian, $30,273.75; Main Street, Powell to Alexander, M. P. Cotton, $5,500; Powell Street, Victoria to Semlin, Christian, Hartney & Christian, $7,895.80; Dundas Street, Templeton to Semlin, Romand & Pinto, $17,282.20; Gore Avenue, Hastings to Powell, Christian, Hartney & Christian, $9,873.50.

Vancouver, B.C.—The Canadian Pacific Railway Company has just awarded a contract to Digby & Grenier, contractors of Fernie, for the construction of a large bridge over the Old Man River at the south fork, near Fernie. The bridge will be 860 feet in length and 137 feet high, and will require 1,500,000 feet of timber, 1,000 yards of concrete, 500 piles and 2,000 yards of excavation. It is stated that its construction will occupy the greater part of six months. This is the second bridge contract which has been awarded by the railway to this firm in that district.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—The Imperial Engineering Company, head office Montreal, has obtained a charter to do street railway, power plant, hydro-electric and other similar electrical construction work.

Montreal, Que.—A Toronto financier who was in town recently said that the C.P.R. had recently placed orders for about $3,300,000 worth of rails, 100,000 tons going to the Consolidated Lake Superior Co., and about 10,000 tons to the Dominion Steel Co. He said: "I hear the C.P.R. is in the market for about 20,000 tons additional, which will make its 1911 rail orders fully as large as they were last year."

Brockville, Ont.—The route map of the Ottawa, Smith's Falls and Kingston Electric Railway was submitted last week to the township of Montague for approval of the people of that section who are beginning to think the promoters of the line mean business. The map shows the line running on the north side of the Rideau river up from Ottawa, through Manotick, Kars, North Rideau, Merrickville, Kilmarnock, to Smith's Falls. From here a branch line is projected to Lanark village, through Perth. The road crosses the Rideau here and runs through Lombardy, Portland, Elgin, Morton, Seeley's Bay, Brewer's Mills, to Kingston.

Ottawa, Ont.—A petition, which will ask for a modern cement bridge instead of the wooden structure, which is proposed is being circulated among the ratepayers of Bronson Avenue is the latest development in connection with the new $8,000 bridge over the G.T.R. tracks, which was before the railway commission recently. When sufficiently signed it will be presented to the mayor and board of railway commissioners.

Cobourg, Ont.—The citizens of Campbellford and Warkworth are agitating for the building of an electric railway through Northumberland County, now that it seems probable that the C.P.R. will build along the lake front, instead of winding through the county, as provided by the original charter. It is stated that the charter is secured and plenty of electric power available.

Calgary, Alta.—On the main line of the C.P.R., a bridge will be built across the Bow river, where the line enters the city from the east. This will be just beyond the new Canadian Pacific yards, and will be an extra strong double-track structure. Then there will be the overhead structure of the viaduct nature across the yards in the east end, to accommodate pedestrial, vehicular and tramway traffic. This bridge will be very costly and will take some time to build. Then west of the city there will be three bridges where the line makes a triple crossing of the Bow, as that stream wends its way down through the foothills. These bridges will be double-tracked and of sufficient strength to accommodate the heaviest traffic for years to come. The C.P.R. and the city will jointly build a subway at Eighth street west this summer, and this will be an important public improvement. At present there are no subways west of First street west. Besides the above, there are many other smaller steel structures contemplated by the C.P.R., and which will be built this summer.

SEWAGE AND WATER.

Toronto, Ont.—The city engineer in his report, estimates the cost of bringing the water from Lake Simcoe to Toronto at approximately $18,000,000. This is in response to a request from the city council for information on the subject. The question of using artesian well for the water supply, Mr. Rust reports is not to be considered, as a sufficient supply could not be obtained from this source. He also quotes from the reports of Herring & Gray, and James Mansergh that the water of Lake Ontario is preferable to that of Lake Simcoe, if filtered. Mr. Rust deems it in the public interest to widen Bloor street from Dundas street to High Park, from 66 to 86 feet at a cost of $132,000, of which the city will pay 75 per cent.

Calgary, Alta.—Work has been started on the laying of the new high pressure pipe line extension, which is to be approximately three miles long, to cost $75,000, and will run from half a mile above the reservoir and joins old pipe line under the Bow into Hillhurst. The result on water supply will be that high pressure will be kept up on Crescent Heights and other elevated portions. Better general pressure will prevail throughout the city.

LIGHT, HEAT AND POWER.

Montreal, Que.—G. M. Gest, Power Building, Montreal, has secured a contract for over $100,000 from the Montreal Light, Heat & Power Co., for laying underground conduits.

Toronto, Ont.—The Canadian General Electric Company has recently been awarded a contract for the supply of complete generating equipment for a new plant to be built by the Winnipeg Electric Railway Company within the city limits of Winnipeg. The prime movers will be high pressure steam turbines. The full equipment will consist of three 3-phase, 4-pole, 3,000 k.w., 1,800 r.p.m., 2,300 volt Curtis steam turbine generator sets, for operation condensing, with 180 pounds steam pressure at 125 degrees Fahrenheit super heat. These turbine sets will be complete with three turbine-driven exciters.

Toronto, Ont.—The board of control at a special meeting held recently decided to offer to buy out the Toronto Electric Light Company, subject to the consent of the Hydro-Electric Commission, on the following terms: To pay shareholders $125 per share for their stock and to assume the bonded indebtedness of the company. The company in return must convey to the city its plant, equipment, business, contracts, and all assets. The offer was based on a report submitted by R. A. Ross of engineering firm of Ross and Holgate, who placed a value of $5,000,000 upon the company's plant. Sir Henry Pellatt, president of the company, says that the plant is worth $7,500,000 and the stock $200, and suggests that the price be fixed by arbitration.

Galt, Ont.—The Grand Valley and the Galt, Hespeler & Preston Electric Railways have both arranged for a supply of power from the Hydro-electric Power Commission, and their cars will soon be driven by power produced at Niagara Falls. The powerhouse will, to-day, be connected with the main transmission line, and power will be supplied almost immediately. The street lighting system will be turned on at Preston, where all the power contracted for has been sold.

Portage la Prairie, Man.—Following the contract made by the Reese Engineering Company with the city of St. Boniface for power, Portage has received a communication from the company which may lead to this city also taking up a power proposition. Some months ago a proposition was submitted by the Reese Company to Portage. At the present time there is a special committee of the city council at work on the advisability of acquiring the plant of the local electric light company.

BY-LAWS AND FINANCE.

Calgary, Alta.—Seven by-laws aggregating close to a million dollars, will be placed for approval before the ratepayers in three weeks. The exact total of these seven by-laws is $940,000. There are, incinerators, $120,000; asphalt plant, $20,000; conduit system, $60,000; waterworks extensions, $245,000; service connections, $40,000; electric light, $380,000; and fire station, $75,000.

South Vancouver, B.C.—For road purposes a by-law for a million dollars will be placed before the electors. Every road on which it is proposed to make improvements will be named. At the commencement of the year a tour of the whole municipality was made by the engineer, accompanied by the chairman of the board of works and the ward councillor. The estimates since prepared, show a total of $1,417,195, disributed thus:—Ward One, $249,340; Ward Two, $337,560; Ward Three, $279,260; Ward Four, $217,280; Ward Five, $333,755. It will thus be necessary to cut these figures down by a total of nearly half a million dollars. The by-law to be submitted for waterworks will total $300,000. It has been decided to get expert advice on the water system, and Mr. H. P. Archibald will be authorized to investigate the whole department in conjunction with the water committee and the superintendent. For sidewalks $50,000 will be asked for. The school by-law, as previously announced, amounts to $260,000, exclusive of the government grant.

CURRENT NEWS.

St. John, N.B.—A company is being formed with a capital of $2,000,000 to establish a cement manufacturing plant at Green Head, close to St. John, N.B. It is said the plant will cost $500,000 and that President Beach of the Pennsylvania Cement Company is interested in the project. A special meeting of the Safety Board will be held to consider the question as the proposed site is owned by the city.

Maisonneuve, Que.—Plans and estimates for the new post office are being prepared by Architect Reeves, the town building inspector. The new office is to be situated on a lot of land, size 100 by 100 feet, on Ontario Street, near the National Lacrosse Grounds. It will be a stone building of two and a half storeys and will cost between $50,000 and $60,000. There were nine building permits issued during February, the principal one being that of the United Shoe Machinery Company to erect a factory, cost $195,000, at the corner of Letourneau and Giroux streets.

New York City, N.Y.—A section of the eighth floor of a reinforced building under construction recently crashed through to the foundation, carrying other floors and burying a number of workmen in the debris. Faulty cement mixing is believed to have been the cause for this disaster.

New York, N.Y.—Sir Thomas C. Shaughnessy, president of the C.P.R., sailed recently from this port for England. Sir Thomas said the Canadian Pacific contemplated spending about $34,000,000 the coming year on improvements and extensions and while in England he expected to place orders for the building of the two new ships for the Pacific trade, running between Vancouver and the Orient. These steamers will be about 10,000 tons each.

Toronto, Ont.—Contractors in the woods this winter report a very busy season eclipsing all former records in the quantity of ties, timber, poles, posts, cordwood, pulp and logs which have been cut. From 15,000 to 20,000 men have been employed at this work continuously, and over $500,000 paid in wages. At Fort Frances the estimated cut of pulpwood is 200,000 cords, this large amount being due to bush fires which swept throughout the Rainy River country last fall. The number of ties cut will reach nearly 4,000,000 in the several camps located along the C.N.R. and C.P.R. Telegraph and telephone poles will reach nearly 250,000, while the logs cut for lumber companies will reach 150,000,000 feet.

South Porcupine, Ont.—Following immediately upon the action of the Associated Board of Trade, recommending that the government do something for Northern Ontario, will come a request from the mine managers of Porcupine for trunk roads built by the government where they are necessary. Realizing that good roads are essential to the development of the mines and the camp mine managers and those interested in mine properties held a meeting in South Porcupine and took action on this question. South Porcupine being the section nearest the developed properties, the road from this part of the town to the Mattagami river was chiefly discussed. This road, it was suggested, might be built along the third concession line, and thus be connected by means of short branch roads with the Dome, the Foster, the Rea, the Hollinger, Bewick, Moreing and Co.'s properties, the Armstrong-McGibbon, and others. The mines returning a good amount in tax, the managers believe the government should build the road. This done the mines will build their own branch roads.

Fort William, Ont.—The Barnett-McQueen Company, of this city, is installing at its works in Christina Street a complete and up-to-date plant for the manufacture of bolts of all kinds. The sum of over $10,000 will be expended, and some 20 men will be employed from the start.

Fort William, Ont.—Fort William will erect an addition 64 ft. x 145 ft. to the Central school; estimated cost $100,000. Hood & Scott, architects.

Victoria, B.C.—A four-storey class "A" fireproof building, to cost $65,000, is planned for the British Columbia Telephone Company, to be built upon the property at the southeast corner of Johnson and Blanchard streets, and the local manager of the company announced this morning that construction will be commenced on the new quarters as soon as the architect completes the plans.

Cement Factories Abroad.—The Belgian Consul at Batavia states that a new company, having its headquarters at Amsterdam, with a capital of 1,350,000 florins (£112,500) has been formed for the establishment of a Portland cement factory at Padang, Sumatra. A note published in Le Ciment states that the importation of cement into Manchuria is likely to be affected before long by the establishment of a factory which it is proposed to erect at Choushuitzu for the supply of 160,000 barrels of cement annually to the Shanghai market. The factory will employ 350 hands (50 Japanese and 300 Chinese).

PERSONAL.

Harry E. Smith, M.I.T., '87, chemist and engineer, of tests for the Lake Shore and Michigan Central R.R. will present a paper on "The Chemist in the Service of the Railroad," before the Congress of Technology, in Boston, April 10-11.

Mr. D. T. Black, town engineer, Campbellton, N.B., has placed his resignation before the town council, on his appointment as town engineer, at Welland, Ontario.

Mr. C. W. Vaux, formerly general passenger agent of the Grand Trunk Railway, has been appointed general passenger and traffic manager of the Canadian Northern Railway.

Mr. J. L. Brower, M. Can. Soc. C.E., manager and engineer of the Structural Steel Company, of Montreal, Que., has resigned to become general manager of the National Bridge Company of Canada, a new company, having a plant under construction at Longue Pointe, Montreal. Mr. Brower has been manager of the Structural Steel Company for the past four years. He was connected for many years with the Pencoyd plant of the American Bridge Company. Mr. Brower was formerly a member of the staff of Mr. William Barclay Parsons, M. Am. Soc. C.E., of New York City.

OBITUARY.

Mr. Milton T. Culbert, B.A. Sc., Manager of the O'Brien Mining Company, Cobalt, died in St. Michael's Hospital, Toronto, on March 14th, 1911. Mr. Culbert graduated in mining from Toronto University with a class of '02, and has been in the Cobalt district ever since the boom. Although but a young man, he had made for himself a prominent position among mining men.

SOCIETY NOTES.

American Institute Meeting in Toronto.—The 260th meeting of the American Institute of Electrical Engineers will be held in Toronto, on April 7th, in lecture room No. 22, Chemistry and Mining Building, University of Toronto. W. S. Murray, electrical engineer, of New York, New Haven and Hartford Railway, will present a paper entitled "Analysis of Electrification, and its practical application to Trunk Lines for Freight and Passenger Operation." Mr. Murray is an authority on this subject and the meeting should prove of decided interest to all men interested in railway work. The meeting is open to all who may be interested.

The Central Railway and Engineering Club.—The regular monthly meeting of the above club will be held in the Assembly Room, Prince George Hotel, on Tuesday, March 21st, at 8.00 p.m., when a paper will be read on "The Doherty Process of Iron Founding," by Mr. W. A. Grocock, engineers' representative, Toronto.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

13076—February 20—Authorizing C.P.R. to construct a spur from mileage 5.5 on Phoenix Branch of the Columbia & Western Railway for a distance of 3.15 miles to Wellington Camp, B.C.

13077—February 22—Authorizing C.P.R. to construct a spur to premises of Dun Bros. across Block 44, Xante St., Blocks 43, 42, 41, lying between Ross and Pacific Avenues, Winnipeg, Man.

13078—February 23—Authorizing Seymour Power & Electric Co. to cross with its wires track of G.T.R. in Lot 3, Concession 2, Township of Murray, County of Northumberland, Ontario.

13079—February 24—Approving location of C.N.R. through Township 56, Ranges 25-24, west 4th, Alberta, mileage 0.00 to 10.25.

13080—February 24—Approving location of C.P.R. Co.'s portion of Weyburn to Lethbridge Branch from a point in Section 25, Township 3, Range 1, west 4th, to a point in Section 29, Township 6, Range 13, west 4th, mileage 316.78 to 400, Alberta.

13081—February 24—Extending for a period of thirty days from date of this Order time within which G.T.R. have to install electric bell authorized by Order No. 12324, of November 18th, 1910.

13082—February 25—Authorizing C.P.R. to cross Second Avenue and Manitoba Streets in city of Moose Jaw, Sask.

13083—February 25—Approving revised location of G.T.P. Branch Lines Co. from Regina to Moose Jaw, Sec. 25, Township 17, Range 20, to Section 29, Township 17, Range 20, west 2nd Meridian, mileage 0.036 to 3.24 Sask.

13084—February 25—Authorizing C.P.R. to open for carriage of traffic second track of the double track known as Brandon Section, from mileage 2 to mileage 55, a distance of 53 miles.

13085—February 25—Directing that town of St. Louis, P.Q., complete subway at Parke Ave., by December 31st, 1911, as ordered in Order No. 10455, dated April 28th, 1910.

(Continued on page 66.)

MARKET CONDITIONS.

Halifax, March 13th, 1911.

Generally the markets are very steady. The demand in the hardware business being particularly strong, continued advances in the price of the linseed oil and turpentine has necessarily effected the prices of paints. The purchases for the spring work have hardly commenced yet, and, therefore, the trade is not particularly brisk, although the outlook is good.

Axes.—Ordinary chopping axes, single bit, $6.50 per dozen, double bit, $11. Special brands, prices on application to jobbers.

Bar Iron.—The market for bar iron is open, but the situation is firm, and prices range as high as $2.25 base.

Black Sheet Iron.—This commodity is in good demand. We quote 24-gauge, $2.40.

Cast Steel.—The market is steady at 10 to 15c., according to makers.

Cement.—Stocks are low and market is steady, $2 per bbl.

Coil Chain.—The jobbing prices of English proof chain in Halifax are as follows: 3-16 x 4, $7.15; 3-16 x 3, $6.25; ¼, $5.35; 5-16, $4.30; ⅜, $3.90; 7-16, $3.85; ½, $3.60; ⅝, $3.60; ¾, $3.50; ⅞, $3.50; 1, $3.50; 1⅛, $3.50.

Fencing Wire.—We quote: Plain, twisted and galvanized at $3.25 per 100 lbs.; barb at $2.75 per 100 lbs.; bright staples in 100-lb. kegs at $3, and in 50-lb lots, $3.25. Galvanized staples are 25c. extra.

Galvanized Sheet Iron.—The wholesale prices are as follows: 16 to 20-gauge, $3.45; 22 to 24, $3.80; 26, $4.30; 28, $4.55. These prices are for less than case lots.

Ingot Tin.—The tin market as usual is a fluctuating one, and the present price is about 38c. net cash.

Lead Pipe.—Quotations here are open, and the price quoted to-day is about $4.75 for ordinary jobbing quantities.

Linseed Oil.—Raw is fully worth $1.20, and boiled, $1.25 per gallon. Orders are small, stocks low, and the outlook firm.

Nails.—Nails are firm. Wire nails, $2.45, and cut nails, $2.60. Business in this line is reported fairly active.

Peavies.—There is a better enquiry than last year. Prices are unchanged at $11 to $13 per dozen, according to make, but we are advised that there will be an advance.

Pig Lead.—We quote $4.25 for English and $4 for Canadian. The outlook is for higher prices.

Pipe.—Wrought iron, 1-in., $5.25.

Roofing Paper.—The demand is good. Tarred paper, $1.70 per 100 lbs.; three-ply roofing 90c. per 100 lbs.; two-ply roofing, 65c.; sheathing paper, 30 cents per roll; tarred sheathing, 40 cents per roll.

Rope.—The price of cordage for next spring's supplies is unchanged. For large lots dealers should write jobbers for quotations. Small lots are as follows: Sisal, 9½c. base; lobster rope, 9¾c.; British manilla, 9½c.; base, best manilla, 10½c. base.

Sheet Lead.—The price of sheet lead is also very firm, 3 lbs. and heavier, $4.75 per cwt., in rolls, and $5.75 in smaller quantities.

Steel.—Tire, $2.50; spring, $2.70; machine, $3.25; toe caulk, $3.50; sleigh shoe steel, $2.50; the above are all base prices.

Tin Plates.—I. C. coke, $3.95 to $4.10; I. C. charcoal, $4.75; I. X. charcoal, $5.50.

Turpentine.—Prices now quoted are as high as $1 to $1.10 in bbls., and $1.05 to $1.15 in smaller quantities. The market is open.

White Lead.—For Canadian pure, in 50 and 25-lb. irons, $6.25 is being asked. Brandram's B.B. genuine in 25, 50, and 100-lb. irons, $7.35, and B.B. No. 1, $6.10. The trade expect prices to be much higher before long.

Zinc.—This commodity is very firm, $7.50 for casks and $8 for smaller quantities. Spelter is $2.75 per cwt.

Montreal, March 14th, 1911.

Pittsburg advices state that the United States is producing pig-iron at the rate of about 25,250,000 tons a year, against less than 20,000,000 tons in the closing week of December, a gain of 25 per cent. At the end of December, however, general furnaces were banked on account of their attendant steel works being closed for repairs, and the capacity nominally in blast was about 21,000,000. The actual capacity of the country is about 33,000,000 tons—statements that the capacity is 38,000,000 or 40,000,000 tons being due to a misunderstanding of the data—so that the country is running at 76 per cent. of capacity, so far as pig-iron is concerned.

The only question now is whether the recovery in production has not gone further than can be sustained. Buying of finished steel products has decreased, comparing the past fortnight with the last week in January and the first week in February, which period represented the heaviest rate of buying on this movement. The present outlook is not encouraging for heavier business until the opening of spring gives its usual impetus.

New orders were received by many iron and steel plants last week, which give the market a decidedly stronger tone. A noticeable increase in the activity of the local mills and factories has resulted, and indications are that most of the mills will be working at full capacity within a short time.

The pig-iron market has taken a jump. It is firmer than it has been for several months. Many sales of basic, foundry and malleable grades have been reported at advanced prices, and sellers are not quoting far ahead.

Consumers are attempting to cover for full requirements over the next several months, and in some cases inquiries call for delivery over one year.

The sale of 2,000 tons of open-hearth sheet bars by a nearby independent mill for delivery up to April 15th at $25, Pittsburg, an advance of $1 a ton, has resulted in some of the other mills practically withdrawing quotations of $24, Pittsburg.

While there is not a great deal of trading in the open market, large consumers being covered by contract, specifications are heavier than at any time in months. As a result mill operations have been materially increased. The Carnegie Steel Co. is operating its 64 open-hearth furnaces at Homestead, and is running some of its Ohio steel mills to capacity.

Advices from the other side of the Atlantic are not very exciting. Trade is coming on steadily, but there is no particular activity. Prices are holding firm, but there is no evidence of an advance at the moment. The export demand is fair.

Local iron and steel men speak very encouragingly of the situation in Canada. Apparently they are looking forward to a big year's business. The somewhat better tone in the market in the United States is reflected here, and the tendency is towards a higher range of prices. Until the United States has a definite advance, however, prices here cannot go any higher. Apparently the Americans are still offering American iron at Buffalo at a figure which Ontario producers are compelled to meet, although they do so very unwillingly. In very few cases, however, are they willing to book ahead at current rates.

Bar Iron and Steel.—Trade is reported first-class. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.95 for 1 x ⅜ base; tire steel, $2.05 for 1 x ⅜-base; toe calk steel, $2.75; machine steel, iron finish, $2.00; imported, $2.05.

Antimony.—The market is steady at 8¼c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; carpet felt, $2.50 per 100 pounds; tar sheathing, 36c. per roll of 400 square feet; dry sheathing, No. 1, 28c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b. Montreal:—$1.35 to $1.40 per 350-lb bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $7 per ton, net; furnace coal, $6.75, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are easy at 13¾c.

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

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

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

Iron.—The following quotations are now given, basis of carloads, ex-store:—No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Carron special, $21 to $21.50; Carron soft, $20.50 to $21; Clarence, $18.50 to $19; Cleveland, $18.50 to $19.

Laths.—See Lumber, etc.

Lead.—Prices are firm at $3.65.

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $17 to $21 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $12 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal Laths: Quotations per 1,000 laths, at points carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3.

Nails.—Demand for nails is steady and prices are: $2.40 per keg for cut, and $2.30 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, $1.25 to $1.45 per gallon; girder, bridge, and structural paint for steel or iron—shop or field— $1.45 to $1.55 per gallon, in barrels; liquid red lead in gallon cans, $2 per gallon.

Pipe.—Cast Iron.—The market shows a firm tone and trade is said to have been most satisfactory Prices are firm, and approximately as follows:—$33 for 6 and 8-inch pipe and larger; $34 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27. On the following the discount is 73½ per cent. for black, and 63½ per cent. for galvanized: 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50. Discount on the following is 71½ per cent. off on black, and 61½ per cent. off for galvanized: 3½-inch, $95; 4-inch, $1.08.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for 1/4, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. Roofing cement in bbls., of 40 gallons, 15c.; in 5-gallon tins, 20c. per gallon. (See Building Paper; Tar and Pitch; Nails, Roofing).

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

Spikes.—Railway spikes are steady, at $2.45 per 100 pounds, base of 5/8 x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $4 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 75c. per 100 pounds; No. 2, 55c. per 100 pounds; pine tar, $9.50 per barrel of 40 gallons; refined coal tar, $4.50 per barrel, pine pitch, 3c. per lb.; rosin, 3¼c. (See building paper, also roofing).

Tin.—Prices are firm at $44.

Zinc.—The tone is easy, at 6¼c.

CAMP SUPPLIES.

Beans.—Prime beans, $1.85 to $1.90.

Butter.—Fresh made creamery, 24 to 26c.

Canned Goods.—Per Dozen.—Corn, $1.00; peas, $1.20 to $2.00; beans, $1.00; tomatoes, $1.45; peaches, 2s, $1.90; and 3s, $2.90; pears, 2s, $1.80; and 3s, $2.40; salmon best brands, 1-lb. talls, $2.07, and flats, $2.25; other grades, $1.40 to $2 10.

Cheese.—The market ranges from 12 to 13c., covering all Canadian makes.

Coffee.—Mocha, 22 to 30c.; Santos, 18 to 21c.; Rio, 15 to 18c.

Dried Fruits.—Currants, Filiatras, 6¾ to 9¼c.; dates, 5½c.; raisins, Valentias, 7¾ to 8¼c.; prunes, 8¾ to 12c.

Eggs.—New laid eggs, 30 to 35c.; No. 1 candled, 17 to 18c.

Flour.—Manitoba, 1st patents, $5.60 per barrel; and patents, $5.10, strong bakers', $4.90.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbados, 34 to 36c.; Porto Rico, 40 to 43c; syrup, barrels, 3c.; 2-lb. tins, 2 dozen to case, $2.25 per case.

Potatoes.—Per 90 lbs., good quality, $1.10 to $1.20.

Rice and Tapioca.—Rice, grade B, in 100-lb. bags, 3¾ to 3½; Tapioca, medium pearl, 5½ to 8c.

Rolled Oats.—Oatmeal $2.45 per bag; rolled oats, $2.20, bags.

Sugar.—Granulated, bags, $4.60; yellow, $4.20 to $4.45; Barrels 5c. above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.; China, green, 14 to 50c.

Fish.—Salt fish.—No. 1 green cod, $8 to $9 per bbl.; herring, $4.50 per bbl.; salmon, $8.50 per half barrel. Smoked fish.—Bloaters, $1.25 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20 to $1.40.

Provisions.—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 14 to 19c per lb.; lard, 14 to 15c. for pure, and 11½ to 12c. per lb. for compound; bacon, 13 to 18c.

Toronto, March 16th, 1911.

A good trade is looked for in most departments of the building trade. Brick makers are heavily laden with orders, and say that this will be the biggest building year that Toronto has ever seen. Roofers and other branches of the building trade concur in the prospect of an unusually active year. In the metal trades firmness is general. Iron and steel goods are looking upwards, all quotations being subject to change without notice. Indeed, one of the large United States mills does not care to sell at present prices over a longer period than the first half of the year.

In the list of camp supplies, butter and cheese are higher, eggs showing a decline. Flour prices are unchanged. No alteration in canned vegetables or dried fruits. Dry salt and smoked meats and pork steady. Feed as quoted last week. No great change in spices or other grocery items.

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

Antimony.—The demand is less active, and the price remains unchanged at $8.50.

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

Bar Iron.—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement.

Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25. Sleigh shoe and other take same relative advance.

Boiler Plates.—¼-inch and heavier $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50 to $9; 2¼-inch, $10; 2½-inch, $10.50; 3-inch, $12.10; 3½-inch, $15; 4-inch, $19.

Building Paper.—Plain, 27c. per roll; tarred, 35c. Nothing doing.

Bricks.—In active movement, with very firm tone. The price is $10.50 to $11.00 for half-and-half. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70 to 75c. per ton of 2,000 lbs., either 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa, or Quebec Province. At Washago, $2.50 per ton for small and $1.15 for large; freight to Toronto, 60c.

Cement.—Car lots, $1.65 to $1.70 per barrel, without bags. In 1,000 barrel lots, $1.55. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra.

Coal.—Anthracite egg and stove, $7.25 per ton; chestnut, scarce, $7.50; pea coal $6.00 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connelsville, 72-hour coke, $5.00 to $5.25. Shipments falling off on account of season drawing to a close. Dealers are buying only such quantities as are actually required so as to facilitate stock taking on April 1st. Nut coal still continues scarce, being held at a premium by miners. The soft coal market is practically unchanged and prices continue stiff as shipments are somewhat blocked by storms.

Copper Ingot.—The market has reached a firm basis, and holders are quite stiff at $13.50 per 100 lbs. Demand is active, and a large quantity moving.

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

Dynamite.—The price is determined by the point at which it is to be delivered. Here we quote 21 to 25c. as to quantity.

Felt Roofing.—Not much moving, price continues as before, $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, American, $8; Scotch, $12.

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

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—At present quotations are lower, thus:—Black Pipe, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.54; 2½-inch, $15.24; 3-inch, $20.01; 3½-inch, $27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $40.75; 6-inch, $52.85. Galvanized Pipe, ¼-inch, $2.86; ⅜-inch, $2.86; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.14, per 100 feet.

Lead.—A fair business is doing at prices unaltered from $3.75 to $4.

Lime.—Retail price in city 55c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 23c. per 100 lbs. f.o.b. car without freight. Demand is beginning.

Lumber.—Demand less brisk, because of the late season of the year, but prices are not materially altered. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $32 to $42.50; hemlock is in demand and held quite firmly, we quote $17.50 to $18.00; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.30; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked. The factories are all busy; the yard trade necessarily more slack, because of the season of the year.

Nails.—Wire, $2.35; cut, $2.60; spikes, $2.85 per keg of 100 lbs., base.

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. Midland, No. 1, $19; No. 2, $18.50. Any change must be upward.

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Season is over.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.95 to $2, f.o.b. cars, Toronto; retail, $2.15 per barrel of 300 lbs., delivered in 5 barrel lots; $2.10 at warehouse.

Putty.—In bladders, strictly pure, per 100 lbs., $2.60; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels, at warehouse.

Ready Roofing.—Prices are as per catalogue.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy.

Rope.—Sisal, 9½c. per lb.; pure Manila, 10½c. per lb., Base.

Sand.—Sharp, for cement or brick work, $1.15 per ton f.o.b., cars, Toronto siding.

Sewer Pipe.—

	4-in.	6-in.	9-in.	12-in.	24-in.
Straight pipe, per foot	$0.25	$0.40	$0.65	$1.00	$3.25
Single junction, 1 or 2 ft. long.....	1.00	1.60	2.60	4.00	13.00
Double junctions	1.25	2.00	3.25	5.00	16.25
Increasers and reducers	....	1.60	2.60	4.00	13.00
P. & H. H. traps	2.00	3.20	6.50	15.00	.....
Bends	0.75	1.20	1.95	3.00	9.75

Above is the October list, as changed. The retail price is less 65 per cent. off these figures on all sizes, 9 inches and under, or less 60 per cent. off these figures on anything over 9 inches. For car-load lots a greater discount.

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

Sheet Steel.—American Bessemer, 10-gauge, $2.40; 12-gauge, $2.45; 14-gauge, $2.30; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices, and an advance is not unlikely.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs. Active and firm at these prices.

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

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

Tin.—Control of the market is still evident, and the upward trend continues. We now quote 47c. to 48c.

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

Zinc Spelter.—Demand not so brisk, and the market easier at $6.

CAMP SUPPLIES.

Beef.—by carcases, $8.50 to $9.50.

Butter.—Dairy prints are 20 to 24c.; creamery prints, 26 to 28c.; do. fresh made, 29 to 30c. Splendid demand for fresh made.

Canned Goods.—Peas, $1.35 to $1.75; tomatoes, 3s, $1.45 to $1.50; pumpkins, 3s, 97½c.; corn, 95c. to $1.00; peaches, 2s, $1.87½; yellow, $1.82½ to $1.87½; strawberries, 2s, heavy syrup, $1.80; raspberries 2s, $1.80 to $1.97½.

Cheese.—Moderately firm, large, 13¾ to 14c.; twins, 14 to 14¼c.

Coffee.—Rio, Green, 15½ to 16c.; Mocha, 23 to 25c.; Java, 25 to 31c.; Santos, 16 to 17c.

Dried Fruits.—Raisins, new, Valencia, 8 to 8½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 8½c.; fine, 9½c.; choice, 10 to 11c.; fancy, 12c.; Filiatras currants, cleaned, 7½ to 8c.; Vostizzas, 9 to 10c.; uncleaned currants, 7 to 7¼c.

Eggs.—Strictly new-laid, 21 to 22c.

Flour.—Prices unchanged thus far; thus, Manitoba flour, first patents, $5.20; second, $4.70; strong bakers', $4.60; Ontario flour winter wheat patents, $3.90; $4 per barrel.

Feed.—Bran, $22 to $23 per ton; shorts, $23 to $24 per ton.

Lard.—Tierces, we quote 11¼c. here; tubs, 11½c.; pails, 11¾c.

Molasses.—Barbados, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium.

Pork.—Not much doing, short cut, $26 to $26.50 per barrel; mess, $1 off, heavy, $22 to $22.50.

Rice.—B. grade, 3½c. per lb.; Patna, 5 to 5¼c.; Japan, 5 to 6c.

Salmon.—As before stated. We quote Fraser River, talls, $2.05; flats, $2.20; River Inlet, $1.90; cohoes, $1.75.

Smoked and Dry Salt Meats.—Long clear bacon, 11 to 11½c. per lb., tuns and cases; hams, large, 12 to 13c.; small, 14 to 15c.; rolls, 12 to 13c.; breakfast bacon, 17 to 18c.; backs (plain), 18 to 19c.; backs (pea-meal), 19 to 20c.; shoulder hams, 13c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 28 to 30c.; compound, 18 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 25 to 30c.

Sugar.—Granulated, $4.35 per 100 lbs., in barrels; Acadia, $4.25; yellow, $3.95.

Syrup.—Corn syrup, special bright, 3¼c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, 17 to 38c. per lb.

Vegetables.—Potatoes—Ontario, $1 per bag, on railway track, Toronto; Ontario Delawares bring $1, and New Brunswick Delawares $1.10; onions by crate, Spanish, $3; Canadian, $1.85; cabbages bring from $1.25 to $1.50 per; barrel; carrots, 60c. per bag; beets, 75c. per bag; turnips, 40c. per bag.

Winnipeg, March 13th, 1911.

Spring-like weather has prevailed for the past week and more and every preparation is being made for an early spring, contractors and supply men are very busy getting things in shape for an early start, and the outlook for a big building year was never better.

For the two quietest months of the season, in the depth of winter, the records of the building inspector's office shows 130 permits issued for 155 buildings, which will cost $632,200. This is an increase of practically $100,000 over the same period last year.

From all accounts the building development of Winnipeg, and what is true of Winnipeg is true of every large centre of the West, will proceed at the same ratio for the balance of the year.

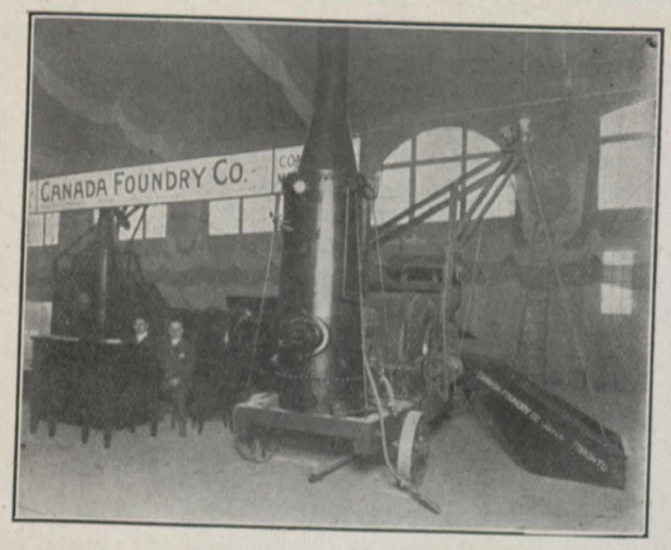
Builders and architects are of this opinion, and it is said that the volume of business in sight is sufficient to warrant the assertion.

Prices in all lines are steady, and as far as we can find out the following list of quotations is correct:—

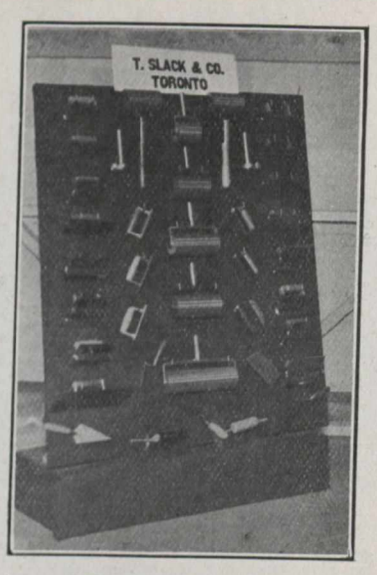
Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50.

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

Views of the Toronto Cement Show



KŒHRING MIXERS.
Exhibited by Canada Foundry Co.



CEMENT TOOLS.
Exhibited by T. Slack & Co., Toronto.

CONCRETE MACHINERY.
Exhibit of London Concrete Machinery Co.

WETTLAUFER MIXERS.
Wettlaufer Bros., Toronto and Mitchell, Ont.

MINIATURE CEMENT MILL.
Instructive Exhibit of Canada Cement Co.

WIRE MESH REINFORCEMENT.
Same Exhibit as at the Chicago Show.

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch, (4, 30, 41, 50, 118, 119, 127, 132, 145, 176.)

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 2 White Pine, 6 in., $55; cull red or white pine or spruce, $24.50; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6in., $55; No. 3, $45.

Bricks.—$11, $12, $13 per M, three grades.

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

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

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

Cement.—$2.40 to $2.75 per barrel in cotton bags.

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

Copper.—Tinned, boiler, 26½c.; planished, 29½c.; boiler and T. K. pits, plain, tinned, 45 per cent. discount.

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 90c. to $1.15 per bale.

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

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

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

Lumber.—No. 1 pine, spruce, tamarac, 2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $29; British Columbia fir and cedar, 2 x 4, 2 x 6, and 2 x 8, 12 to 16 feet, $32; 2 x 20, 4 x 20, up to 32 feet, $42.

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

Picks.—Clay, $5 per dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb. (132.)

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

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

Plaster.—Per barrel, $3.25.

Roofing Paper.—60 to 67½cc. per roll.

Rope.—Cotton, ¼ to ½-in., and larger 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¼c., sisal, 10½c.

Shingles.—No. 1 British Columbia cedar, $4; No. 2, $3.50; No. 1 dimension, $5; No. 1 band saw, $6.

Spikes.—Basis as follows:—1¼, 5 and 6, $4.75; 5-15 x 5 and 6, $4.40; ⅝ x 6, 7 and 8, $4.25; ⅝ x 8, 9, 10, and 12, $4.05; 25c. extra on other sides.

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

Staples.—Fence, $2.40 per 100 lbs.

Timber.—Rough, 8 x 8 to 14 x 16 up to 32 feet, $38; 6 x 20, 8 x 20, up to 32 feet, $42.

Tool Steel.—8½ to 15c. per pound.

POSITIONS WANTED

RAILROAD ENGINEER (26), 8 years' experience design and construction of railroads, retaining walls, roads, roof trusses and columns of steel, desires permanent position, Winnipeg or west. Box A21, Canadian Engineer.

PRACTICAL and technical electric railway man, with 17 years' experience, is open for a position as superintendent of operating or constructing of electric railways. Capable of locating lines, designing, equipping, and constructing in all its branches in the system. A hustler and not afraid of work, salary reasonable. Box 174, Canadian Engineer.

ENGINEER.—A graduate in civil engineering, experienced in plain and reinforced concrete, general construction work, mill equipment and installation, excavation, quarrying and railroad work. Has held positions of responsibility and had organization and executive work to do. Would prefer position where work was of a commercial as well as an engineering nature. Permanent position desired. Best references furnished. Apply to Box 176, Canadian Engineer Office, B33 Board of Trade Building, Montreal.

POSITIONS VACANT

WANTED, as assistant to business manager, a technically trained man, experienced as commercial engineer and familiar with cost accounting system of Public Electric Utilities operating in large cities. Must have initiative and executive ability and show clearly that he has made good elsewhere. Application not considered unless it contains full details as to where born, age, education, positions held, salaries received and references. Address Box 170, Canadian Engineer.

TOWN ENGINEER

wanted to take full supervision of water, sewerage and street departments. Apply, stating salary, experience and references to John T. Reid, Town Clerk, Campbellton, N.B.

FOR SALE

FOR SALE.

A good 15-in. dumpy Berger level-erecting eyepiece, in perfect condition, nearly new. Price, $75.00. Address, Box 162, Canadian Engineer.

SAND DREDGE FOR SALE.

Hydraulic Sand Dredge in excellent condition, complete with necessary pumps, engines, boiler, "A" frame, spud cutter, etc.

Accessories include 500 feet of steel discharge pipe, of which 250 feet is fitted with flexible joints; also seven pontoons to carry same.

For further information and details apply to the City Engineer of Hamilton, Canada.

Hamilton, Canada, March 1st, 1911.

PATENT NOTICE.

Any one desiring to obtain the invention covered by Canadian patent No. 117412 granted on March 23rd, 1909, to John Nazel, of Philadelphia, Pa., U.S.A., for TUBE TRIMMING MACHINE, may do so upon application to the undersigned who are prepared to supply all reasonable demands on the part of the public for the invention and from whom all information can be obtained. Fetherstonhaugh & Co., 5 Elgin St., Ottawa, Canada. Russel S. Smart, resident.

TENDERS CALLED FOR

CITY OF BRANTFORD.

Tenders for Pavement.

Sealed tenders addressed to Alderman C. H. Hartman, Chairman of the Board of Works, in care of the City Clerk, Brantford, Ont., will be received until 12 o'clock noon on

THURSDAY, MARCH 30th, 1911,

for the construction of a pavement on South Market Street.

About 5,000 square yards of top surfacing, of which 800 square yards will be on a ten per cent. grade.

Tenders for different kinds of surfacing will be received.

Concrete foundation for this pavement will be laid by the city.

Single track line of street railway on street.

Plans and specifications may be seen, and instructions to bidders and forms of tender obtained at the City Engineer's Office.

Each tender must be accompanied by a marked cheque for 5 per cent. of the amount of the tender.

The lowest or any tender not necessarily accepted.

T. HARRY JONES,
City Engineer.

City Engineer's Office,
Brantford, March 13th, 1911.

TENDERS FOR A STEEL BRIDGE.

THE CITY OF KINGSTON.

Tenders will be received by registered post only, by the Municipal Council of the City of Kingston, Ont., up to noon on Wednesday, April 5th, 1911, for the supply and erection in place of a steel truss drawbridge, one concrete pier and timber abutments, all on a grillage foundation. Channel between swing pier and abutment to be 80 feet. The bridge to be floored with three-inch plank floor on steel stringers. Specifications may be seen and all other information obtained at the office of the undersigned.

The lowest or any tender not necessarily accepted.

H. B. R. CRAIG,
City Engineer.

March 14th, 1911.

CITY OF PRINCE ALBERT.

Tenders for Intercepting Sewer.

Sealed tenders addressed to the Commissioners of the City of Prince Albert and marked "Tender for Sewer," will be received until noon on Saturday, the 15th day of April, 1911, for the construction of a main intercepting sewer, as follows:—

5,749	lin.	ft.	4′ 6″ x 3′ 0″	concrete	sewer.
4,640	"	"	4′ 3″ x 2′ 10″	"	"
2,798	"	"	4′ 0″ x 2′ 8″	"	"

19 manholes.

Alternate bids for reinforced concrete pipe will be considered.

Plans and specifications may be obtained at the office of the City Engineer, also at office of Canadian Engineer, Winnipeg, after April 1st.

A marked cheque for $2,500, in favor of the treasurer of the City of Prince Albert must accompany each tender submitted.

Andrew Holmes,
C. O. Davidson,
F. A. Creighton,
Commissioners.

Prince Albert, Sask.,
March 7th, 1911.

WELLAND, ONTARIO.

Sealed tenders will be received until Monday noon, April 3rd, for the construction, delivery and erection in place in Welland, Ontario, of one unit of waterpower driven waterworks pumps, three millions imperial gallons daily capacity, including turbine, pipes, valves, etc.

Specifications, prepared by Mr. Wm. Kennedy, Jr., Engineer, Montreal, may be obtained from the undersigned.

Envelopes to be marked "Tenders for pumps."

R. COOPER,
Chairman Water Commissioners,

Welland, Ont.

(Tenders continued on pages 68, 70, 74.)

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from page 58.)

13086—February 25—Authorizing G.T.P. Branch Lines Co. to cross highway on its Yorkton extension, in south-west ¼ of Section 24, Township 26, Range 4, west 2nd Meridian, District of Yorkton, Province of Saskatchewan.

13087—February 25—13038—February 27—Authorizing Hydro-Electric Commission to cross with its wires wire and tracks of C.P.R. at Concession St., Tillsonburg, Ont., and G.T.R. at Swansea, Township of York, Ont.

13089 to 13094 Inc.—February 27—Authorizing city of Toronto to cross with its wires track of G.T.R. and wires of G.N.W. on Bloor St.; track of G.T.R. at Hanna Ave.; track of C.P.R. and C.P.R. Tel. Co.'s wires on Yonge St.; track of G.T.R. and wires of G.N.W. Tel. Co. on Royce Ave.; track of C.P.R. and C.P.R. Tel. Co.'s wires on Avenue Road; track of G.T.R. and wires of G.N.W. on Queen Street East.

13095—February 27—Authorizing city of St. Catharines to lay a water main under track of G.T.R. on Lot 17, Concession 8, Township of Grantham, Ont.

13096-97—March 2—Authorizing city of Toronto to cross with its wires wires of Bell Telephone Co. on Dufferin St., at Bloor St., and on Davenport Road at Bathurst St.

13098—March 3—Authorizing Hydro-Electric Power Commission to cross with its wires wires and track of C.P.R. at Lot 2, immediately south of the public road between Concession 11 and 12, Township of Dereham, Ont.

13099 to 13103 Inc.—March 3—Authorizing city of Toronto to cross with its wires wires of Bell Telephone Co. on Dufferin St., at Shanley Ave. on Davenport Road at Ossington Ave., on Dufferin Road at Dundas St., on Davenport Road at Perth Ave., on Perth Avenue at Macauley Avenue.

13104—March 3—Authorizing S. W. McMullin, of East Florenceville, N.B., to lay water main under track of C.P.R.

13105—February 27—Approving revised location of C.P.R. Kipp to Aldersyde Branch from mileage 67.06 being a point on the northern boundary of Section 32, Township 18, Range 26, west 4th Meridian, to mileage 84.18 being a point in Section 6, Township 20, Range 28, west 4th Meridian, all in Province of Alberta. Original location approved by Order No. 9278.

Tenders Called For

(Continued from page 66.)

TOWN OF ROULEAU, SASK.

TENDERS.

SEALED TENDERS addressed to W. H. Stewart, Secretary-Treasurer, will be received in the council chamber, up to 12 o'clock, noon, on April 4th, 1911, for the following:

"Contract E." Electrical machinery, pole line, etc.

"Contract F." Pumping machinery, compressed air system.

"Contract G." Producer Gas Plant.

"MAINS."

Cast iron or steel water mains, as follows:—

12,000 feet 6-inch C. I. water main, tested to 300 pounds hydrostatic pressure.

1,000 feet 4-inch C. I. water mains, tested to 300 pounds hydrostatic pressure.

1,400 feet 2-inch C. I. water main, tested to 300 pounds hydrostatic pressure.

Special castings, tees, etc., at per pound.

"VALVES."

Hydrants, valves, etc., as follows:—

22 6-inch hydrants, one steamer nozzle, and two 2¼-inch nozzles; 8 feet O-inch bury.

47 6-inch left-handed gate valves.

47 6-inch valve boxes extending 7 to 9 feet.

An accepted cheque equal to five per cent. of the amount of the tender must accompany each tender and envelopes must be endorsed with the letter of the contract referred to, or "Mains" and "Valves."

The council reserves the right to reject any or all tenders, and to waive any irregularities therein.

Plans and specifications may be seen at the Secretary-Treasurer's office, Rouleau, or at the office of the Engineer, Regina.

Copies of the plans and specifications will be forwarded from Regina, on receipt of an accepted cheque for $10.00, said cheque to be refunded upon return of the said plans and specifications.

J. DARLINGTON WHITMORE,
Consulting Engineer, 104 Willoughby and Duncan Block, Regina, Sask.

J. H. CRAIG, Mayor.
W. H. STEWART, Secretary-Treasurer.

CITY OF SASKATOON.

Tenders Wanted for Electrical Unit.

Sealed tenders addressed to the undersigned City Commissioners, and marked "Tenders for Machinery," will be received until 4 o'clock p.m., Monday, March 27th, 1911, for the following:

A. 750 K.W. 2,200 Volts, 60 Cycle, 120 R.P.M., 2-Phase Generator, Exciter, Switchboard, and Exciter Switchboard, installed complete. Alternative tenders for the above are asked for in three-Phase.

B. 1,250 H.P 120 R.P.M., Vertical Cross Compound Corliss Engine, with necessary condensing apparatus, and feed water heaters, installed complete.

C. Direct connected Exciter Engine to run Exciter for 759 K.W. Generator, installed complete.

D. One Steel Smoke Stack with a height of 100 feet, and inside diameter of 80 inches, together with corresponding connections to Boilers, installed complete.

Specifications will be furnished on application to the City Commissioners, Saskatoon.

A marked cheque for 5 per cent. of tender submitted, must accompany each tender.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL, Mayor. JAS. CLINKSKILL W. B. NEIL City Commissioners.

Saskatoon, February 28th, 1911

NOTICE TO CONTRACTORS.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on TUESDAY, MARCH 28th, 1911, for the supply of STEEL EXTENSIONS FOR MANHOLES ON 6-FT. STEEL PIPE-LINE.

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

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

The tenderers shall submit with their tender the names of two personal sureties (approved of by the City Treasurer), not members of the City Council, or officers of the Corporation of the City of Toronto, or in lieu of said sureties the bond of a Guarantee Company, approved as aforesaid.

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

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, March 7th, 1911.

CITY OF SASKATOON.

INTERCEPTING SEWER.

Sealed tenders addressed to the undersigned city commissioners and marked as to contents, will be received until 12 o'clock noon on Friday, April 14th, 1911, for the following work:—

Contract No. 78—Pipelaying.
" " 79—Furnishing concrete sewer pipe.
" " 80—Furnishing cast-iron sewer pipe and specials.

Plans, specifications, etc., may be seen at the office of the City Engineer, Saskatoon, also at the following places:

The Canadian Engineer—62 Church St., Toronto.
" " " —315 Nanton Bldg., Winnipeg.
" " " —Board of Trade Bldg., Montreal.
Engineering News. —220 Broadway, New York City.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL (Mayor),
W. B. NEIL,
City Commissioners.

Saskatoon, Saskatchewan, Canada,
March 1st, 1911.

THE CITY OF CALGARY.

Tenders will be received by the City Commissioners up to 12 o'clock noon on the 22nd day of March, 1911, for the following machinery and plant:

One 1,500 K.W. Turbo Generator set with condenser, etc.
One 100 K.W. Exciter and Switchboards, complete.
Three 1,000 K.V.A. single-phase Transformers, 12,000 to 2,300 volts, with switching gear, etc.

An accepted cheque for 2 per cent. of the tender must accompany all bids. Cheques will be returned after the contract has been signed.

The successful tenderer will be obliged to enter into a bond with the City for the fulfilment of his contract on a date to be agreed upon by the City and Contractor.

The City reserves the right to accept any or reject the whole of the tenders submitted, or to depart from the specification as may be deemed advisable by the City.

W. D. SPENCE,
Dated at Calgary, Feb. 9th, 1911. City Clerk.

(Tenders continued on pages 70, 74.)

Tenders Called For

(Continued from pages 66 and 68.)

CITY OF MOOSE JAW, SASKATCHEWAN.

SEWER AND WATER EXTENSIONS.

Sealed tenders endorsed "Tender 28," "Tender 29," "Tender 30," and "Tender 31," will be received by the undersigned City Clerk until 8.30 o'clock p.m., on Monday, April 10th, 1911.

Any tender received after the above stated time will be declared informal.

CONTRACT 28—

The laying of approximately 30,700 lineal feet of tile pipe sewer, building manholes, etc.

The laying of approximately 29,700 lineal feet of cast iron water main, placing valves, valve boxes, hydrants, etc.

CONTRACT 29—

The supplying of approximately:

29,600 lineal feet of 6-in. C.I. Water Pipe.
112 " " of 4-in. " " "
132 6-in. cast iron reverse curves.
34 6-in. cast iron crosses.
72 6-in. cast iron tees.
29 4-in. off 6-in. cast iron tees.
28 4-in. cast iron tees.
95 6-in. cast iron plugs.

CONTRACT 30—

The supply of approximately:

28,000 lineal feet of 6-in. Vitrified Tile Sewer Pipe.
26,600 " " of 8-in. " " "
5,225 " " of 10-in. " " "
1,100 " " of 12-in. " " "
25 8-in. Tees.
75 6-in. Tees.
25 8-in. ¼ Bends.
100 6-in. ⅛ Bends.
25 8-in. Stops.
25 10-in. Stops.
400 4-in. to 6-in. Increasers.

CONTRACT 31—

The supply of approximately:

65 6-in. 3-way Hydrants.
147 6-in. Gate Valves.
29 4-in. Gate Valves.
150 6-in. Valve Boxes.
29 4-in. Valve Boxes.
88 Manholes, Frames and Covers.

Plans and specifications for Contract 28 may be seen at the office of the City Engineer, Moose Jaw, Sask., and at the offices of the Canadian Engineer at Toronto and Winnipeg.

Plans and specifications for Contracts 29, 30, and 31 will be sent upon request.

The lowest or any tender not necessarily accepted.

J. M. WILSON, City Engineer.
W. F. HEAL, City Clerk.

Moose Jaw, 24th February, 1911.

CITY OF GUELPH.

PAVEMENT CONSTRUCTION.

Sealed tenders addressed to the city clerk will be received up till noon on Thursday, March 30th, 1911, for the construction of approximately 26,000 square yards of pavement, with about 5,000 lineal feet of street railway track and approximately 13,000 lineal feet of combined curb and gutter.

Particulars may be obtained from the City Engineer.

A marked cheque for $1,000.00 must accompany each tender.

The lowest or any tender not necessarily accepted.

J. HUTCHEON, City Engineer.
T. J. MOORE, City Clerk.

Guelph, March 7th, 1911.

CITY OF SASKATOON.

Tender for Material for Connections—Contract No. 85.

Sealed tenders addressed to the undersigned City Commissioners and marked as to contents, will be received until 12 o'clock noon, on Friday, March 24th, 1911, for the following material:—

(a) Tile Pipe and Specials.
(b) Galvanized Iron Pipe.
(c) Lead Pipe.
(d) Brass Fittings.
(e) Service Boxes.
(f) Water Meters.
(g) Tapping Machines.

All information may be obtained on application to the City Engineer.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL (Mayor)
W. B. NEIL
City Commissioners.

Saskatoon, Sask., March 1st, 1911.

CITY OF SASKATOON.

WATER FILTRATION.

Sealed tenders addressed to the undersigned and marked "Water Filtration," will be received until 12 o'clock noon on Friday, March 31st, 1911, for the installation of a Mechanical Water Filtration Plant for the city of Saskatoon.

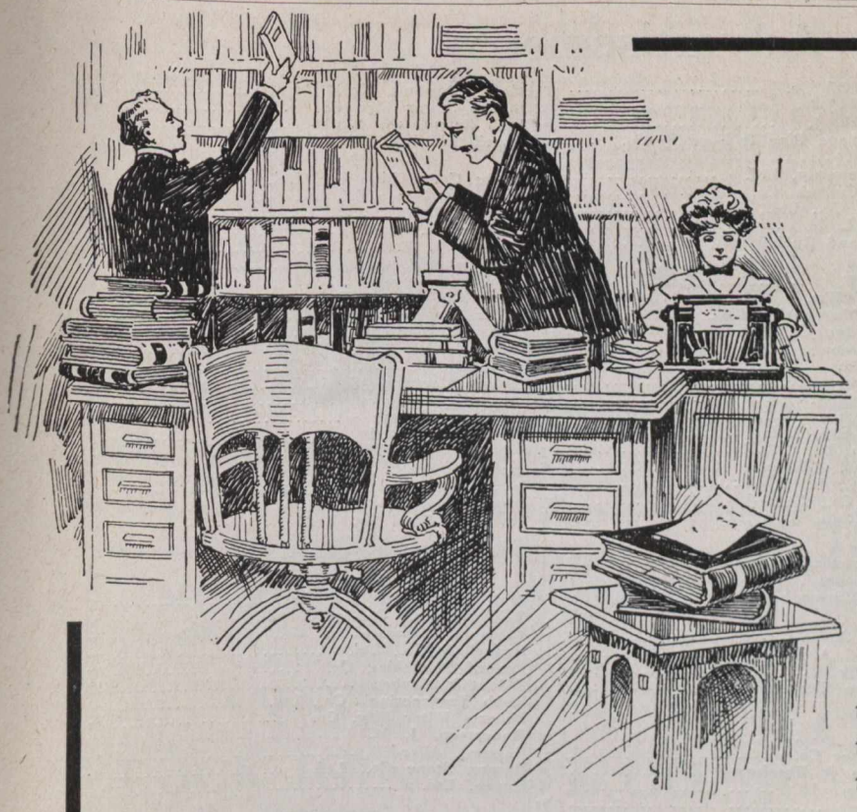
All information may be obtained on application to the City Engineer.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL (Mayor),
W. B. NEIL,
City Commissioners.

Saskatoon, Saskatchewan,
February 28th, 1911.

(Tenders continued on page 74.)



It is perhaps not generally known

that we have an Information Department consisting of trained and practical men, whose time is employed solely in answering enquiries from people interested in cement.

Now it will be readily understood

that out of the mass of enquiries that come to us, there are a number that include questions as to what might be termed Allied Industries. These we now answer to the best of our ability, but we could answer them still more satisfactorily, if manufacturers of materials used in conjunction with cement would co-operate to the extent of sending copies of their catalogues and other literature, to be placed on file in our office for reference.

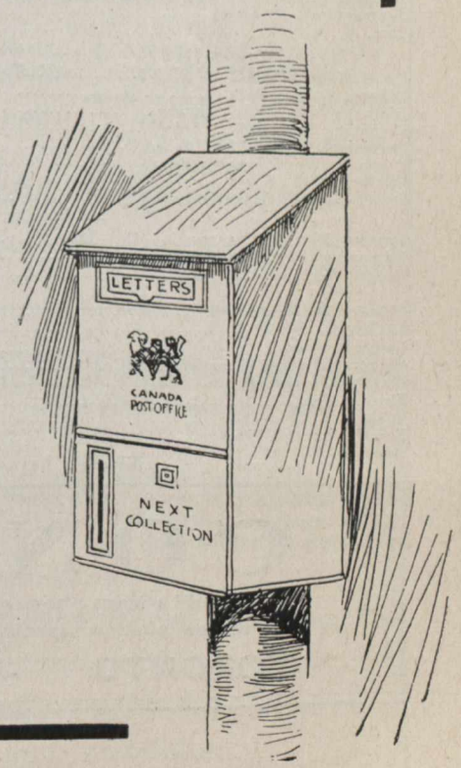
We should like to obtain

the names and addresses, together with catalogues, and any other obtainable information of manufacturers of and dealers in:—

1. Concrete Machinery
2. Building Blocks
3. Cement Bricks
4. Tile Molds
5. Fence Posts
6. Reinforcing Material
7. Waterproofing Compounds

It is not alone for our own convenience that we make this suggestion: Firms who manufacture or deal in such articles, will find it to their own advantage to have this information in the hands of our Information Department, thereby enabling us to hand on to them, from time to time, enquiries for such materials as they severally make.

In sending catalogues, literature or information, please address same to "Sales Department."



The

Canada Cement Co., Limited

Banque National Bldg. - MONTREAL

Index to Advertisements

Tenders Called For

(Continued from pages 66, 68 and 70.)

CITY OF MOOSE JAW, SASKATCHEWAN.

Main Drainage Works.

Sealed tenders endorsed "Tender A" and "Tender B," will be received by the undersigned City Clerk until 8.30 o'clock p.m. on Monday, April 10th, 1911. Any tender received after the above stated time be declared informal.

Contract "A."

Supplying materials for and constructing a Sewage Disposal Plant complete, including a Pump House, Sedimentation Tanks and Percolating Filters, also the supplying of materials for and the laying of a Trunk Sewer and Water Main.

Contract "B."

Supplying two Electrically-driven Centrifugal Pumps and Auto Starters complete with all piping, connections, etc.

Plans and specifications for contract "A" may be obtained from the City Engineer, Moose Jaw, upon receipt of a marked cheque for the sum of $25, to be held until return of plans and specifications; and for contract "B" plans and specifications will be sent upon request.

The lowest or any tender not necessarily accepted.

J. M. WILSON, City Engineer.
W. F. HEAL, City Clerk.

Moose Jaw, February 18th, 1911.

QUEEN VICTORIA NIAGARA FALLS PARK.

Boulevard Bridges.
Boulevard Roadway.

Sealed Proposals endorsed "Proposal for Boulevard Construction," will be received until Tuesday, March 28th, 1911 at noon, for the construction of (a) 5 Steel Concrete Bridges and (b) a Macadam Roadway, with the necessary drainage being Section 4B, 5,182 feet, commencing at Miller's Creek, and extending to the southerly limit of the Shipyard, according to plans and specifications for the several works on file at the Administration Building, Queen Victoria Park, Niagara Falls, Ontario.

JOHN H. JACKSON,
Superintendent.

Niagara Falls, Ontario, March 2nd, 1911.

CIVIC CAR LINES.

TENDERS FOR RAILS AND TIES.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, April 4th, 1911, for delivery of thirteen hundred and forty (1,340) tons of open hearth steel rail, 80-lb. section, also thirty thousand (30,000) untreated wood ties, white cedar preferred, although other woods will be considered.

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

Specifications and forms of tender may be obtained upon application to the office of the City Engineer, Toronto.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, February 28th, 1911.

TENDERS FOR A STEEL BRIDGE.

THE RURAL MUNICIPALITY OF SWAN RIVER, in Manitoba, invite tenders for one ninety-four (94) foot centre to centre of end bearings Steel-riveted Pratt Truss Bridge and two Concrete Piers with (Steel) Stringers, and three (3) inch Tamarac Plank Floor. To be erected over the Woody River, east side of Section 36, Township 37, Range 27, west of the Principal Meridian in Manitoba, in accordance with Specifications, which can be obtained from the Provincial Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

The bridge site is within one mile of Bowsman Station on the Canadian Northern Railway.

Sealed Tenders to be delivered to the undersigned on or before the 15th day of April, A.D., 1911.

JOSEPH ARMSTRONG,
Secretary-Treasurer, Municipal Council,
Swan River, Manitoba.

TENDERS FOR A STEEL BRIDGE.

The Municipal Council of THE RURAL MUNICIPALITY OF MINNITONAS invite TENDERS for the supply and erection of a Steel Warren Truss Bridge, and Two Concrete Piers. Bridge to be 60 feet centre to centre, of end bearings with Steel Stringers and Three-inch Plank Floor in accordance with Plan (No. F 10), and specifications on file at this Office, and also at the Office of the Chief Engineer, Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

Tenders under Seal to be delivered to the undersigned on or before the 15th Day of April, A.D. 1911.

The lowest or any Tender not necessarily accepted.

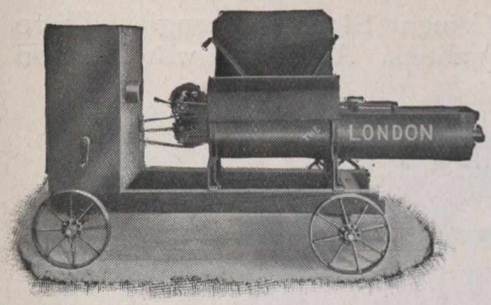
E. WIDMEYER,
Secretary-Treasurer, Municipal Council,
Minnitonas, P.O., Manitoba.

TOWN OF NEW LISKEARD.

Tenders will be received up to 1 o'clock p.m., of March 20th, 1911, for pumps and motors in duplicate, with connections, for sewage outfall works of the Town of New Liskeard. Plans and specifications may be obtained on application from C. H. Fullerton, Town Engineer.

GEO. TAYLOR, Mayor. PERCY CRAVEN, Clerk.

LONDON



London Automatic Batch Mixer No. 1.

CONCRETE MIXERS are made in all styles and sizes, meeting every requirement. **CONTRACTOR,** WE DO NOT DICTATE TO YOU AS TO WHAT STYLE OF MACHINE YOU SHOULD PURCHASE, we have EVERY STYLE AND SIZE of mixer required.

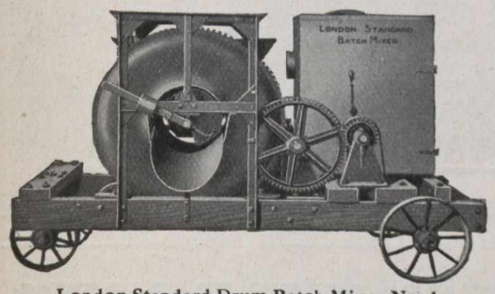
THE LONDON AUTOMATIC BATCH MIXER No. 1, with 2½ H.P. Gasoline Engine has a capacity of 50 yards per day, weighs only 1,600 lbs., is easily moved from place to place, can be set to give any desired capacity up to 50 yards, will measure any materials automatically, will give any consistency of moisture. This machine has the largest sale of any mixer manufactured or sold in Canada.

THE LONDON AUTOMATIC BATCH MIXER No. 2 has a capacity of 75 yards per day with two hoppers and 150 yards per day with three hoppers Price, with three hoppers, **$405.** This machine AUTOMATICALLY MEASURES and PROPORTIONS any three materials and has the same features as the London No. 1.

These machines will be shipped anywhere on approval. WHY PAY A LARGE PRICE FOR CONCRETE MIXER WHEN YOU CAN PURCHASE AN AUTOMATIC MACHINE AT A MODERATE PRICE?

The London Automatic Machines will save you money—
- In the First Cost of Mixer.
- Cost of Maintenance.
- Cost of Producing Concrete.

London Automatic Batch Mixer No. 2



London Standard Drum Batch Mixer No. 1, equipped with Gasoline Engine.

London Standard Batch Mixers

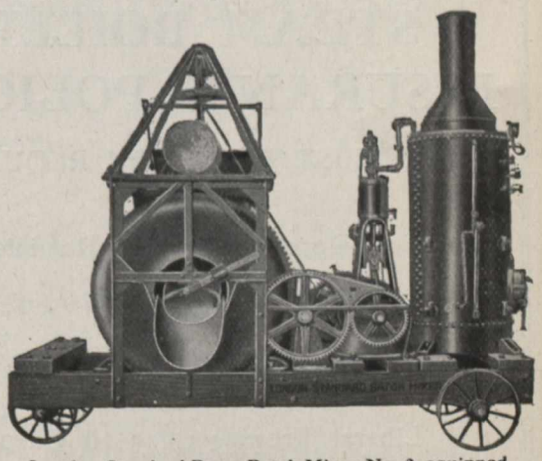
THE LONDON STANDARD DRUM BATCH MIXERS are made in four sizes, namely, one-third yard, one-half yard and one yard batches and are furnished with any equipment.

THE MANY NEW AND IMPROVED FEATURES of the London Standard Drum Batch Mixers appeal to every contractor desiring a mixer of this type. WE CAN GIVE YOU THE BEST VALUE FOR YOUR MONEY of any Firm doing business, BECAUSE we manufacture only Concrete Machinery, and on this account we can sell you a machine at very much less cost than Firms who do not manufacture their own machines but handle a concrete mixer along with other lines of goods.

We also Manufacture—

CARTS FOR CONVEYING CONCRETE BLOCKS AND TILES
WHEELBARROWS; CONCRETE CARTS
FACE-DOWN BLOCK MACHINES; FRICTION HOISTS
CEMENT BRICK MACHINES; POWER HOISTS
POWER CEMENT DRAIN TILE MACHINES
HAND CEMENT DRAIN TILE MACHINES
ADJUSTABLE SILL, STEP AND WINDOW CAP MOLDS
SEWER PIPE MOLDS; FENCE POST MOLDS
ORNAMENTAL MOLDS; SILO CURBS
CONCRETE CHIMNEY CURBS;
ROCK CRUSHERS
And a full line of CEMENT WORKING TOOLS

We are the largest manufacturers of Concrete Machinery in Canada, and can meet every requirement of the Contractor in the line of Concrete Machinery at the lowest possible cost. Tell us your requirements.



London Standard Drum Batch Mixer No. 2, equipped with Steam Engine and Loading Skip.

LONDON CONCRETE MACHINERY COMPANY

LIMITED

19 MARMORA ST. - LONDON, CANADA

BRANCHES.

A. C. BROWN & CO., 1048 Westminster Avenue, Vancouver, B.C.
W. H. ROSEVEAR, 52½ Princess Street, Winnipeg, Man.
HAMILTON MACHINERY COMPANY, 609 8th Avenue W., Calgary, Alta.
T. A. MORRISON & CO., 204 St. James Street, Montreal.
GEO. B. OLAND & CO., 28 Bedford Row, Halifax, N.S.
LONDON U.K. CONCRETE MACHINERY CO., 1 and 2 Birkbeck Bank Chambers, London, England

CATALOGUE INDEX

Some of the most valuable information on engineering and contracting subjects is to be found in the trade literature of the large supply houses.

The Canadian Engineer maintains a card index upon which is kept an up-to-date list of manufacturers of contractors supplies and engineering equipment. If you want the catalogues of any of these firms all you need do is to send us a postal giving your address and the list numbers (as printed below) of the catalogues you wish sent. This will save you time and labor and insure prompt service. This department can put you in direct communication with the principal manufacturers of and dealers in engineering equipment of all kinds.

1 Air compressors.
2 Air lift pumping machinery.
3 Alloys.
4 Aluminum.
5 Angles (see structural steel).
6 Architects' supplies.
7 Asbestos and Asbestos Products.
8 Asphalt.
9 Asphalt plants and tools.

10 Bars (steel)
11 Bearing Metals.
12 Bearings, ball and roller.
13 Belt dressing.
14 Belt tighteners.
15 Belting, chain, link, canvas, etc.
16 Benders (rail).
17 Blacksmiths' tools.
18 Blast furnaces and fittings.
19 Blasting powder.
20 Blocks and tackle.
21 Blowers.
22 Boiler fittings, mountings and tubes.
23 Boiler tubes.
24 Boilers (tubular).
25 Boilers (water-tube).
26 Bolts.
27 Bolts (machine).
27A Bonding for Concrete.
28 Bonds (Contractors').
29 Books (engineering and technical).
30 Boots.
31 Brackets and cross-arms
32 Brick and tile.
33 Brick (paving).
34 Bridge builders.
35 Bridge engineers.
36 Bridges (concrete).
37 Buckets.
38 Buckets (clam shell).
39 Buckets (concrete).
40 Buckets (dredging and excavating).

41 Cables (manila).
42 Cableways.
43 Caisson Foundations.
44 Car replacers.
45 Carbolineum.
46 Cars (ballast).
47 Cars (concrete).
48 Cars (dumping).
49 Cars (industrial).
50 Cars (inspection).
51 Carts and wagons (ash and dump).
52 Carts (concrete).
53 Castings (malleable iron).
54 Castings (steel).
55 Cement.
56 Cement block and brick machines.
57 Cement-making machinery.
58 Cement testing machines.
59 Cement waterproofing.
60 Centers.
61 Chemists.
62 Chimneys (concrete).
63 Chimneys (steel).
64 Clutches (friction).
65 Coal and ore-handling machinery.
66 Cofferdams.
67 Compressed-air tools.
68 Concrete block machines
69 Concrete reinforcement.
70 Conduits (steel)
71 Conduits (vitrified clay).
72 Contractors' (general).
73 Conveying machinery.
74 Conveyers (belt).
75 Conveyers (cable).
76 Cordage.
77 Cranes and hoists.
78 Cranes (derrick).
79 Cranes (electric).
80 Cranes (hand-power).
81 Cranes (locomotive).
82 Cranes (travelling).
83 Crusher castings (rock).
84 Crushing rolls.
85 Culverts.
86 Curb (steel).

87 Dams (concrete).
88 Derails.
89 Derricks (pile driving).
90 Derricks (steam).
91 Drafting Instruments and supplies (see engineers' and surveyors' instruments and supplies).
92 Dredging machinery.
93 Drills (pneumatic).
94 Drills (rock).
95 Drums (hoisting).
96 Dryers (cement, asphalt and sand).
97 Dynamite.

98 Elevators (bucket).
99 Engineers and contractors.
100 Engineers' and surveyors' instruments and supplies.
101 Engines (compressed air).
102 Engines (gas, gasoline, oil).
103 Engines (high duty—pumping).
104 Engines (hoisting).
105 Engines (oil).
106 Engines (steam).
107 Engines (traction).
108 Excavating machinery.
109 Explosives.
110 Fans.
111 Fence, railing and posts
112 Filters (feed water).
113 Filters (water).
114 Fire brick and fire clay.
115 Forgings (steel).
116 Foundations.
117 Foundry equipment and supplies.
118 Frogs and switches (ry.).

119 Garbage crematories.
120 Gas producers.
121 Gates and valves.
122 Gauges (steam), (see steam specialties).
123 Generators (electric).
124 Governors (water-wheel).
125 Grain elevators and storage tanks.
126 Grinding & Mixing Machinery.

127 Hand cars.
128 Heating and ventilating machinery.
129 Hoists (chain and rope).
130 Hoists (pneumatic).
131 Hoists (steam).
132 Hydrants.

133 Ice and refrigerating machinery.
134 Incline cableway engines.
135 Inspection of materials.
136 Irrigation supplies.

137 Jacks (screw and lever)
138 Jacks (hydraulic).
139 Jacks (pneumatic).
140 Jacks (track).

141 Kilns (cement).

142 Lamp posts.
143 Levels.
143A Lights (Contractors' & Municipal).
144 Locomotives (industrial and light).
145 Locomotives (steam)
146 Locomotives (traction).

147 Manganese steel.
148 Manhole covers.
149 Meters (water, oil and gas).
150 Mixers (asphalt).

151 Oakum.

152 Paints and metal coatings.
153 Paving joint filler.
154 Penstocks.
155 Pile driving machinery.
156 Pile protection.
157 Piling (interlocking steel).
158 Pipe (galvanized iron).
159 Pipe (reinforced concrete).
160 Pipe (riveted steel).
161 Pipe (wood).
162 Portland cement.
163 Pulverizers.
164 Pumps (pneumatic).
165 Pumps (centrifugal).
166 Pumps (diaphragm).
167 Pumps (waterworks).

168 Rail joints, fastenings and specialties.
169 Railroad track supplies.
170 Rails and track.
171 Rails, second-hand.
172 Railways, industrial and narrow-gauge.
173 Reinforcement steel for concrete structures.
174 Riveting hammers.
175 Riveting machines.
176 Road machinery.
177 Road oils.
178 Road rollers.
179 Roofing.
180 Rope (wire).
181 Rubber boots.

182 Sand-blast machines.
183 Scarifiers.
184 Schools and colleges.
185 Scrapers, road.
186 Second-hand machinery and supplies.
187 Sewage disposal.
188 Sewer braces.
189 Sewer buckets.
190 Sewer flushers (automatic).
191 Sewer pipe.
192 Shovels (steam).
193 Shovels and picks (hand).
194 Sluice gates.
195 Steam specialties.
196 Steel substructures for tanks.
197 Street-cleaning implements, machinery and snow plows.
198 Street sprinklers.
199 Structural materials
200 Structural steel.

201 Testing laboratories (chemists, etc.).
202 Ties (steel and wood).
203 Tile.
204 Track tools.
205 Traction ditching machines.
206 Transits.
207 Trench excavating machi
208 Turbine pumps.
209 Turntables (overhead).

210 Valves (sluice).

211 Wagons (contractor
212 Wagons (garbage).
213 Wagons (oil).
214 Well-drilling machin
215 Wheelbarrows.
216 Winches.

CONTRACTORS

Should always phone the nearest office of The Canadian Engineer before going out of town to see plans or specifications of work. The plans, etc., may be on file at our offices.

TORONTO - WINNIPEG - MONTREAL