THIS ISSUE CONTAINS { Page of Costs / Vancouver's Water Supply

Canadian Engineer

A WEEKLY JOURNAL
For CIVIL, MECHANICAL, ELECTRICAL and STRUCTURAL ENGINEERS and CONTRACTORS

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WINNIPEG OFFICE, Room 315, Nanton Building

Vol. 16. Toronto, Canada, January 15th, 1909. No. 3.

BUYER'S REFERENCE—PAGE 2.

WHERE TO BUY

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For the Assistance of Engineers, Contractors and Purchasing Agents

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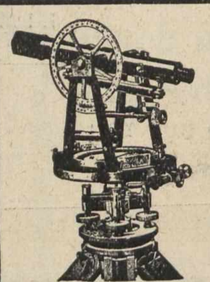

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Electric Smelting is a subject of increasing importance to Canadian Engineers and this work contains a clear and connected account of the principle on which electric furnaces are constructed, the uses to which they can be put and the more important details of their construction. The articles upon which the book is based appeared in the Canadian Engineer during 1906.

THE ELECTRIC FURNACE

ITS EVOLUTION
THEORY AND PRACTICE
BY ALFRED STANSFIELD, D. Sc., A. R. S. M.
Professor of Metallurgy, McGill University

208 PAGES. Fully Illustrated. PRICE $2.00

The evolution of the Electric Furnace from its simplest beginning is as briefly set forth as is consistent with clearness, together with the important facts relating to its theory and practice. The rapid growth of the Electric Furnace makes it increasingly difficult for the metallurgist to keep in touch with its recent developments. A few years ago it was a scientific curiosity, but now threatens to rival the Bessemer converter, the open-hearth steel furnace, and even the blast furnace itself.

The Book Department, Canadian Engineer
62 Church Street TORONTO

WORLD'S LARGEST DREDGER.

Description of the Leviathan, Building For the Mersey.

The giant dredger of the Mersey Docks and Harbor Board is now nearing completion at the Tranmere Bay Development Company. The dredger ship was begun a little over twelve months ago and launched in October. Her construction embodies the greatest improvement in maritime engineering. Great progress has been made in the installation of the propelling machinery, hydraulic machinery and pumps, and it is hoped that her trials will take place early in the new year.

Designed by the engineer-in-chief to the Mersey Docks and Harbor Board (Mr. A. G. Lyster), the Leviathan is to be placed at the Mersey Bar for the further improvement necessary to main-

(Continued on page 48.)

The Canadian Engineer

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

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NOTICE TO ADVERTISERS

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TORONTO, CANADA, JANUARY 15, 1909.

CONTENTS OF THIS ISSUE.

We will give a month's extension of subscription for a copy of the Canadian Engineer of January 8th, 1909. If you do not file yours, we should be glad to have it.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The annual meeting of the Society will be held in Toronto, January 28th, 29th and 30th, 1909.

Mr. Wm. Kennedy, Jr., Montreal, Que., says: "As Toronto is a large engineering and commercial centre—the second in the Dominion—and furnishes a large number of members to the Canadian Society of Civil Engineers, it is fully entitled to the holding of the annual meeting of the Society, and should be well attended by the members of the Society. I am sure the resident members will give the visitors a royal welcome to the "Queen City."

STREAM POLLUTION.

A question of ever-increasing difficulty for our sanitary engineers and boards of health is the prevention of stream pollution. In the earlier days of sewage disposal works in America the waste material was turned into the most convenient stream or lake. Quickly this method of disposal became a public nuisance and contaminated the water supply. One of the most complete investigations that has been made into this subject is reported in a report on the River Pollution in the State of Rhode Island, U.S.A., the results of an examination of the conditions causing the pollution of the Moshassuck, Woonasquatucket, and Providence Rivers, published by the Rhode Island State Board of Health. This report, published in the form of a brochure, will be found of great value, not only to those locally interested in the above-named rivers, but generally to engineers and others who may have to deal with the purification or clarification of objectionable trade wastes. The report is compiled by and is the result of extensive investigations under the direction of Mr. Herman Stabler, assistant engineer, U.S.A. Geological Survey. Much of the value of the work is also due to Mr. Gilbert H. Pratt, chemist of the Rhode Island State Board of Health, under whose direction fell a very large portion of the chemical examinations.

Providence River, the name applied to the head of Narragansett Bay, is formed near the centre of the city of Providence by the junction of the Moshassuck and Woonasquatucket Rivers, and flows under bridges and through open channel for several hundred yards before it widens out to form the city harbor. For many years the Providence River has been a foul-smelling stream, and its serious pollution a menace to public health. It is, in fact, a striking example of the result of want of forethought, and of the serious difficulty and great expense of rectifying the negligence of the past.

Time was when the citizen might inhale the salt sea odor, calling to his senses not far distant marshes of sea green weeds, oysters, clams, and fishing grounds. Gradually the tide of civilization, with its varied industries, utilized the streams which join to make the Providence River—some for power purposes, and others for bleaching and cleansing cloths and yarns, others for the dumping or disposal of their refuse, not only human excreta, but also waste material.

The city of Providence fell into the common error of utilizing its own river for the disposal of its sewage wastes by entering the numerous sewers into the stream. But not only is the city of Providence to blame in the matter; the tributaries before they enter the river bring down pollution from higher sources beyond the city's jurisdiction. Therefore, although the city of Providence has gradually awakened to the pollution of its own nest, the matter is of much broader character than merely local, and the State has taken the question up in a most thorough and exemplary manner.

With the purpose of determining the amount of pollution actually present, and, if possible, ascertaining the character and sources of the pollution, the State Board of Health availed itself of the advantages offered by the U.S.A. Geological Survey. By contract the two departments divided the expense. That the money so invested was successfully applied is shown by Mr. Stabler's report, which presents such complete data of value, which ought to act as a stimulant to both the manufacturers located on the streams as well as to the citizens of Providence, who may have wondered where the fault lay that their once fair stream of thirty years ago had become a filthy, opaque, foul-smelling open sewer. The assistance given by the manufacturers to the investigation shows a willingness of co-operation which is highly commendable.

The examination commenced in August, 1906, and the report was issued at the end of 1908. Comments upon plans for reducing the pollution of the streams are included, but detailed studies of manufacturing wastes and methods of purifying the same are reserved for a later report. Judging from the complete character of the present report, the succeeding one will be anxiously looked forward to.

Apart from its local value, the report certainly will appeal to engineers and others as a sample of how such investigations should be carried out.

The plan of investigation adopted was to divide the river and its tributaries into sections, at which sampling and survey stations were installed. In all, there were forty-two such stations. The highest up-river station, representing a length of river receiving the first source of pollution, and each section in turn representing the addition of some further source of pollution. Numerous samples of both the river's water and the polluting effluents were taken at each station, and a careful examination made of any action taken to purify or partly purify such effluents before they entered the river.

The result is a progressive diagnosis of the increase and cause of pollution of the river and its tributaries from source to seaboard. Every item of pollution is scrutinized and laid bare, so that the intelligent mind can readily separate the pure, virgin river water from its foreign and obnoxious contents.

The value of such a report lies in its thoroughness and practical utility. Not only are the sources of pollution enumerated, but their quality and quantity made manifest, and the work of thorough purification made easy. The Board of Health can now commence practical work of treatment with the full knowledge that such will be attended with absolute success.

Provincial Boards of Health in Canada would do well to take into consideration the advisability of adopting measures of so complete and minute a character. Systematic surveys and reports upon the sources of pollution of many of our own rivers would prove of the greatest value in stimulating a general interest in the preservation of pure streams and lakes. Haphazard dealing with certain towns and cities occasionally here or there is only a method of playing with a great subject, and is not based on either economic or scientific lines.

The Sate of Rhode Island are to be complimented not only on their endeavors with regard to their own interests, but to the example which, it is to be hoped, other States will follow.

Mr. Herman Stabler is also to be complimented as the author of a plain, matter of fact, scientific and most admirably arranged investigation and clear, useful report.

EDITORIAL NOTES.

Originally we intended to print the Index for 1908 separate, and send it only to those writing to the office, but the demand has been so large that we are sending one to every subscriber. The index this year is more complete than usual, as all articles are cross-indexed.

* * * *

During 1908 building operations in Victoria, B.C., have been very active, the total amount expended being above a million and a quarter, and not two hundred thousand below 1907, which was the record year.

* * * *

Lumbering operations in New Brunswick are improving, the rise in price of lumber in the United States encouraging a larger cut.

* * * *

Costs, cost systems and shop management covers a field which the graduate in mechanical engineering or the young man coming up through the shops find it hard to quickly master. To assist in meeting the difficulties encountered in this work Oscar E. Perrigo, of the Modern Systems Correspondence School, Boston, Mass., has outlined a course of instruction. Himself a practical shop man, a successful designer of machinery, and for a number of years in charge of shops, he and his corps of instructors are prepared to give practical assistance in the matter of costs and shop systems.

COMING MEETINGS OF ENGINEERING SOCIETIES.

American Society of Civil Engineers.—January 20th, 1909, Annual Meeting, New York, N.Y. Secretary, Chas. W. Hunt, 220 West 57th Street.

American Society of Heating and Ventilating Engineers.—January 19-21, 1909, Fifteenth Annual Meeting, Engineering Societies Building, 29 West 39th Street, New York, N.Y. Secretray, W. M. MacKay, P.O. Box 1818, New York.

Canadian Cement and Concrete Association.—First Annual Convention and Exhibition, March 1-6, 1909, St. Lawrence Arena, Toronto. Secretary, A. E. Uren, 62 Church Street, Toronto. Manager of Exhibition, R. M. Jaffray, 1 Wellington Street West, Toronto.

Canadian Society of Civil Engineers.—Annual Meeting, January 28th, 29th and 30th, 1909, at Toronto. Secretary, Prof. C. H. McLeod, 413 Dorchester Street West, Montreal.

Engineers' Club, of Toronto.—January 21st, 1909, at 8 p.m., illustrated lecture, "The Manchester Ship Canal," by R. Dawson Harling. Secretary, R. B. Wolsey, 96 King Street West, Toronto.

Illinois Society of Engineers and Surveyors.—January 27-29, 1909, Annual Meeting at Chicago. Secretary, E. E. R. Tratman, 1636 Monadnock Block, Chicago.

National Brick Manufacturers' Association.—February 1-6, 1909, 23rd Annual Convention, Rochester, N.Y. Secretary, Theo. A. Randall, Indianapolis, Ind.

Providence Association of Mechanical Engineers.—June 22, 1909, Annual Meeting. Secretary, T. M. Phetteplace.

Western Society of Engineers.—January 20th, 1909, Extra Meeting. "Steel Castings," by R. P. Lamont, M.W.S.E. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

NICKEL STEEL FOR BRIDGES.

R. E. Chadwick. *

Probably few articles have appeared within the last year that are of more importance to the structural engineer than that entitled "Nickel Steel for Bridges" lately presented before the American Society of Civil Engineers by Mr. J. A. L. Waddell, Mem. Am. Soc. C. E. Prepared by an acknowledged authority on bridge engineering, this paper should command the serious attention of the whole engineering profession, and since Canada is the foremost nickel producing country in the world, it is of special interest to the Canadian to learn of the possibilities of extending the field of usefulness of that metal.

On reading Mr. Waddell's paper, one cannot but be impressed with the care that has been taken in its preparation and the thorough manner in which the subject has been studied. Experiments to demonstrate the suitability of nickel steel for bridge construction were started in the latter part of 1903 and extended over a period of three years. The objects of these experiments were as follows:

1st. The determination of the percentages of carbon and nickel required to produce a steel having the highest possible elastic limit and ultimate strength consistent with easy manipulation and perfect safety.

2nd. The making of a series of comparative tests of nickel steel and medium carbon steel.

3rd. The preparation of a complete set of specifications for the design of bridges in nickel steel.

4th. The preparation of diagrams giving weight of metal and cost per linear foot for all ordinary types of railway bridges for the purpose of comparing nickel steel with carbon steel from an economic standpoint.

At the outset Mr. Waddell started preliminary work in order to determine the proper limits of nickel and manganese, which would give a satisfactory steel. The limiting factor here was not strength but hardness, since with high nickel and manganese, a steel could be produced having an extremely high ultimate strength but totally unfit for bridge construction owing to the difficulty of working it in the shops. The limit for plate and shape steel was eventually taken as 3½ per cent. for nickel and 0.7 per cent for manganese, which gave a workable steel of high ultimate strength and elastic limit at a comparatively low cost.

Accordingly two special melts of basic open hearth nicnel steel were made for comparison with ordinary medium steel and the results of tests on these melts fully demonstrated the suitability o fnickel steel for bridge construction. The ultimate tensile strength on plain specimens averaged 99,300 pounds per square inch as compared with about 60,000 pounds for carbon steel, while the elastic limit showed even greater increase, being 61,300 pounds as against 32,500 pounds for carbon steel. In comparison tests on short struts nickel steel was 75 per cent. stronger than carbon steel and for struts of medium length 47 per cent stronger. Nickel steel for plates bearing on pins was 66 per cent. stronger and bearing on rivets 83 per cent stronger, and pins of nickel steel tested for bending gave at excess of strength of 85 per cent over similar pins of carbon steel.

One would think that steel possessing these qualities of strength would not stand the abuse to which bridge steel is subjected in the shops, but on the contrary, while it is true that nickel steel is infrior to carbon steel in this respect, the tests show that it is perfectly safe for bridge construction. Plain bars of nickel steel will bend cold 180°, about a circle of diameter equal to twice the thickness of the piece tested, and in many cases can be bent to satisfy the usual test for carbon steel, 180° to diameter equal to the thickness of the piece tested. When drifted to destruction nickel steel will stand only about 70 per cent as much abuse as carbon steel but even this is enough to pass most specifications for bridge steel. Nickel steel will punch cleaner than carbon steel and holes can be spaced quite as close, but tensile tests show that the injury due to punching is more pronounced in the nickle steel. Reaming, however, removes all the bad effects of punching.

* Of Oxley and Chadwick, Consulting Engineers, Toronto, Ont.

The difficulty of working nickel steel in the shops may possibly prove to be a serious objection to its rapid introduction for all classes of bridge work. Certainly a better quality of tool steel would have to be used for punches, drills, reamers, and planer tools. Ordinary steels fail so quickly in nickel steel that it would be necessary to use the finer grades of alloy steels exclusively. Even with these steels, however, the tools lose their edges in a very short time.

When so much is written on the corrosion of steel this series of tests would not be complete without a comparison of the resistances of nickel steel and carbon steel to the corroding influence to which bridge metal is subjected. Accordingly the two steels were placed side by side in a weak solution of sulphuric acid, in damp salt, in locomotive fumes, and in wet cinders, and the loss of weight during a given time was ascertained. Strange to say the carbon steel was about 75 per cent. better than nickel steel in the acid test, while in all the other three tests the conditions were reversed, nickel steel being much superior to carbon steel. This was especially true in the case of the salt test where the loss of weight in the carbon steel was about four times as much as in the nickel steel.

Based on the results of this very complete series of tests Mr. Waddell prepared a complete set of specifications for nickel steel bridges to have the same strength and rigidity as the best carbon steel bridges of the present day. These specifications are a modified form of those given in "De Pontibus" * for carbon steel bridges, all clauses which would be affected by the change of metal being re-written to suit nickel steel. Below we give in a condnsed form the provisions which especially apply to the new metal.

Specifications for Nickel Steel Bridges.

Metal. All rolled steel shall be made by the basic open-hearth process.

In bridges composed entirely of nickel steel, the eye-bars, pins, and rollers shall be made of "eye-bar steel;" the rivets, bolts, and all adjustable members shall be made of "rivet steel;" and all other portions, except castings, shall be made of "plate and shape-steel."

In bridges of mixed nickel and carbon steels, the floor system, the lateral system, and those parts of trusses of minor importance, such as struts having a large excess of section.

* "De Pontibus," A pocket-book for Bridge Engineers. By J. A. L. Waddell. New York: John Wiley & Sons..

Ingredients.	Percentages. Rivet steel.	Plate and shape steel.	Eye-bar steel.
Nickel	3.24 to 3.75	3.25 to 3.75	4.00 to 4.50
Carbon	0.12 to 0.18	0.34 to 0.42	0.40 to 0.50
Phosphorus	0.03 max.	0.03 max.	0.03 max.
Sulphur	0.04 "	0.04 "	0.04 "
Silicon	0.04 "	0.04 "	0.04 "
Manganese. ...	0.55 to 0.65	0.65 to 0.75	0.75 to 0.85

As the manufacturer will have to keep the elastic limit and the ultimate strength up to a certain minima, he will be allowed some liberty in the amounts of carbon to use in order to produce the required results, but he is not to attempt to obtain suc hresults by increasing the manganese, nor will be, under any circumstances, be permitted to pass the limits of phosphorus, sulphur, or silicon.

Tensile Strength.—The ultimate tensile strength per square inch on unannealed test pieces of all three kinds of rolled nickel steel used in structural metal work shall be as follows:—

	Pounds.
Rivet steel	70,000 to 80,000
Plate and shape steel....................	105,000 to 120,000
Eye-bar steel	115,000 to 130,000

The preceeding figures are for test pieces taken from the edge of the piece. In case test pieces are taken from the interior, these figures may be reduced by 3,000 pounds each.

The preceding figures also apply for all plates up to ⅞-inch in thickness and for all shapes up to ⅝-inch in thickness. For each additional ⅛-inch in thickness the ultimate strength may be reduced 1,500 pounds per square in down to an inferior limit of 95,000 pounds for the thickest eye-bar flats.

Elastic Limits.—The least allowable elastic limits per square inch obtained from unannealed test pieces shall be as follows:—

Rivet steel	45,000 lbs.
Plate and shape steel	60,000 lbs.
Eye-bar steel	65,000 lbs.

The preceding figures are for test pieces taken from the edge of the piece. In case of test pieces taken from the interior, the figures may be reduced by 2,000 pounds each.

The preceding figures also apply for all plates up to ⅞-inch in thickness and for all shapes up to ⅝-inch in thickness. For each additional ⅛-inch in thickness the elastic limit may be reduced 1,000 pounds down to a limit of 57,000 pounds per square inch for plate-and-shape and eye-bar steels.

Elongation.—The percentages of elongation shall be obtained from the unannealed test pieces after breaking on an original length of 8 inches, in which length must occur the curve of reduction from stretch on both sides to the point of fracture. The least allowable elongations for the three kinds of rolled structural steel shall be as follows:—

Rivet steel	25 per cent.
Plate-and-shape steel	15 "
Eye-bar steel	12 "

The preceding figures apply to plates, shapes, and flats ½-inch thick or less. For thicker metal they are to be increased by unity for each increase of ¼-inch in thickness.

Bending Tests.—Specimens of rivet steel shall be capable of bending, by either pressure or hammering, to 180°, and closing down flat upon themselves without cracking, when either hot or cold.

Specimens of plate-and-shape steel, when either hot or cold, shall be capable of bending by pressure 180° around a mandrel having a diameter equal to twice the thickness of the test piece, without showing signs of cracking on the convex side of the bend.

Specimens of eye-bar steel, when similarly treated, shall be capable of bending by pressure 90° around a mandrel having a diameter equal to three times the thickness of the test piece, without showing signs of cracking on the convex side of the bend.

Drifting Tests.—Punched rivet holes in the plate-and-shape steel, pitched two diameters from a sheared edge, must stand drifting until their diameters are 40 per cent. greater than those of the original holes, and must show no signs of cracking the metal.

The total taper of the drift pins shall not exceed 1 in 12.

Fracture.—All broken test pieces for all three classes of steel and all broken eye-bars must show a silky fracture of uniform color.

Full-sized Eye-bars.—Full-sized eye-bars must show an ultimate tensile strength per square inch for the various thicknesses of metal as follows:—

1 inch	105,000 lbs.
1½ inch	100,000 lbs.
2 inches	95,000 lbs.
2½ inches or greater	90,000 lbs.

The elongation shall not be less than 10 per cent. in a gauged length of 10 feet, and the elastic limit shall not be less than 55 per cent. of the ultimate strength of the bar.

Cast Steel.—All steel castings shall be made of open-hearth steel of the same composition as that specified for eye-bar steel, except that acid steel having a maximum limit for phosphorus of 0.06 per cent. may be used. The ultimate tensile strength shall vary within the limits of 110,000 and 130,000 pounds per square inch the elastic limit shall not be less than 55 per cent. of the ultimate tensile strength, and the elongation of test specimens in 2-inch shall not be less than 20 per cent.

Impact Allowance Load.—The impact allowance load is to be a percentage of the equivalent uniform live load found by the following formulae:—

$$P = \frac{40,000}{L + 500} \text{ for railroad bridges.}$$

$$P = \frac{10,000}{L + 150} \text{ for highway bridges.}$$

where P is the percentage and L is the length in feet, of span or portion of span covered by the live load, when the member considered is subjected to its maximum stress.

Intensities of Working Stresses.—The following intensities of working stresses are to be used for all cases, except where wind loads are combined with other loads, in which cases the intensities are to be increased 25 per cent.; but the sections shall not be less than those required by the stresses from all loads except wind.

	lbs.
Tension on eye-bars	30,000
Tension on plates and shapes in bottom chords, main diagonals, and laterals	28,000
Tension on nett section of plate-girder flanges (assuming one-eighth of the web to act as part of each flange), on extreme fibres of rolled I-beams, and on shapes in body of suspenders, hip verticals, and hanger plates (there being 50 per cent. increase of nett area for section through eyes)	24,000
Bending on pins	50,000
Bearing on pins	38,000
Bearing on rivets	30,000
Shear on pins	25,000
Shear on rivets	14,000
Shear on webs of plate girders (gross section)	17,000

For field rivets, the intensities for bearing and shear are to be reduced 20 per cent.

Compression on top chords	30,000—120 l/r
Compression on inclined end posts	30,000—140 l/r
Compression on all other struts with fixed ends	27,000—120 l/r
Compression on all other struts with one or two hinged ends	27,000—160 l/r

Where l is the unsupported length of the strut, in inches, and r is its least radius of gyration, in inches.

Compression on end stiffeners of plate girders, 22,000 lbs.

For forked ends, the intensity of working stress shall be determined by the formula,

$$p = 15,000—450 \ l/t,$$

where p is the greatest allowable working stress (impact being considered; l is the unsupported length, in inches, measuring from the centre of the pin-hole to the centre of the first transverse line of rivets beyond the point at which the full section of the member begins; and t is the total thickness of one jaw, in inches.

The greatest allowable pressure upon expansion rollers of fixed spans, when impact is considered, shall be determined by the equation,

$$p = 1,000 \ d,$$

where p is the permissible pressure, in pounds per linear inch of roller, and d is the diameter of the latter, in inches. The preceding formula is to be used for the rollers of swing spans with the span at rest, but, for the span in motion, the formula to be used is,

$$p = 400 \ d,$$

where d is the mean diameter of the roller, in inches.

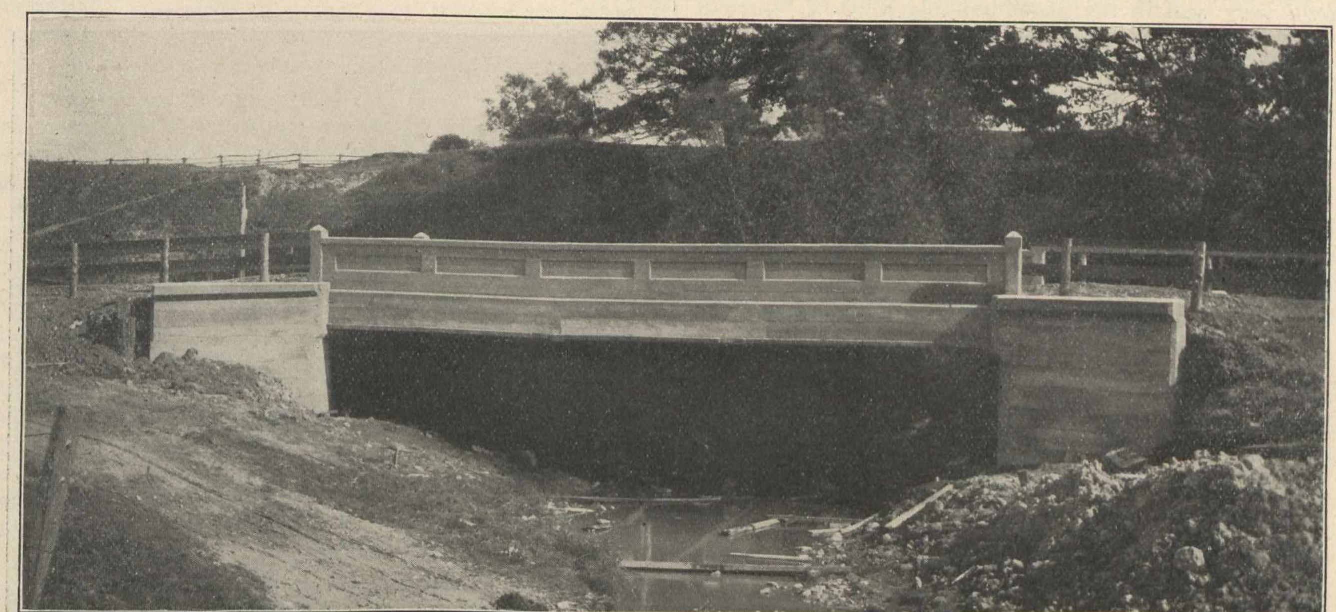
Having shown that bridges can be designed in nickel steel that are equal to carbon steel bridges in safety and rigidity, and slightly superior in the ability to resist corrosion, the governing feature is merely a question of cost. Pound for pound, nickel steel will cost about 1.5 cents more than carbon steel, and the cost of fabrication will be slightly more per pound on account of the increased wear and tear on the tools. However, the total weight of a nickel steel bridge is much less than one of carbon steel, resulting in a saving that in most cases far exceeds the difference in pound prices of the two metals.

The strength of nickel steel being nearly twice that of carbon steel, it is evident that a bridge of the former will weigh a little more than half as much as one of the latter. Thus we have, in addition to the decrease of weight due to superior strength, a corresponding decrease in stresses, and consequently in weight, on account of the lighter dead loads, This saving, insignificant in short spans, is of the utmost value in long spans where the ratio of dead load to live load is high.

Curves plotted by Mr. Waddell from careful estimates based on the present prices of nickel show that, except for short plate-girder spans, practically all types of bridges can be constructed more economically by using nickel steel for all main members and carbon steel for the less important details. Indeed from an examination of the diagrams we find a saving on the longer plate-girder spans of from five to ten per cent., while in trusses, the saving is much greater, ranging up as high as twenty per cent. for long span bridges. Whether this saving is enough to warrant the introduction of nickel steel for general bridge construction remains to be seen. Already it is being used almost exclusively for eye-bars in all the more important structures, and who can tell, perhaps in the near future carbon steel will be a thing of the past, as wrought iron is at the present day.

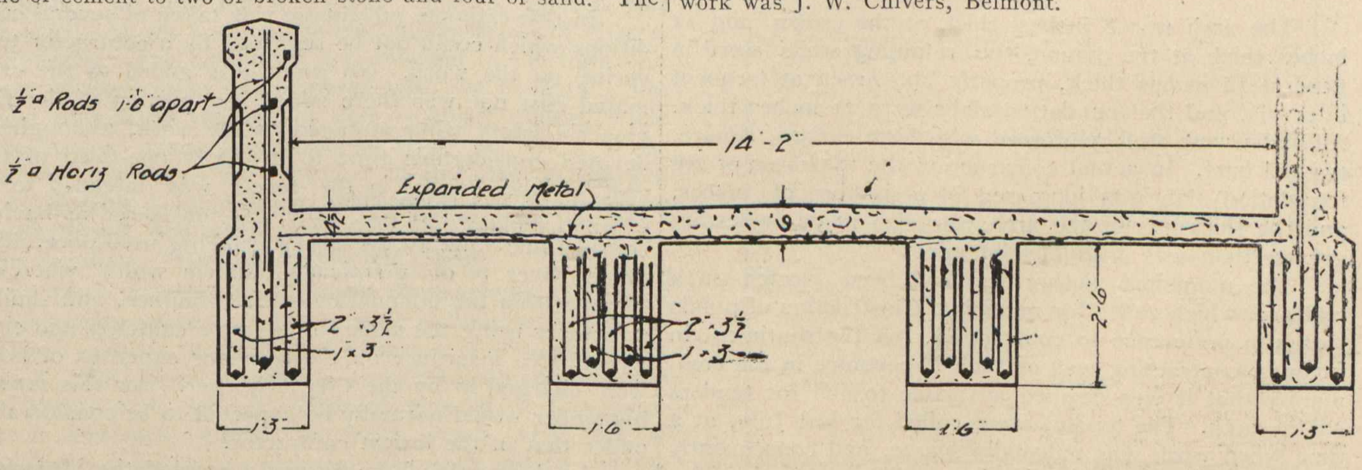
PARTICULARS REGARDING THE ERECTION OF A FORTY FOOT BEAM SPAN OVER CATFISH CREEK IN THE TOWNSHIP OF YARMOUTH AT MAPLETON.

This bridge is 40 ft. in the clear between abutments. Three of the wings are 10 ft. long and one 14 ft. long. The abutments and wings are reinforced ½-inch iron placed 2 ft. apart both vertically and horizontally. The beams are reinforced as shown on cross section with Kahn bars. The railing is reinforced with ½-inch rods as shown, and the floor with expanded metal. The foundations of the abutments extend 3 ft. below the bottom of the creek and are on hard pan. The abutments and wings are built up with a mixture of one part of Portland cement to seven parts of creek gravel and sand. The beams, floor and railing are in the proportion of one of cement to two of broken stone and four of sand. The surface of the floor (1½-inch thick), is composed of one of cement to two of sand and one of broken stone. This bridge is calculated for a load of 150 lbs. per square foot of floor, or a concentrated wheel load of 15 tons on two axles, 10 ft. centres. The height of the floor from the bottom of the foundation is 14 ft. After the bridge was completed it was left for thirty days before it was opened for traffic.



Mapleton Concrete Girder Bridge.

The total cost of this bridge together with filling in the approaches and building railing for one hundred feet on each side was $1,457.91. The bridge was designed by Jas. A. Bell, County Engineer of Elgin, and the contractor for the work was J. W. Chivers, Belmont.



CROSS SECTION

A PAGE OF COSTS
ACTUAL, ESTIMATED and CONTRACTED

COST ACCOUNT OF SEINE RIVER BRIDGE, ST. BONIFACE.

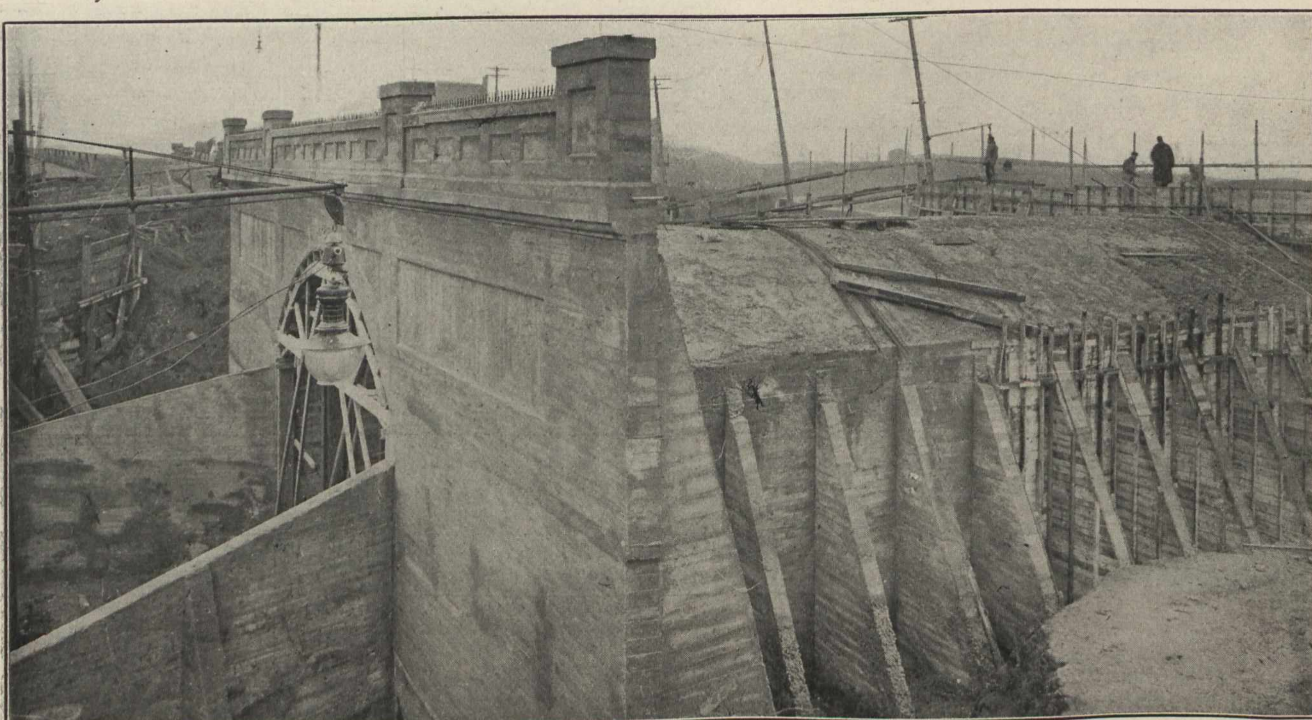
There has recently been completed in St. Boniface, Man., a reinforced concrete bridge over the Seine River, on Provencher Avenue. The plans were originally made by a former city engineer for a plain concrete structure, but the design finally adopted was of reinforced concrete, which material reduced the cost as originally contemplated. The width of the roadway is 80 feet, and the arch was made to carry the entire width without reduction, the span of the arch being 30 feet. Over the crown is 4 feet of earth fill, while the distance from the top of the roadway to low water is 26 feet, the depth of the stream at this point being about 3 feet. The stream runs through a very flat country, and, while it rises considerably at times, it never has any great amount of current. It was, however, deemed advisable to make the clear waterway as ample as possible, and for this reason the rise of the arch was made low, the springing point being 15 feet above low water. The banks are made in both cases with earth fill. The type of the structure is shown very well in the accompanying view.

The arch was 8 inches thick at the crown and 12 inches thick at the haunc, the retaining walls were in general 12 inches thick, properly buttressed at frequent intervals, and the foundation slabs were 21 inches thick. All slabs were well reinforced with high carbon, square, twisted bars. In actual construction the thickness of the foundation slab was increased in a number of places, and the thickness of the arch was also made somewhat greater than was originally intended.

The municipal authorities had been elected on a platform which called for municipal construction of public works in preference to contracting, but the sentiment in favor of contracting was of such importance in the community that it was deemed advisable to call for tenders on the arch. The tenders were called for last July, at a time when work was unusually scarce, and consequently competition was unusually keen. The invitation for tenders stated that the city would furnish reinforcing bars, cement and piling at the bridge site, but that the contractor was to furnish all other material and labor, leaving the bridge ready to receive the earth embankment. A temporary wood structure had to be built to use during construction, but this was not part of the general contract.

Seven tenders were received, the highest being $15,133 and the lowest being $10,367. The city engineer, Mr. M. P. Blair, Associate Member Canadian Society Civil Engineers, put in a tender based on actual estimated cost without profit of $7,000. The details of this estimate are as follows:—

4,328 yards excavation at 25 cents	$1,082 00
Driving 5,000 lineal feet piling at 20 cents	1,000 00
Placing 650 yards concrete at $1.50	975 00
600 yards rock at $1.60	960 00
260 yards sand at $1.30	338 00
Form lumber, assumed at	500 00
Erecting, removing and resetting forms	730 00
Erecting mixer	40 00
Bracing trenches	190 00
General labor, use of tools	1,185 00
	$7,000 00



Seine River Bridge, St. Boniface, Manitoba.

In this estimate advantage was taken of several conditions which could not be regarded by a contractor tendering on the work. No profit was added to the estimated cost nor was there added any portion of the Engineer's salary while engaged on the work, although he devoted considerable time to it. Only one-third of the cost of the lumber in the forms was intended to be charged against this job, as it was considered as having considerable value to the city after being used once. The Seine River is of practically uniform width wherever found within the boundaries of St. Boniface, and similar structures using the same forms, were contemplated elsewhere. No insurance on the men nor expenses of bond were charged in by the City Engineer. For this reason his tender would normally be expected to be considerably under that of the lowest contractor.

As the result of the figures presented the Municipal Council decided to accept the tender of the City Engineer and to construct the bridge by day labor. The actual cost of construction is as follows:—

Actual cost—excavation 5,336 yards at 38.2 cents; some moved twice	$2,034 63
6,060 feet piling, furnished, 14.7 cents per foot	893 85
Sub-contract, driving ditto	939 30
Form and scaffold lumber, $1,491; one-third charged to job	497 00
Labor on forms	652 12
Cost of reinforcing bars	1,418 00
Labor placing bars	128 95
Gravel and rock, f.o.b. cars, 872 yards at $1.	872 00
Hauling above	322 50
1,446 barrels cement at $2.45	3,542 70
Labor mixing and placing concrete, including bracing and general labor	1,407 68
Erection of mixer	61 25
Finishing labor (plaster, etc.)	56 00
Coal	24 00
Oil for forms	30 80
	$12,880 78

This cost includes, of course, the cement, bars and piling, which were intended to be furnished by the city under any circumstances. These three items were as follows:—

Piling	$ 893 85
Reinforcing bars	1,418 00
Cement	3,542 70
	$5,854 55

Deducting the sum of these three, $5,854.33, from the total cost of the bridge leaves $7,026,23 as the actual cost of that portion contemplated by the City Engineer's estimate of $7,000.

The close agreement between the estimate and the actual result can be regarded somewhat as a fortunate coincidence. The work as actually constructed includes 1,060 lineal feet more piling than contemplated by the plans. It also includes 1,008 yards more of excavation than was estimated by the City Engineer, and 222 additional yards of concrete. The additional excavation was due to the fact that the method of handling the work was changed from that originally planned, and such a change would not be allowed by the City Engineer as an extra had the work been done by contract. The concrete and the piling would, however, be legitimate charges, and would have raised the lowest tender of $10,367 well above this figure had the work been done in this manner.

The work was carried on under considerable difficulty. The excavation was interrupted by frequent rains, and the banks slipped, causing the handling of considerable additional material. The work of driving piles was also frequently interrupted by rain, and as a consequence the extra work of placing concrete did not start until late in the fall, and had to be prosecuted by two shifts, working day and night, Sunday included, until it was finished. Work under these circumstances is, of course, expensive. The conditions are reflected in the high unit cost of excavation as compared with the estimate. The cost of placing reinforcing bars is about typical, while the cost of placing concrete at $1.63 per yard is abnormal, owing to the fact that in this item is charged considerable general labor, which could not be otherwise apportioned, and which in the estimate is included under the heading, "General Labor and Tools."

The specifications originally contemplated the use of crushed limestone, but there was submitted to the engineer samples of very good gravel at a price of $1 per yard. This gravel was clean, and contained enough sand to fill the voids without additional material; in fact, some of it contained slightly too much sand. The cost of sifting out the coarse material and again sifting out the fine material, and then mixing the two together in the proper proportions was found to be 32 cents per yard. This was used for all arch concrete, but for abutments the mix of the gravel as delivered was deemed satisfactory, as it did not vary greatly from the proper proportions. The footings were made of crusher rock dust and limestone, which had been owned by the city for several years. In making the estimate out this material is treated as costing the same as gravel.

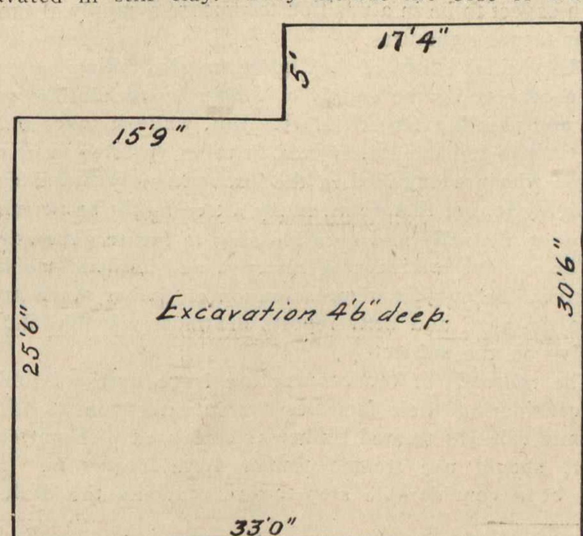
The result is highly satisfactory to the municipal council. They now have a structure far better than could be built by any other means than by reinforced concrete at a cost of about $4,000 less than could be obtained by contract.

Structures like this commend themselves to all well-governed municipalities. Most city fathers take up municipal work after having spent a lifetime in business in private life, and consider that they are doing all that can be expected if they conduct municipal affairs with the same care and on the same lines that they conduct their private business. The position of a municipality, however, is quite different from that of a private individual. The individual can only look forward to a limited space of life. He must, therefore, utilize his funds to get the greatest possible immediate returns. The municipality, on the other hand, has a life which is eternal. It does not build for a few years, but builds for generations. A private individual might under certain circumstances not be justified in incurring debt in order to put up a structure of the character of this for private use, as, for example, a reinforced concrete warehouse. There is no question whatever about the advisability in the case of a city. Had the city of St. Boniface put up a wooden or steel structure in place of the present arch, the council of twenty-five or fifty years hence would have to find money to replace it. Under the present circumstance they have a bridge now built which is in as good condition as ever, and so will their children's children have, and it is only fair, therefore, that inasmuch as the next generation has been relieved of the cost of replacing a bridge at Provencher Avenue they should be expected to pay part of the cost in the form of maturing debentures. Such system of finance in the case of a municipality is thoroughly sound, and in addition gives the best possible structures. It is commended to all cities having bridges to build.

The general design of the Provencher Avenue bridge was made by M. P. Blair, City Engineer of St. Boniface. The details of the concrete reinforcement were made and the reinforcing bars supplied by Clarence W. Noble, Winnipeg. Material used was high carbon, square, twisted bars.

CELLAR EXCAVATION.

The following costs are in connection with a cellar excavated in stiff clay. They include the cost of excavat-



ing and trimmings sides as well as digging cellar entrance.

Two teams were employed at first with plow and scraper, and one extra man besides teamsters. When nearly the required depth only one team was used and one man put on the sides with pick.

The cost was divided as follows:—

Team and Teamsters.

85 hours at 40 cents per hour................$34 00

Laborer.

72 hours at 20 cents per hour............... 14 40

$48 40

There were 155 cubic yards excavated in the main cellar and 3 cubic yards in the entrance, or 158 cubic yards cost $48.40, or 30.6 cents per cubic yard.

This cost is high, and under good management could be reduced another 5 cents per cubic yard with like conditions.

PRESERVATION OF TIMBER.*

The subject of preservation of timber has been under consideration for ages. There are indications that efforts were made during ancient times to prolong the life of timber used in structural work, by the use of antiseptics, but as far as is known no satisfactory results were obtained until the decades between 1830 and 1850. During those years many processes came into use, but, although somewhat effective, most of them have been abandoned.

The question of preservation of timber to prolong its life may be one of necessity or economy, depending upon the available supply of timber, the location and kind of the structure, the cost of reconstruction, the length of life of structures on land or in sea water, etc.

This question of necessity or economy for preserving timber engaged the European engineers in the early period of railroad construction by reason of the limited area of timber lands, the density of the population requiring the land for agricultural purposes, and the advanced development of the industries of their country in those days. In the United States, to within a few decades, there was a large area of forest lands available, and what was then considered an unlimited supply of timber for all time to come.

The Forestry Division of the United States, on account of the fast diminution of the supply of timber, has given a great deal of attention to the subject of preservation of timber for various purposes, with antiseptics, and, while these investigations are still in progress, sufficient results have been reached to show the value of various methods and treating processes. The important point in these investigations is to find a method of treatment that combines permanency with reasonable first cost, and ease of application.

The constant reduction of the available supply of timber necessarily produces a corresponding increase in its market value. It is only by enforcing a more conservative method in the use of our forests and the lumber cut therefrom, and by treating the timber to prolong its life in the structures, that we can expect to be in a position to procure a supply of timber for our future structures.

The various states of the Union are also taking an active part in conserving the supply of timber by reclaiming waste lands and planting forest timber. But, while it takes only a short time to fell the stately tree, it takes years to grow one. If those who are engaged in the lumbering operations could thoroughly realize this point, many a tree might be permitted to grow to maturity and be a blessing to future generations.

The various engineering societies and associations have also given the subject of preservation of timber much attention in the past, and their reports are most valuable and instructive on the subject.

The railroads of the country are large users of timber, and, considering their facilities for investigation as to the economic value of treated timber as compared with untreated timber, should use treated timber more frequently. This would be a considerable step toward reducing the draft on the timber lands to a more satisfactory amount as compared with the available supply. But on account of the first cost of treated timber over that of untreated, the latter will be used oftener, unless the national government and the various states regulate by laws the use of the forests of the country, and prohibit the present destructive methods of cutting timber. Such government or state regulation would restrict the amount of timber to be cut in a season, thereby limiting the available supply for such period, compelling consumers to adopt a preservative process that would prolong the life of timber.

Numerous processes have been patented in this country and abroad for treating timber to prolong its life, but few only have stood the test of time. The following are the processes that have gained more or less prominence at various times:—

Kyanizing, using chloride of mercury.

Margaryizing or Boucherizing, using sulphate of copper.

Creosoting, using dead oil of coal tar.

Burnettizing, using chloride of zinc.

Allardyce, using chloride of zinc with dead oil of coal tar.

Wellhouse, using chloride of zinc with glue and tannin.

Thilmany, using copper sulphate and zinc sulphate, with after treatment of barium chloride.

Hasselmann, using sulphate of copper, iron and aluminum.

Creo-Resinate, using creosote, resin, formaldehyde, followed by milk of lime.

Hagen method, using chloride of zinc and gypsum.

Powell Process, using saccharine.

Vulcanizing.

Woodiline and Carbolineum Avenarius.

These processes have been fully described in the 1904 report of your association, with the exception of the Powell Process; a description of this process will be given below; and the processes which are now in general use in the United States as far as they have come to the knowledge of your committee, will also be further dwelt upon in this report.

The Powell Process of treating timber with saccharine has, during the year of 1907, been extensively tested in England. This process differs entirely from other processes, both in the material employed for displacing the sap and in its method of application. The preservative agent is sugar in one or another of its varieties, molasses being used for cheap timber that requires no surface finish, and saccharine for the more expensive woods.

The timber may be treated in a closed cylinder or in an open tank. The essential part of the method consists in boiling the wood in a solution of sugar and water, after which it is artificially dried and is then ready for use.

The claim is made that on account of the boiling point of sugar being higher than that of water, the moisture contained in the wood is converted into steam and escapes in the same manner as the released air. The moisture and air having been completely driven out, the solution is permitted to cool, during which stage it is constantly absorbed by the wood. In this way the cells and interstices are filled with sugar; and, when the wood is dried, the sugar is found to be thoroughly assimilated by its tissues. Whether timber treated in this manner will give satisfactory results under all conditions your committee has not been able to ascertain. This description of the process is given only as general information.

The processes in use in the United States for treating timber are the Bethell Process or Creosoting, using dead oil of coal tar, and Burnettizing, using chloride of zinc; the former is used for all kinds of structural timber, while the latter is more generally used for treating bridge and track ties.

The process of treating timber with Woodiline or Carbolineum Avenarius, applied either with brushes or by soaking, is also used in this country. These liquids contain creosote as the preservative ingredient.

Woodiline or Carbolineum should preferably be applied to seasoned timber. Applied to green timber they will close

*Abstract of Report presented at the eighteenth annual convention of the Railway Superintendents of Bridges and Buildings, Washington, D.C.

the pores on the face of the timber, and for this reason will act rather as a detriment to the life of timber than a preservative. This treatment will, no doubt, give good results on smaller sticks of timber than can be air-seasoned quickly, and on which the solution will penetrate proportionately deep. For heavy railroad structures, however, the pressure processes are no doubt the most reliable and effective. Brush treatment of joints and points where water can collect will undoubtedly be of considerable benefit and will retard decay.

The Burnettizing process consists in impregnating timber with a solution of zinc chloride in water. It is used extensively by some of the western and southwestern railroads of this country for treating ties, and is apparently giving good satisfaction in localities not subject to much rainfall. The ties and truck on which they are loaded are hauled into a steel cylinder 6 to 8 feet in diameter, and from 60 to 150 feet long. When the cylinder is filled with material for treatment, the end door of the cylinder is closed and thoroughly packed and bolted, when live steam is admitted into the cylinder and held under pressure for several hours, the length of time depending on the degree of the seasoning of the timber to be treated. After the steaming has continued for such period as is necessary to liquify the sap and solidify the albumen, and transform the water contained in the timber into steam, the cylinder is exhausted of steam and air, and a partial vacuum is maintained for a short time. During this interval the moisture and liquids formed by the steam are expelled from the timber. The cylinder is then filled with the solution of zinc chloride and water, the pressure pumps are started, and the pressure in the tank is raised to from 80 to 100 lbs. per square inch. This pressure is maintained until the pores of the timber have absorbed the necessary amount of solution. The solution remaining in the cylinder is withdrawn, the cylinder is opened, and the timber brought out and dried ready for use.

If wood treated in this manner is exposed to the action of water the solution is likely to leach out, leaving the cells of the wood unprotected. This defect has been overcome by a light after treatment of the timber with creosote or dead oil of coal tar that has proven satisfactory. Owing to the fact that the zinc chloride solution leaches or evaporates from the timber in time, the process of Burnettizing is not desirable for treating structural timber, except for use in dry locations.

The process that has been most widely used in this country is the so-called Bethell Process, or Creosoting, using dead oil of coal tar. It is not more generally used on account of the comparatively high price of the treatment. For timber used in harbor structures, where marine insects, such as the teredo, operate, the creosoting process has been used with greatest success. Its value for such purposes is incalculable, since the teredo will not attack timber properly treated with creosote, while untreated timber is destroyed by this insect in some of our Southern ports in as short a time as six months.

Creosoted timber is also widely used for structures on land when greater permanency of structures is desired, and when reconstruction is not only expensive but the delays to such reconstruction interfere with the business to a greater or less extent. As stated before, on account of its comparatively high cost only, is creosoting with dead oil of coal tar not more universally employed for structural timber.

The creosoting process consists in treating the timber with dead oil of coal tar. The material is treated in steel cylinders as previously described for the Burnettizing process. When the cylinder is filled with timber to be treated, live steam is turned into the cylinder and a pressure of from 50 to 70 lbs. per square inch maintained for from 3 to 10 hours, according to the condition of the timber to be treated and the amount of oil required. It is important that the artificial seasoning by steaming be done not too quickly, so as not to scorch, split or otherwise injure the timber. Timber well air-seasoned required no steaming. At the proper time the steam pressure is removed and the condensed water in the bottom of the cylinder is blown out before the steam is exhausted through an outlet at the top of the cylinder.

When the steam is all out of cylinder, the vacuum pump is started and kept in operation for about 4 to 8 hours at a gauge pressure from 22 to 24 inches. During this process the temperature of the cylinder is maintained by passing steam through heating coils.

When the vacuum pump is stopped, the oil, which has been heated in the storage tank to the proper temperature by means of steam coils in the tank, is admitted into the cylinder. As soon as the cylinder is full of oil, the pressure pump is started. When the gauge shows a pressure of 150 lbs., the pump is generally held at this pressure until the material to be treated has, according to the readings of the various gauges during the progress, received the quantity of oil specified. The oil not consumed is allowed to run out of the cylinder into a tank below it, and from there is pumped back into the storage tanks.

The difference in the gauges in the measuring tank before the cylinder is filled and after the unused oil is pumped back into the storage or measuring tank, shows the amount of oil that penetrated the timber. This amount can never be obtained very closely until the treatment of a batch is completed.

A modification of the general creosoting process, "The Rueping Process," is extensively used by the Atchison, Topeka & Santa Fe Ry. It includes the usual seasoning of the timber by steaming if the timber is not air-seasoned: It is then placed in a cylinder and subjected to treatment for half an hour or one hour of air pressure from 60 to 75 pounds, depending upon the wood, so that all cells will be filled with compressed air. Without reducing this pressure in the cylinders, the warm dead oil of coal tar is next forced from the storage tank into the cylinder. When the cylinder is filled with the dead oil of coal tar and the timber in the cylinder is immersed, the pressure pumps are started and the fluid forced into the wood under pressure, rising from 60 or 75 pounds to 150 or 200 pounds, depending on the nature of the wood to be treated. Under the increased pressure the oil penetrates into the cells of the wood, soaking or impregnating the cell walls, compressing still more the air formerly forced in at 60 to 75 lbs. pressure. When the wood is sufficiently impregnated with the fluid, the amount being usually specified in pounds per cubic foot, the pressure in the tank is reduced to that of the atmosphere. The air compressed in the cells forces as much of the impregnating fluid out of the wood as does not adhere to the cell walls. The excess is allowed to flow from the cylinders back into the storage tanks. This process has the distinctive feature that no more of the treating fluid remains in the wood than is necessary for impregnating, coating or saturating the cell walls.

The United States Department of Agriculture, Forestry Division, has made some tests with the open tank method of treating timber, with a view of ascertaining a cheaper and more easily applied method than the methods in general use at the present time. The Forestry Division, in its circular No. 101, claims that an open tank plant for the treatment of timber can probably be installed for less than one-fourth of the cost of a pressure cylinder plant of the type in general use. The open tank method is not to be considered as a universal substitute for the pressure process. The tests of this method have not reached the point of development, however, that would warrant its application to all kinds of timber used in structural work. It is especially well adapted to treatment of woods with coarse grain and open cells.

The experimental tests covered the treatment of fence posts, telephone poles and mine timber, and satisfactory results were obtained. No difficulty should be encountered in treating cross ties and piling yellow pine, and lodgepole pine. The open tank method is rapidly being developed by the United States Forestry Bureau, who expresses the hope that future experiments will reveal methods of applying it to many other species and for other purposes.

Much has been written in regard to the injury to the fiber or structure of the timber, and reduction of strength, on account of the high temperature and heavy pressure to which the timber is subjected during the treatment in pressure cylinders, but investigations made show that the percentage of injury to the timber compared with the prolongation of its life in a structure is so small that it need not be seriously considered. Much of this objectionable feature can be avoided by air-seasoning the timber before treatment and also by taking proper care during the treatment not to abuse the material, bu attempting a too rapid treatment; and in all cases fitting the treatment to he kind and grade of timber under treatment.

In connection with the high cost of creosoted or other treated timber, it may be well to mention that this is in many cases due to the fact that an expensive kind and grade of timber is selected for a certain structure when a cheaper kind and grade, if properly treated, will give equal service and satisfaction. Instead of high grade Southern long leaf yellow pine, short leaf yellow pine, lob-lolly pine, Norway pine, and other cheaper timber may often be satisfactorily substituted.

The amount of treatment required depends largely upon the location of the structures; whether in sea water where marine insects operate; or on land, in low districts or high altitudes. The position of the timber in the structure also has a bearing on the lasting qualities. Best results are obtained when timber that is to be treated is first framed and then treated; especially if it is to be used in sea water. The least defect or injury to a treated timber near the water line in infested waters, will result in attacks by marine insects, which, having once gained an entrance, will destroy the parts not reached by the preservative. It is generally known that even with the best modern appliance the treatment will not penetrate through the whole stick of timber of the larger sizes used in railroad work.

The following shows the amount of deal oil of coal tar treatment used per cubic foot of timber on the railroads noted:—

	Piles driven on land.	Piles driven in sea water.	Square timber in trestles and wharves.
	lbs.	lbs.	lbs.
Southern Railway	12	16 to 20	12
Louisville & Nashville R.R..	12	20	12
Chicago & Rock Island R.R.	12	....	12
Norfolk & Western R.R.	..	12 to 16	..
St. Louis & San Francisco R.R.	12	....	12
Texas Pacific R.R.	10 to 18	18 to 20	10 to 18

For use in waters infested with boring insects, less than 22 lbs. per cubic foot is not recommended.

The following quotation from a letter received by the committee from the chief engineer of the Louisville & Nashville R. R., will no doubt prove interesting for many of our members:—

"The average life of creosoted timber has not been determined on the Louisville & Nashville lines. We have creosoted timber in trestles which has been in place 30 years and is still sound. We have had extensive experience with creosoted piles in sea water. It is necessary to be very careful to see that piles are properly treated for use in sea water, and they should have about 20 lbs. of creosote oil per cubic foot of timber. I have known a very long trestle constructed of fine yellow pine piles, untreated, to have been cut down by the teredo within one year after it was built. This same trestle was reconstructed with creosoted piles; the creosoted piles were driven 30 years ago and are now in use, but some of them were affected by the teredo and had to be protected by other means, surrounding them with concrete or placing vitrified clay pipe around them and filling the space between the pipe and pile with sand."

There are no doubt many other cases where treated timber has been in use for many years and is still sound. For example, the Lehigh Valley R.R. Company rebuilt one of its coal shipping piers at Perth Amboy, N.J., in 1886, using creosoted timber and piling. The pier is still in a very good condition, and will no doubt last for many years more.

Among experts there seems to be a great deal of difference in regard to the quality of dead oil of coal tar (creosote), to yield best results for preservation of timber. Specifications as to the composition of dead oil of coal tar differ very materially, although the results desired are the same. European railroads appear to have secured better results than those obtainable in this country, due, no doubt, in a considerable degree, to the difference in the composition of the coal from which the coal tar is obtained. Specification requirements, as well as the quality of the oils, differ in their composition.

Results from creosoted timber in this country are very remarkable. It is surprising that, although the life of creosoted timber, in many instances, is three or four times greater than that of untreated timber, creosoted timber is not more universally used for all kinds of structures, not only in sea water where the marine insects operate and practically compel the use of creosoted timber, but also for structures on land where the cost of renewals, combined with the interference with operations, is an item of great expense and inconvenience.

No specific data can be furnished covering the cost of creosoted timber. This cost varies so greatly with the location, market conditions, etc., that any data given would be misleading. It may be of interest, however, to state the cost of treatment of the timber irrespective of the first cost of the timber. Even the price of the treatment varies considerably on account of the changes in the market price of the dead oil of coal tar, the cost of fuel and labor, but the figures noted below for creosoting timber may be useful as a general guide.

Cost of treatment of yellow pine square timber, 8 lbs. of oi' per cubic foot, about $12.50 per M. ft. B. M.

Cost of treatment of yellow pine square timber, 12 lbs. per cubic foot, about $16 per M. ft. B. M.

Cost of treatment of yellow pine square timber, 16 lbs. per cubic foot, about $20 per M. ft. B. M.

Cost of treatment of yellow pine piling, 12 lbs. per cubic foot, about 20c. per cubic foot.

Cost of treatment of piling, 18 lbs. per cubic foot, about 24c. per cubic foot.

These prices are based on the price of oil about 7½c. per gallon delivered at the creosoting works, and the cost of labor, fuel, etc., about $4.50 per M. ft B. M. To this must be added the interest charge on plant, depreciation of plant and profit.

In comparing prices for creosoted timber, it should be remembered that the condition of the timber to be treated, the kind of timber to be treated, and the amount of treatment required, will have a bearing on its cost f.o.b., at the works. The total cost of the treated timber will be represented by the sum of the transportation charge from the works to the site of the structure where the material is to be used, the cost of the untreated timber at the works and the cost of treatment.

For Burnettizing bridge ties, using ¼-lb. of 100 per cent. solution of chloride of zinc per cubic foot of treated timber, the cost again varies with the quality and kind of timber, but generally $1.90 per M. ft. B. M. at the works for cost of treatment can be assumed as a fair figure for pine ties.

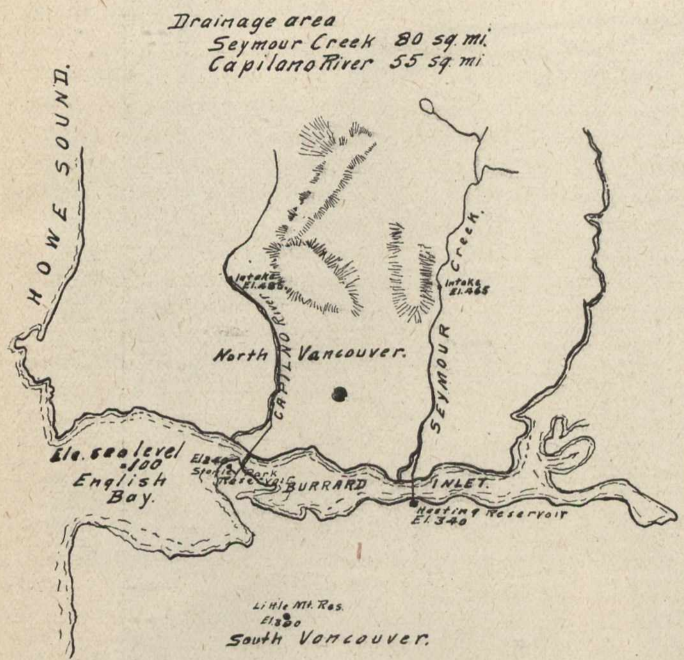
F. E. Schall,
F. D. Beal,
W. F. Steffens,
Committee.

WIND GAUGE FOR TRAINS.

A singular device for the protection of railway trains crossing a viaduct exposed to heavy winds has recently been employed at Ulverston, England. It consists of a wind gauge fixed at the west end of the Levens viaduct. When the wind pressure reaches thirty-two pounds to the square foot an electric contact is made automatically and bells ring in the signal cabins on each side of the viaduct. Upon this all trains are detained until the force of the wind abates. The interruption is telegraphed along the line. In February, 1907, a wind velocity of sixty-five miles an hour was recorded. The danger of very high winds to trains on an exposed bridge or viaduct was tragically illustrated many years ago by the lamentable Tay Bridge disaster in Scotland.

VANCOUVER'S WATER SUPPLY.

The growth of the city of Vancouver, B.C., as been so rapid that it became absolutely necessary to enlarge the water supply. The first plan suggested was the enlarging of the present Capilano system at a cost of $750,000, but it was suggested that Seymour Creek offered better facilities for a pure water supply. The preliminaries to the undertaking



were conducted with some secrecy owing to the danger that others might find what the city desired and forestall them in securing water rights on the creek, purchasing land, etc. When the plan was made public a clash did occur on the question of the allotment of water rights on the creek, the councils of North Vancouver, South Vancouver, Richmond and Burnaby entering a protest against Vancouver being given the entire cord. This question was finally settled and it was arranged that each of the applicants should be given a water record, Vancouver obtaining a right of 1,400 inches out of a flow of 3,000 inches, the estimated limit of the creek's supply.

Why Plan Was Favored.

One of the factors which led to the Seymour Creek being chosen as a source of the city's water supply was the large amount of water in the stream, it being feared that the Capilano supply would ultimately be insufficient for the city's rapidly growing population. An examination of the facts showed that the watershed of the Seymour Creek was eighty square miles, as against an area of only thirty-five miles for the Capilano. The precipitation over both drainage areas is about the same, 120 inches annually, which gives the Seymour an average daily flow of 40,000,000 cubic feet, as against 30,000,000 cubic feet for the Capilano. Another point which made the adoption of the new system advisable was the provision of an alternate pipeline across the inlet. As long as the city was tied down to the supply from the Capilano, the submerged mains would naturally be laid across the First Narrows. A nest of five mains now connects the north Capilano system at that point with the city reservoir and mains, and there is ever a danger, with a large amount of shipping passing through the First Narrows, that the mains might all be damaged. Destructive work of this character has several times been done in the past, but luckily for the city, only one main has been injured at a time. With the installation of the Seymour system a crossing of the inlet could be made at Second Narrows, where there is not much water traffic, and by this means an alternate route for the supply could be obtained, so that should accidents occur at one crossing, the supply through the alternate submerged mains would still be at service.

The point at which the intake for the Seymour system should be located having been decided, the city started actual work by giving the contract for the building of a seven-mile road to the location at a cost of about $50,000. After considerable discussion it was decided that it was advisable for the city to own a private right-of-way and land necessary for the purpose was secured either by private purchase or expropriation. The primary object of the construction and maintenance of the road being to render possible ready access to every point of the pipe line in case of accident to the mains. The pipeline road takes the east side of the creek at the inlet, continuing on this route until a point shortly above the canyon is reached. At this spot, in order to make the laying of the line less expensive, a crossing is made, and the west side taken to the intake.

At this crossing is constructed a steel bridge on concrete piers, the height being ample to ensure the construction from destruction by the wild floods which often rage on the Seymour.

The Pipe Line.

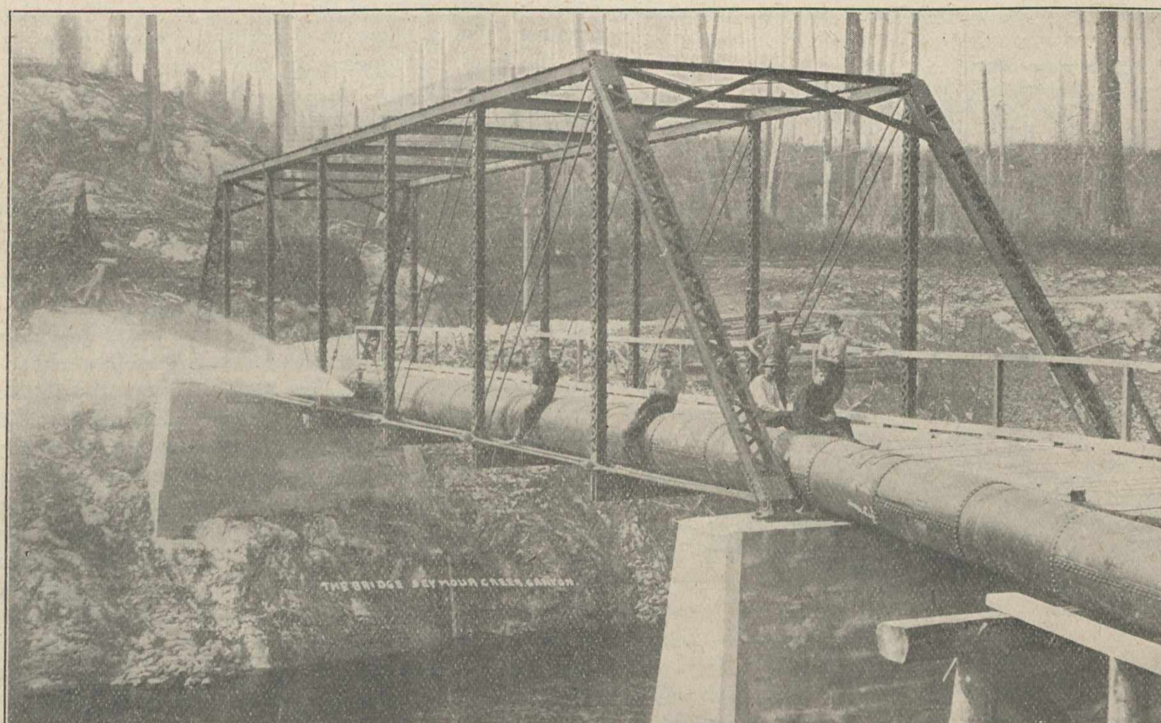
The pipe line which conduct the water from the intake to the submarine main at the Narrows are laid along the side of the road save at a few places. From the intake to the canyon this main consists of a wooden pipe, 36 inches in diameter for 1,000 feet, and 21,700 feet of 30-inch pipe, all banded with steel hoops supplied by the Canadian Pipe Company. This pipe should not be confused with wire wound wooden pipe, it being what is known as continuous stave pipe and is actually built in the trench where it lies. t is made of sections of clear fir, 2½ inches thick, 6 inches wide, and from 12 to 30 feet long. These are shaped in the trench in circular form and surrounded by heavy steel hoops, the number of the latter to each foot of pipe being computed according to the pressure at the various jevels. When the point is reached where the cost of the wooden pipe advances to near that of steel pipe through the larger number of bands required to make the main sufficiently strong, a change is made to the steel type of main. In the Seymour system this occurs, as noted, just at the canyon, and from this point to the Inlet the water is conveyed in a 24-inch steel pipe, two and two-thirds miles long. Across the bridge spanning the Seymour steel pipe is also used on account of the vibration caused by travel over the construction affecting the wooden main.

Seymour Creek Canyon.

The line is designed to deliver 9,000,000 gallons per 24 hours.

A continuous wooden stave pipe is used down to a point where the static head is 210 feet, the spacing of the bands here being 1¾ inch, centre to centre. From this point to the city Stewart and Lloyds "Patent Inserted Joint," lap-welded, steel pipe built in 19-foot sections is used. Each length is made entirely of one sheet of steel plate, having a thickness of 5-16-inch.

In the 30-inch wooden pipe there are two gate valves, one placed about 1½ miles below the intake and the other about 1½ miles below the first one, in this steel pipe there are also two gate valves, one at the upper end and the other at the lower end. These valves can be used in case of a break in the main, but in the wooden pipe were put in chiefly to facilitate construction.



Bridge of Seymour Creek Carrying Pipe.

For the construction of this wooden pipe a large amount of fir of the highest grade was needed. The city decided that this should be turned out on the ground and for that purpose purchased extensive timber limits near the intake and placed a saw mill at the point. Here the 540,000 feet of staves required for the work have been cut. Owing to the high class of stock required there has been a large accumulation of lumber which was not suitable for staves and this is now piled in a large yard just above the intake. The total turn out of the saw mill during its period of operation was 540,000 feet of staves, 775,000 feet of ordinary lumber, and 88,000 feet of cedar. A portion of the cull material has been used for other works in connection with the system, but a large supply is still on hand, the final use of which is not yet settled. The city has saved considerable money by the operation of its municipal sawmill plant, even though there should be absolutely no return from the cull lumber still on hand, owing to the difficulties of marketing the stock.

Building the Pipe in the Trench.

Seymour Creek is a mountain stream and although the water is beautiful and clear most of the time, yet at freshets it becomes a raging torrent, and carries down hundreds of tons of gravel, boulders and finer sediment and rubbish.

This being the case the intake, which is 465 feet above sea-level, becomes the chief feature in the water works system, and has to be designed to overcome the following difficulties. First, to prevent it from being choked up at every freshet with gravel and boulders, and afterwards to separate the finer sediment and vegetable matter from the water and prevent it from entering the pipe.

The intake is so placed that water enters it at right angles to the direction of the stream. The racks being placed parallel with the current, a large portion of the gravel and rubbish which would otherwise accumulate against them is swept away by the stronger current of the stream.

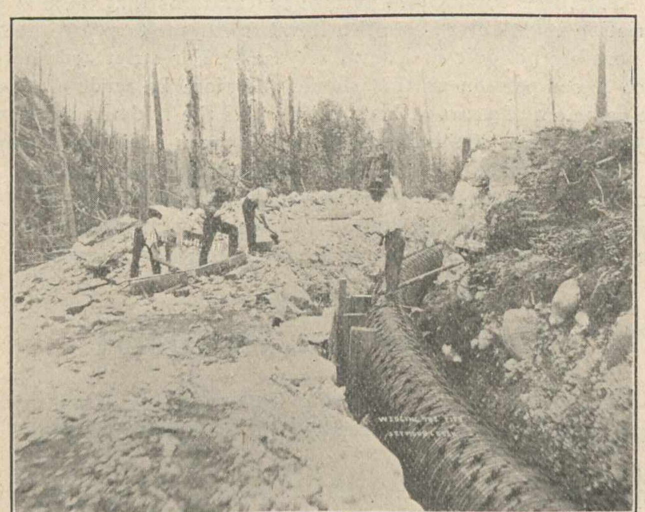
About 50 feet below the intake there is a low weir across the stream about three feet high, built of large broken rocks containing from ¼ to ¾ of a cubic yard in each. These rocks were hauled in place by a donkey engine, their only duty being to keep enough water on the intake during extreme low water. The finer sediment is separated from the water by means of two sediment tanks 20 feet by 100 feet each, with a depth of 6 feet. At the lower ends of the tanks are placed a double row of screens in front of the gates, connecting with the 36-inch pipe. There are sixteen screens in all, 5 feet square and operated by an hydraulic hoist, which lifts a row of 8 screens at a time, when they are cleaned by a jet of water supplied by a neighboring stream through a 4-inch pipe line, with a head of 125 feet.

A weir or baffle on the bottom of the tanks 18 inches high, is placed a few feet in front of the screens, its duty being to keep the sediment or heavy rubbish from coming down against the screens, just above this weir is a skimmer which crosses both tanks and takes care of the over-flow, its chief duty being to carry off the floating matter, such as leaves and small particles of wood, etc.

Each tank is supplied with a scour gate 24 inches square placed in the bottom, to be used in cleaning out, by means of flushing. The tanks are arranged with gates so that each can be cleaned out without interfering with the supply to the city. They are situated about 300 feet below the intake and connected therewith by an open conduit 6 feet in width.

Two tanks are used in order that one may be employed while the other is being cleaned. At the lower end of the tanks a concrete gutter or spillway is built, slightly lower than the upper line of the tank wall, to allow the leaves and floating material to pass out at once.

From the settling tanks the water passes through the screen house, where are located a double set of light screens which keep material not deposited in the tanks from getting in the mains. These screens are arranged in parallel rows



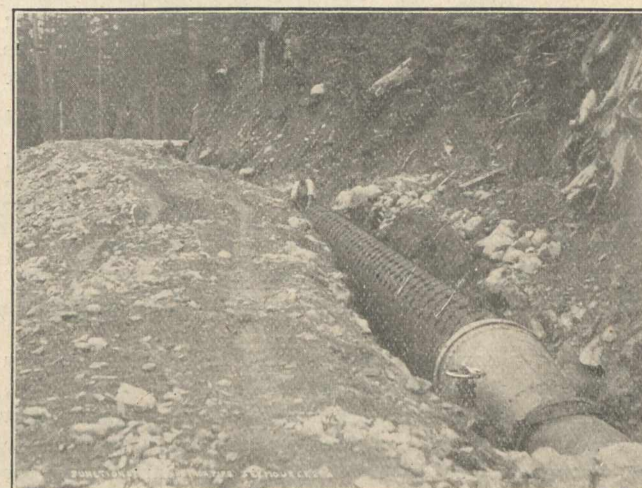
Wedging tee Pipe at a Curve.

of eight so that while one set is being lifted for cleansing the other set may be employed at their work. For the lifting of these screens a special equipment has been provided. A hydraulic equipment is arranged, the power being secured from a small tributary of the Seymour coming in just above the intake. A simple turn of a valve starts the heavy set of eight screens on their upward journey, and again lowers them after their cleansing.

After passing through the screens the water enters a 36-inch wooden pipe, which joins a short distance below with

The work along Seymour Creek, from the intake down to the Narrows was heavy, containing some very large side-hill cuttings, and a considerable amount of rock work along the edge of the canyon. It cost about $300,000 including the wagon road.

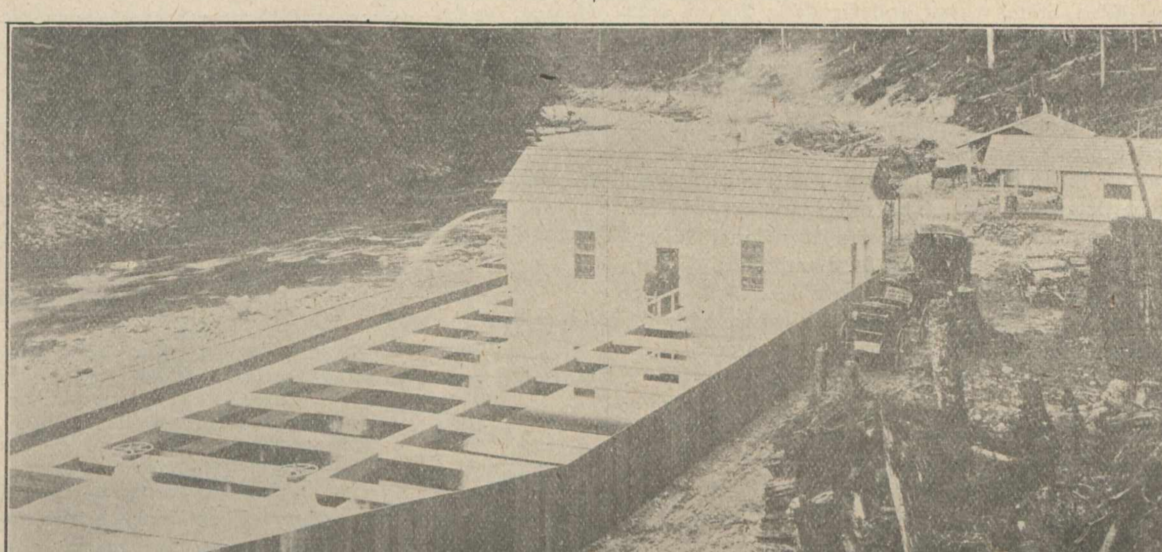
The pipe trench almost throughout was excavated throughout a compact mass of large boulders and gravel, deposited by glacial action. The work was done partly by contract and partly by day labor, and I might here mention that we purchased a saw-mill and a logging donkey engine



Join of Wooden and Iron Pipe.

with which we manufactured the staves for the wooden pipe and lumber for the intake, on the ground adjoining the intake where there was a sufficient quantity of fir and cedar timber.

The cost of the submerged main across the Second Narrows was about	$15,000
Tunnel	2,500
Special steel pipe in tunnel with bends and wye pipes.	2,500
Shore connections	3,000
Total	$23,000



Intake at Head of Pipe Line.

the 30-inch wooden main, which in turn joins with the 24-inch main at the canyon.

The Screen House.

The screen house is located in the rear of the caretaker's house so that constant watch is maintained on the water entering the intake so that the proper control, cleansing of screens, etc., may be done promptly at all hours of the day or night. Near at hand are also buildings for the accommodation of the waterworks teams, and a small cabin for officials who may be compelled from time to time to remain at the source of supply.

The cost of the supply main from the Narrows to the city, a distance of about 15,000 feet, was $77,000, making a total of $400,000.

The estimated cost of completing the Little Mountain Reservoir with the necessary pipe line connection together with the second submerged main is $200,000, making the total cost of the Seymour Creek system complete, $600,000.

Messrs. Hermon and Burwell, Consulting Engineers, of Vancouver, B.C., designed the system and had full charge of the construction. Mr. S. Madison is Superintendent of Waterworks.

MEAN SEA LEVEL AT QUEBEC AND NEW YORK.*

By W. Bell Dawson, D.Sc., M. Inst. C.E., F.R.S.C., M. Can. Soc. C.E.

The following information and deductions with regard to Mean Sea Level at New York compared with its determination at Quebec will prove of interest; as it affords a relation which has long been desired by engineers to bring our levels along the St. Lawrence, including the harbors of Quebec and Montreal, into relation with the open Atlantic.

The result is based on a long series of tidal observations at Quebec obtained by the Tidal and Current Survey, under the direction of the author, and on the levels of the Georgian Bay Canal Survey, under the direction of Mr. A. St. Laurent, C.E., the field work being in charge of Mr. C. F. X. Chaloner.

The comparison is based upon the elevations of the sill of Old Lock No. 1 of the Lachine Canal, at the head of Montreal harbor, where the levels meet which have now been carried through from New York via Rouses Point, and along the St. Lawrence from Quebec by Mr. R. Steckel, C.E., of the Public Works department, by the geodetic series taken previous to 1891.

The tidal observations at Quebec have been obtained by a registering tide gauge situated at the Dry Dock at Levis, which gives a continuous record day and night throughout the year. They are reduced throughout to the Admiralty Low Water datum at Quebec, as used for the chart of Quebec harbor. This datum has also been adopted by the Tidal Survey as the plane of reference for the Tide Tables for Quebec. It is defined by the Admiralty in their own publications as 28.0 feet below the Bench Mark cut on the east side of the principal gateway to the Marine and Fisheries building in Quebec.

The various connections by means of which the reductions are made, are as follows:—From the Admiralty Bench Mark in Quebec to the Levis dry dock where the tide gauge is situated, connected by Mr. Steckel's levels across the river; one of his Bench Marks being set in the masonry of the dry dock. From Levis to Montreal, connected by Mr. Steckel's levels. From Montreal to Rouses Point, from the levels of the Georgian Bay Canal Survey, which there connect with the levels of the United States Coast and Geodetic Survey from New York. The elevation taken for the Coast Survey Bench Mark at Rouses Point is the revised value of 1903. As explained in Mr. St. Laurent's report, the elevation of this Bench Mark is based upon a readjustment made in that year by the United States Coast Survey, and is now accepted as 107,955 feet above Mean Sea Level, instead of 110.06 as used before the 1903 determination. The difference between Mr. Steckel's datum and that of the Georgian Bay Canal Survey, is based on a common Bench Mark at St. Lambert.

Admiralty Bench Mark at Quebec, as above described.	28.00
Sill of Old Lock No. 1, Lachine Canal. Difference of level as determined by Mr. R. Steckel, 15.50 feet below the Admiralty Bench Mark at Quebec. Resulting elevation	12.50
Mean Sea Level, or half tide at Quebec, as determined at the Levis dry dock; from the hourly ordinates of of the tide during eight years of continuous observations, from 1894 to 1902. Mean of the eight years, 8.584 feet above the Admiralty datum ..... (The value adopted by the Royal Engineers in 1864, for mean sea level in Quebec harbor, corresponds to 8.72 feet above the Admiralty datum. This would be somewhat further up the river than the dry dock).	8.58
Mean Sea Level at New York determined by the Georgian Bay Canal Survey, as 5.38 feet below the sill of Old Lock No. 1, Lachine Canal	7.12
Steckel's datum referred to the Admiralty datum; the elevation of the Admiralty Bench Mark above his datum being 27.039 feet	0.96
Admiralty Low Water datum at Quebec; adopted as the datum for the Tidal Survey	0.00

*Read before Canadian Society of Civil Engineers.

It thus appears that Mean Sea Level or half tide at Quebec, when accurately determined by tidal observations, is 1.46 feet above Mean Sea Level at New York.

Note.—With regard to this determination, it may be noted that the method of determining Mean Sea Level by the summation of hourly ordinates is equivalent to taking it at the level of the horizontal line which bisects the area of the tide curve. This is the most accurate way of dealing with a river tide, in which the rising side of the curve is steeper than the falling side.

Also, it is found from precise observations that there is a variation in Atlantic Mean Sea Level from year to year, which is possibly periodic in a term of years. For strict accuracy, such a comparison as this should therefore be made during the same set of years at both places. As the re-determination of the elevation of the Bench Mark at Rouses Point was made in 1903, this should make the comparisons practically simultaneous, as regards the years on which the data are based.

There are no other known sources of error which affect the result, within the limits of accuracy in geodetic levelling.

THE WORLD'S COAL PRODUCTION.

The following table, showing the production of the principal coal-producing countries for the years mentioned:—

	Net tons.
United States, 1907	480,363,424
Great Britain, 1907	299,970,677
Germany, 1907	226,773,605
Austria-Hunary, 1907	43,955,315
France, 1907	40,708,215
Belgium, 1907	26,261,745
Russia and Finland, 1906	23,857,961
Japan, 1906	15,362,467
India, 1906	10,957,240
Canada, 1907	10,510,240
New South Wales, 1906	8,541,525
Spain, 1906	3,620,588
Transvaal, 1907	3,261,533
New Zealand, 1906	1,937,080
Natal, 1905	1,264,995
Mexico, 1906	846,416
Queensland, 1907	765,265
Holland, 1907	587,283
Italy, 1906	521,711
Sweden, 1906	327,361
Victoria, 1906	179,907
Cape Colony, 1906	142,877
Tasmania, 1907	65,958
Other countries	8,400,000
Total	1,209,184,109

It will be observed that in 1907 the United States produced 60 per cent. more coal than Great Britain, and over 100 per cent. more than Germany.

Thomas A. Edison, in his laboratory in West Orange, N.J., on January 6th, expressed confidence in the success of his latest invention, a practical storage battery for power-propelled cars, which is destined to solve the traffic problem in large cities. His scheme is to place these batteries under the seats of cars, and he says they can be sufficiently charged at the existing power houses to run an entire day continuously.

"No additional tracks, poles or power houses will be required," added Mr. Edison, "and the needs of future transit facilities can be economically cared for by the new battery cars. They will run one hundred miles without recharging, and will even utilize the machinery which brings the car to a stop for the recharging. The cars will run on any rail, the present street car tracks or steam rails, and if they jump the tracks can get back on the rails with their own power.

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UNDERGROUND TRANSMISSON MEDIUMS.—VI.

By J. Stanley Richmond.

Tracks and Bonding.

In spite of all that has been written and said, and though the average traction engineer is well aware that it is important that the track conditions, from a conductivity point of view, should be kept up to the standard required by modern and approved engineering, it is remarkable how many railroads permit their bonding to deteriorate This is very regrettable, and can only be explained on the basis that, being hidden from officials, the condition of the bonding is not constantly brought to their notice, like the conditions of the other phases of street railroading are. Bond testing should be methodically carried out constantly; this is, as soon as the whole system has been tested, it should be all gone over again and again to the N times. For this purpose a Conant rail-joint testing instrument with the built-up frame contacts (not the poles) should be used. The operator should be a young man of a plodding—very plodding—character, and his assistant be a boy. Both of them should be on the pay-rolls of the maintenance of way department. The young man should receive two dollars, and the boy fifty cents, a day. Both of them should report at the office at 8.30 a.m., be at work on the streets at 9 a.m., go to lunch at noon, be back at work on the streets again at 1 p.m., start for the office at 4.30 p.m., and, on arrival there, enter up the readings on clean sheets, a fac-simile of which is given in Fig. 24, and leave them, before quitting at 5.30 p.m., on the desk of the head of the department. The head, on the first of each month, should turn in the accumulated sheets, with a brief attached criticism of them, to the general manager for perusal. To check the accuracy of the Conant rail-testing instrument, a duplex millivoltmeter (Richmond pattern) is very handy. Such an instrument has been mentioned in a previous article ("Earth Voltage and Potential Measurements")* in connection with the first method of testing for stray transmission, and is used by taking the track drop across the joint with one side of the instrument and the drop across three feet of straight rail with the other side of the instrument. Ordinary good bonding, carried out with one bond at each joint in outlying sections and two bonds at each joint where the loads accumulate, with, perhaps, three bonds at each joint in some special cases (where the load is exceptionally heavy), will give results showing, in many cases, joints and straight rail as equal; this is, the conductivity of three feet of joint (eighteen inches each side of the junction of two rails) is the same as that of three feet of straight rail (rail without any joint); in other cases the results will show that the joints are equal to six or nine feet of rail. Where the bonding is out of order, the results, of course, will show much worse conditions. Where the tests give joints as being equal to more than six feet of straight rail, the joints should be rebonded. The practice of drilling holes in the rails beforehand, to insert the bond terminals in, cannot be too strongly condemned, unless they are drilled slightly smaller than required and are reamed out to the right size just before the bonds are installed. This because the holes will accumulate a certain amount of moisture and oxide in a very short time, which will, sooner or later, cause imperfect contact between the bond terminals and the rail metal. Bonds should be flexible, and preferably of the ribbon type. The bond terminals should be large—very large—and welded by some heat process to the ribbons (not pressed), and when inserted in the rails should be swaged up by compression applied to the head and the other end. When soldering can be carried out, the terminals and the rails should be sweated first; and when the terminals have been compressed heat should be applied to make the two sweated surfaces run together. The terminals should then be compressed again.

Those who are practically acquainted with track conditions, considered from the point of view of conductivity, know, more or less, that it is very difficult to keep the bonding of special work, as it is usually carried out, up to standard. This is due to several reasons: the three main ones being the more than usual amount of motion at the joints, which loosens and breaks the bonds; the use of small lengths of rail to "make-up"; and the extra trouble which is experienced in getting at the bonds for repairs, especially when the special work is the result of cross lines with the thereby heavy traffic. Carefully taken short track-drop readings generally show, when the bonding on clear runs is in fairly good condition, that most of the total drop is due to the drops across the pieces of special work (steam railroad crossings being the worst offenders) unless the ordinary special bonding is new, when the drops across special work will be less than that across equal lengths of clear track. This has been somewhat generally understood for several years; and, as a result it has been customary to lace the special work with lengths of bare wire, usually trolley wire, though in some cases galvanized wire has been used. The writer, therefore, adopted for such points a class of bonding which he terms special long bonding, the details of which will be given further on.

BANK AND BUNK RAILWAY COMPANY

Bank, Bu.

BOND TEST SHEETS

...... Test. Sheet No. ......

Tests made by..

Date..

Weather..

Preceding weather....................for....................days

Locality	Joint No.	North Track		South Track		West Track		East Track	
		N. Rail	S. Rail	N. Rail	S. Rail	W. Rail	E. Rail	W. Rail	E. Rail

FIG. 24.—REPORT SHEET

When new track is being laid, the special work and the ends of the clear runs should be connected together without the use of short lengths of rail to make-up; this is, if fifty-foot rails are being used and the distance to be connected up is sixty feet, one fifty-foot length and a 10-foot length should not be used. What should be done in such a case is to cut two thirty-foot lengths off two fifty-foot rails and use them to make-up the sixty-foot space. Short lengths, therefore, when used, should always be used on the clear runs. The special work should be extra ballasted, and the extra ballasting should be continued on under the clear runs (gradually tapering) for a short distance. It is also a good plan to use, for the top of such ballasting, a dressing of concrete. This concrete should be rammed in after the special

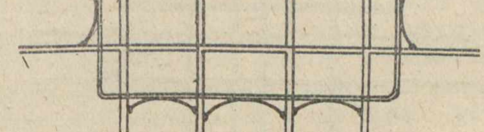


Fig. 25.—Old Method of Rail Lacing.

* Canadian Engineer, December 18, 1908, p. 896.

work and clear runs have been bolted up; and, if possible, no cars should be run over it until the concrete has set. If this work is being done on a road which is only operated during the day, the concrete should be rammed in as soon as the last car has passed, which will give it a few hours to set. This policy will reduce the joint-motion at these points to a minimum; and it is absolutely necessary that the special work should be carried out in a very substantial manner when it is the result of a steam railroad crossing.

In track maintenance it is often found that the joints at certain points of the clear runs show considerable motion. At the points where repairs are found to be constantly required (evidence of which will be shown by the repeated bond tests), it will generally be found, on examination, that the trouble is due to the unstable character of the foundation soil as a result of surface or other drainage. The cure for this is to dig out the under-soil for about two and one-half ties each way, place a longitudinal tie under and attach it to the four tie ends and then fill in with stone ballast, which should be well rammed. If the motion is due to rotting sleepers (ties) as a result of soggy ground, the ties should be replaced with creosoted ones, creosoted by the vacuum process (not the superficial one); and if the conditions producing rot are extreme (alternating sogginess and dryness) the ends of the ties should, before installation, be dipped into a tank of P. & B. paint, thinned down with carbon bisulphide, a commercial quality of which can be bought by the car-boy. The use of iron ties is not recommended.

The special long bonding, which will be described in detail, consists of the laying of sufficient extra copper to act, so far as the conductivity of the return is concerned, as a factor of safety in the case of deterioration of the special work bonds. The cables used for these long bonds may be laid in concrete, and there ought to be one cable for each rail. It is much preferable, however, to use, instead of the concrete, box troughs with a minimum cross-sectional area, into which, after the top has been nearly all nailed down, melted pitch, mixed with a little tar to keep it moderately soft, is poured.

Fig. 25 illustrates the old-fashioned method of rail-lacing. while Fig. 26 represents how similar special work is provided with special long bonding.

Fig. 27, in a similar way, shows how a turnout was originally strengthened. Such a plan has, however, been proved to be exceptionally weak; and the method which should be adopted is illustrated in Fig. 28.

Where the turnout is more complicated on account of it forming the junction between two lines, the special long bonding becomes more complicated. Fig. 29 shows the old lacing method; while Fig. 30 illustrates the modern and

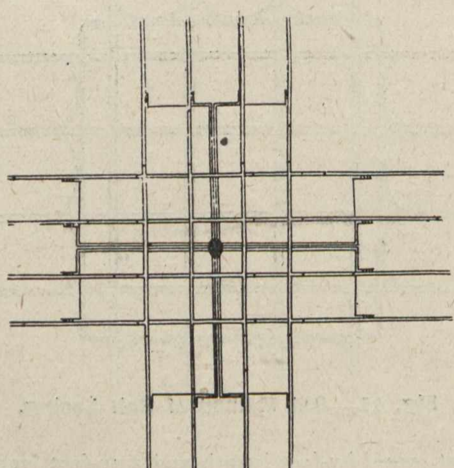


Fig. 26.—Special Bonding on Special Work.

approved plan; in which case, as will be noticed, part of the special bonding is laid to one side of the tracks. This is because it is often very difficult, when installing this work in connection with track which has been previously laid, to dig a trough near the tracks on account of the many ties. There are so many forms of special work that it is beyond the limit of an article to give all the combinations which can be worked out; but it is believed that the few examples given will assist the track engineer to understand the principle involved.

A few of the details to be observed in connection with this work are as follows:—

The cable ought to be double-braided weatherproof, with a stranded core made up of tinned wires if there is any considerable amount of soldering to be done. The size of the cables ought, according to the loads at the different points, run from 200,000 to 1,000,000 circular mils.

The terminals which are used to connect the cables to the rails are illustrated in Fig. 31, the ribbons of which should be spread out and coiled around the ends of the

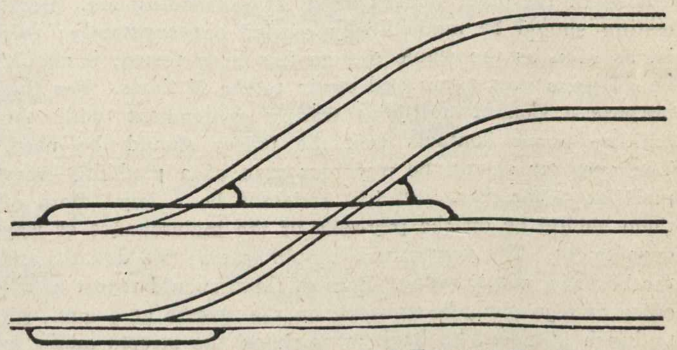


Fig. 27.—Original Method of Turnout Bonding.

cables (previously cleaned with gasoline) and then soldered by pouring melted solder over the junctions of the two. This, provided that the method of electrical welding of bonds is not adopted.

The number of rail connections at each point should vary from three to six, according to the loads to be taken care of.

All the cables at each piece of work should be bared about the middle, then cleansed, bound together and finally be sweated and covered with tape and painted with P. & P. paint.

A slight kink should be made in each cable end near to the rail contacts; and, when the contacts are made, they should receive a liberal covering of the insulating paint.

To carry out this work, the first requirement is that accurate tracings to scale should be made of each piece of special work. Blue-prints from these should be then sent to the electrical engineer, who should mark on them the sizes of the cables to be used and the price of such per foot. They should then be handed over to the track engineer. This is the man who by a little originality and patience can save a few hundred dollars. A couple of hours spent on the blue-print of each piece of work will be found to be a paying investment. When the track engineer has marked on each blue-print the points to which the cable ends are to be connected and the route which the cables must follow, it should be returned to the drawing office with any notes which may be found necessary. The drawing office should then complete each tracing, and as each one is finished send a blue-print from it to the electrical engineer, so that he may check the sizes of the cable given. When so checked, he should forward the blue-print to the track engineer, by whom it

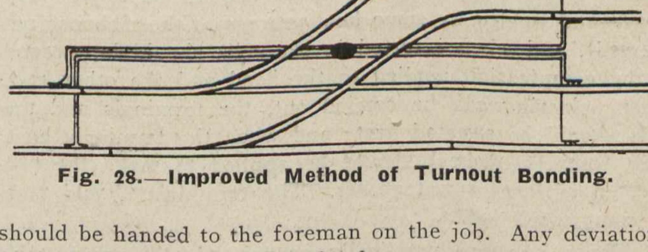


Fig. 28.—Improved Method of Turnout Bonding.

should be handed to the foreman on the job. Any deviations from the blue-prints which the foreman may find necessary should be mentioned in his daily reports to the track engineer, by whom the drawing office should be notified, so that they may make the necessary changes on tracings.

It is advisable that this work should be simultaneously installed at several points; in which case the track engineer will probably find it necessary to have an assistant to deal with instead of his regular foreman. This assistant should be a bright, active and intelligent young engineer, with two quick eyes in his head and a fine quality of gray matter behind them; in fact, an embryo expert. His remuneration should be at least $90 a month. Particularly must he keep

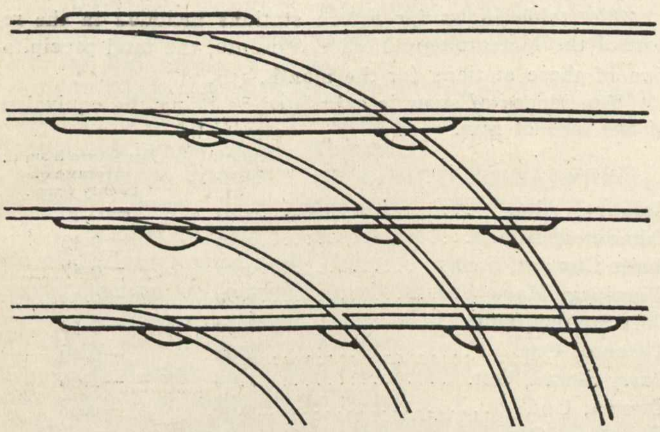


Fig. 29.—Original Method of Bonding at Junction.

his eyes on every part of the work undertaken by the bonding men. The number of men in each gang on the special long bounding will vary, according to the area covered by the special work, from six to twelve; and they should be strong and active street laborers at the highest local rate of pay. Each gang should have a boss. College technical students who are husky football players make good bosses; remunera-

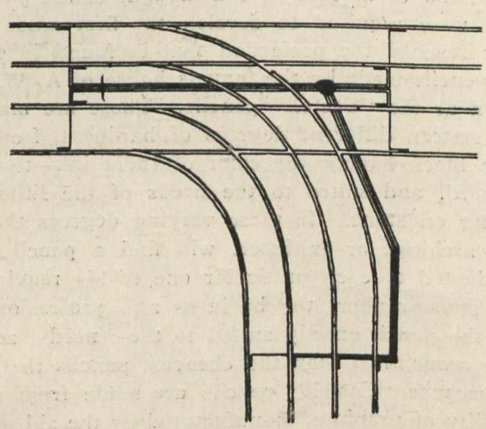


Fig. 30.—Improved Method of Bonding at Junction.

tion, $50 a month; hours, 7 a.m. to 6 p.m. Some leniency should be allowed toward the men on hot days, especially during the middle hours; and plenty of iced water, with a liberal allowance of oatmeal in it, should be provided.

As for auxiliary insulated copper (return feeders), they in the majority of cases will be found to be only necessary where the tracks converge near the power-house; provided

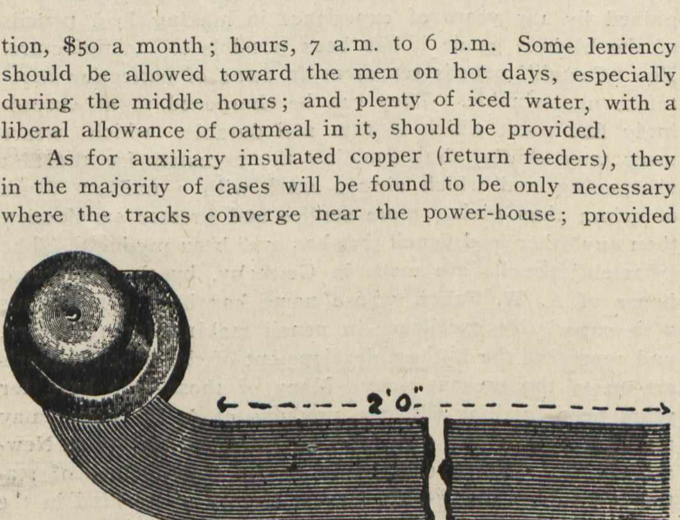


Fig. 31.—Cable Terminal.

that the ordinary and special long bonding has been carried out as has been already outlined. The cables, for this purpose, should be insulated from the low voltage side of the generators right up to the connecting points, each of which points should be the junction of the middle points of the cables used for the special long bonding of a piece of special work. Such connections, after they have been well soldered, should be plentifully taped and thoroughly painted with insulating paint. To attempt to give, even roughly, an idea of the one, two, three, four or more points that such auxiliary copper should be run to would be absurd. For the location and unmber of such points are governed entirely by the lay-out of the tracks and the special conditions of load pertaining thereto. Such work, of course, should come under the charge of the electrical engineer and be carried out either by his line or conduit department.

FORESTRY.

On an Indispensable Pre-requisite to a Successful Forestry Policy for New Brunswick..*

By W. F. Ganong.

It must be a matter of rejoicing to the members of this society that the citizens of New Brunswick, and therefore their government, have awakened to the importance of a policy of conservation of the public forests and related interests. Thus the first real step towards forest development has been taken. But the second, unfortunately is likely to prove slow and costly, namely, a realization that a forestry policy will not administer itself, and cannot be carried out by anybody to whom it happens to be convenient to turn it over. As the members of this society well know, I have spent much of my summers for some twenty years past in the woods of New Brunswick, and have penetrated, unguided, to its most remote parts, in pursuit of scientific facts about the geography and natural history of the province. I have thus had opportunity to see at first hand, and uninfluenced by those who may have special intertsts to advance, the methods, the results and the needs of administration of the public lands. Further, my interest in these matters has led me to seek information as to the ways in which they are managed elsewhere and the results of such managment. And, fiinally, I think the conclusions I have reached are as nearly disinterested as can possibly be, since my attitude towards the whole matter is abstract and scientific, and I have no personal ends, present or conceivable, to serve.

Upon this basis, and with these data, I have been led to conclusions which are briefly as follows: Our forestry interests, including therein lumbering, hunting, trapping, fishing, opening of lands for settlement, regulation of water supplies and development of water powers, provision for sportsmen-tourists, for wild parks, and for sanitoria, are capable of a vastly greater and more profitable development than they have at present; but on the other hand the conditions are so complex that their efficient development and management is only possible by the concentration of their administration in the hands of some responsible body which can combine continuity of policy, skilled knowledge, initiative experiment, executive authority and the possibility of efficient and economical business administration of details. Can anybody who knows the recent history of politics in New Brunswick and the present state of political ethics in Canada, suppose that a continuously economical and efficient administration of public utilities is possible under political management? Yet at present the administration of the forestry interests of the province is under purely political control, not only in general policy, but down to the minutest detail. Aside, however, from the purely political dangers which threaten a forestry policy, it is a fact of even greater importance that the present system of management from its very nature is prohibitive of efficient administration and development. The forest interests of the province are administered at present by the Department of Crown Lands under the Surveyor General. Now the Surveyor General, no matter how capable, devoted and upright, knows nothing of these matters when entering office and must depend upon advice of his

* Read before the Natural History Society of St. John, N. B.

subordinates. Moreover, he has little inducement to educate himself thoroughly in them since he has his own private business to absorb him, and his tenure of office is uncertain, not only because of the hazards of elections, but also because of the likelihood of the promotion to a higher portfolio. The members of the permanent staff of the Crown Land Office are so fully occupied by the regular duties of that office that leisure and opportunity for study, for observation in the forests themselves, and for travel and examination of the methods and experience of other countries is wholly excluded. Under such conditions noth'ng but a drifting policy can be expected, and a progressive policy is impossible.

Such are the conditions; now what is the best remedy? Elsewhere the executive administration of forest interests is in the hands of special bodies, either a department composed wholly of experts, as in the United States Division of Forestry, or else forest commissions employing expert assistance, as in many of the States. Taking everything into account I believe the best solution for New Brunswick conditions would be found in the appointment of a Public Lands Commission, composed of four or five eminent citizens of the province representing the different interests involved, serving without pay, but provided with a salaried expert secretary, whose entire time and energy could be devoted to the executive details of the commission's work, and to the study of forest problems here and elsewhere. The commission would thus be the executive manager of the forest business, and would suggest legislation to the legislature in whose hands of course the legislation would wholly remain. Such a plan would ensure continuity of policy, stability of administration, economy of management and adaptability to conditions based upon knowledge. Its results might not be perfect, but they would far exceed anything possible under present conditions.

PRECIPITATION FOR DECEMBER, 1908.

In the Yukon Territory, Dawson City recorded 22 inches of snow, which is exactly twice as much as the average quantity. In British Columbia the precipitation was everywhere less than usual, varying from one-tenth of an inch at Kamloops, to 1.55 inches at Victoria. In Alberta the negative departure was from 59 to 82 per cent. In Saskatchewan, in the vicinities of Prince Albert and Qu'Appelle, the snowfall appears to have been much more than the general amount, but elsewhere in the province there was a deficiency equivalent to from 70 to 88 per cent. In Manitoba the deficit was from 36 to 70 per cent. In Ontario, over Lake Superior and from the Ottawa Valley eastward, there was a marked positive departure, while in the peninsula the negative departure was equal to 2.66 inches at Parry Sound: 1.00 inch at Kingston, and less elsewhere. In Quebec the average was well exceeded, except apparently in the extreme eastern portion. Montreal recorded a positive departure of more than 2.00 inches. In the Maritime Provinces the precipitation was above the average, the positive departures varying from .40 of an inch at St. John, to 2.50 inches at Halifax.

Thickness of Ice.

Thickness of ice is reported as follows:—

Western Provinces.—Edmonton, 13 inches; Battleford, 18 inches; Medicine Hat, 12 inches; Swift Current, 20 inches; Qu'Appelle, 18 inches; Minnedosa, 16 inches.

Ontario.—Port Arthur, 8.5 inches; Bruce Mines, 11 inches; White River, 9.5 inches; Gravenhurst, 3 inches; Port Burwell, 5 inches; Lansdowne, 8 inches; Southampton, 3.5 inches; Ottawa, 6 inches.

Maritime Provinces.—Chatham, 14 inches; Charlottetown, 3.5 inches.

Depth of Snow.

At the close of the month, the ground throughout Canada was as a general rule, snow-covered, although in some sections, notably Southern Alberta, Southern Ontario, and in Nova Scotia, the ground was practically bare of snow.

The higher levels of British Columbia were probably well covered with snow, and in that portion of the Western Provinces which was snow-covered, the depth varied between 4 and 14 inches.

In Ontario the mantle of snow varied in depth from a trace in the south, to about 24 inches in the Georgian Bay and Upper Ottawa Valley. Quebec was snow-covered to a depth of from 20 inches in western districts, to 38 inches in the east. The depth of snow in the Maritime Provinces decreased from about 20 inches in Northern New Brunswick, to a trace near the Bay of Fundy.

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

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

Station.	Depth in inches.	Departure from the average of twenty years.
Calgary, Alta.	0.20	—0.40
Edmonton, Alta.	0.30	—0.43
Swift Current, Sask.	0.20	—0.47
Winnipeg, Man.	0.60	—0.33
Port Stanley, Ont.	2.40	—0.50
Toronto, Ont.	2.06	—0.46
Parry Sound, Ont.	1.80	—2.66
Ottawa, Ont.	3.90	+0.98
Kingston, Ont.	2.20	—1.00
Montreal, Que.	5.70	+2.08
Quebec, Que.	4.30	+0.70
Chatham, N.B.	3.00	—0.20
Halifax, N.S.	7.80	+2.52
Victoria, B.C.	4.90	—1.55
Kamloops, B.C.	0.80	—0.01

In these days when every man carries a lead pencil in his pocket, few of us ever give a thought to the patient efforts that were required to develop the first crude pencils until they reached the perfection that is found in the new brand of pencils made by the famous house of A. W. Faber, and known as the "Castell" pencils. These are made in a series of sixteen different degrees of hardness, from 6B—a rich, deep black having the color of India ink—to 8H, extremely hard, and suited to the needs of the lithographer for drawing on stone. In these varying degrees the artist, designer, architect or engineer, will find a pencil that is exactly adapted to each particular one of his requirements. And the stenographer, the business and professional man will find the pencil exactly suited to their needs, and actually more economical than the cheapest pencils that can be bought, because "Castell" pencils are made from the very finest quality of graphite, manufactured by the aid of chemical science and that practical knowledge which has been gained by 147 years of experience in making lead pencils of the highest grade it has been possible to manufacture. The "Castell" pencils represent an acme of perfection heretofore unattainable. They can be sharpened to an exceedingly fine point which is firm and durable, which wears away very slowly, thus avoiding the necessity for constant sharpening and which always mark with a uniform depth of color; thus giving more service and greater satisfaction than any other lead pencil that has ever been produced. The "Castell" pencils are made in Germany, by the celebrated house of A. W. Faber, whose name has been synonymous with superlative excellence in pencil making for 147 years, and represent the highest development of the pencil maker's art up to the present time. Many of those who have for years been familiar with the products of A. W. Faber may not have known that they have an extensive factory in Newark, N. J., devoted exclusively to the manufacture of stationer's rubber goods—the largest factory of its kind in the world. Here they not only make pencil and ink erasers, but all styles and varieties of rubber bands from 3/8 inch to 12 inch heavy parcel band, each of which is guaranteed to stretch six times and is actually tested to stretch twelve times its length. Wherever the name A. W. Faber appears, whether on a pencil, or on rubber goods, it is a quality mark and signifies the best of the kind that can be produced. Be sure that the name is A. W. Faber—this is the original house—the one with 147 years' experience.

ENGINEERING SOCIETIES.

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

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

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

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

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

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

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

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

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months. January 21st, illustrated lecture, "The Manchester Ship Canal," by Mr. R. Dawson Harling.

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

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, W. G. Miller, Toronto; Secretary, H. Mortimer-Lamb, Montreal.

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

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

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

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

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto. President, C. A. Jeffers; Secretary, C. L. Worth.

WESTERN SOCIETY OF ENGINEERS, 1735 Monadnock Block, Chicago, Ill.—Andrew Allen, President; meets regularly first Wednesday in each month. January 20th, extra meeting, "Steel Castings," R. P. Lamont.

SOCIETY NOTES.

Engineers' Club, Montreal.

A meeting of the Finance Committee of the Engineers' Club was held last night. There were present Mr. H. H. Vaughan, Watson Jack, Frank Thompson, Percival W. St. George, Courtlant Strange, Mr. Frank Thompson in the chair. A dividend at the rate of 4 per cent. per annum for the current year upon the paid-up capital stock of the club was declared, payable on the 15th of January instant.

Canadian Society of Civil Engineers.

The annual meeting for the election of officers and members of council for the year 1909, and for the transaction of business will be held in the Banquet Hall of the King Edward Hotel, as follows:—Thursday, 28th January, 10 a.m.—Meeting for the nomination of scrutineers, receiving the report of council, reception and discussion of reports of committees, and discussion of the general business of the society. 1 p.m., luncheon in the King Edward Hotel; 3 p.m., continuation of the business meeting for the discussion of reports, etc. Consideration of the vote in connection with the sectional divisions of the society; 5 p.m., His Honor the Lieutenant-Governor of Ontario will receive the president and members of the society, and ladies accompanying them; 7.30 p.m., meeting in the Convocation Hall of Toronto University. Address by the retiring president, Dr. John Galbraith; 8.30 p.m., the undergraduates of the Faculty of Applied Science of Toronto University will entertain the members and associate members of the society at dinner.

Friday, 29th January.—8.30 a.m.—A special train, supplied by the courtesy of the Grand Trunk Railway Company, will leave Toronto Union Station, for Hamilton, Port Colborne, and Welland. The Canadian Westinghouse Company and the International Harvester Company have invited such members of the prty as wish to visit the works of these companies, to remain in Hamilton during the day. The Canadian Westinghouse Company will entertain these members at luncheon. At Port Colborne, the party will inspect the new elevators, recently completed, and will be entertained at luncheon by the Dominion Government. The train will leave for Welland at 2 p.m., where the works of the Plymouth Cordage Company will be inspected. The party will arrive in Toronto about 6 p.m; 7.30 p.m., members' dinner in the King Edward Hotel.

Saturday, 30th January.—10 a.m.—Meeting for the reception of reports of scrutineers and concluding the business of the annual meeting. If found necessary, an afternoon meeting will be held, commencing at 3 p.m; 2.30 p.m., an informal meeting of the members of the newly-elected council.

Ontario Association of Architects.

The annual meeting of the Ontario Association of Architects was held in Toronto, Jan. 12th and 13th.

President H.B. Gordon in his address dwelt on the need of greater control over architectural work in order to prevent the erection of badly constructed buildings, vulgarly decorated, which were an offence and danger to present and future generations.

Mr. E. Burke submitted the report of the Education Committee, which advocated the system of compulsory examinations for admission to the profession.

Tuesday afternoon Mr. Walter J. Francis, C.E., of Montreal, read a paper on Re-inforced Concrete. The address was illustrated with lantern slides.

Wednesday afternoon papers by Prof. C. Francis Osborne of the University of Pennsylvania on Architectural Education, and a public illustrated address by Mr. W. A. Langton, on Styles in Architecture, were presented.

EFFECT OF TEMPERATURE ON THE SETTING OF CONCRETE.

Although it has been generally assumed that the temperature has considerable effect both on the time required by concrete for setting and on the ultimate strength of concrete, authentic information has been lacking with regard to the matter. Especial interest, therefore, attaches to the series of tests which have been undertaken by the Aberthaw Construction Co., of Boston, in the Quincy Market Cold Storage Warehouse of that city. Here ideal conditions are presented for experiment through a wide range of temperatures. In all tests so far conducted the material, including the water used in the samples, was left for twenty-five hours in the room, where the temperature was above freezing. The samples were made up in this room and left there until the time for testing, when they were covered up so as to preserve the same temperature, taken to the laboratory and immediately tested. The result, with the cement chemists' comment, follows. All samples were left in air without immersion in water:—

Temperature of air and materials.	Initial set.	Final set.	Mixture	Average tensile strength in pounds per sq. in. 24 Hrs.	7 Days.	28 Days.
72°	45 min	3h-50 min	Neat	290	457	443
			1 cement, 3 sand, by weight	....	168	168
41°	45	8—00	Neat	29	514	583
			1 :3	....	189	221
34°	45	8—00	....	17	417	508
			1 :3	....	127	202
34°	(Room, 7°).		Froze solid in 10 min.	Cement soft on melting; no set.		
Sample: 24 hrs. in —7° and 24 hrs. in 72°....			Neat	....	75	....
Sample: 7 days in —7° and 24 hrs. in 72°...			No strength owing to cracks.			
Sample: 7 days in —7° and 7 days in 72°....			....	28	....	....
Sample: 7 days in —7° and 24 hrs. in 72°...			1 :3	....	29	....
Sample: 7 days in —7° and 7 days in 72°....			....	....	28	....

On this test all neat briquettes cracked badly when allowed to stand in normal temperature.

The cement chemist, Mr. H. L. Sherman, states in his report that in the two coldest rooms, at six degrees and seven below zero F., the cement froze very quickly, and when the briquettes were removed from the cold room to the temperature of this laboratory they thawed out and were fairly soft again. These briquettes showed no strength on thawing, but some were allowed to stand for different times in this temperature, with the results indicated on the report sheets. Other results are to follow on briquettes made for a longer period.

It is very interesting to note that the temperature of 41° seems to give the best results, even at seven days.

It appears that this better strength at the lower temperatures may be due to the slower rate of evaporation of the water, and hence to giving the cement its ideal condition in connection with water for a longer time. Of course, where the water was frozen this does not apply. This theory is borne out by the fact that the percentage increase is greater on the 34 degree tests than on the 41 degrees.

ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

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

5746—October 13—Authorizing the T.H. & B. Ry. Company to construct a farm crossing where its railway abuts the lands of Henry New, being parts of Lots Nos. 5 and 6, Con. 3, Tp. of Barton, Co. of Wentworth, Ont.

5747—November 21—Authorizing the Ingersoll Telephone Company to place its wires across the tracks of the T.L.E. & P. Ry. on Charles Street West, Ingersoll, Ont.

5748—November 28—Approving "Form MX 27" and "Form MX 70" of the Maritime Express Company, and permitting the same to be used until the 1st June, 1909, upon and subject to the terms contained in Order of December 19, 1907.

5749—December 3—Extending for a period of 3 months from the date of Order, the time during which the C.N.O. Ry. Co. may use for construction purposes the crossing of its line with the G.T.R. spur line to Edward's Mill, at Rockland, Ont.

5750—December 3—Authorizing the G.T.P. Ry. Co. to close the road allowance in Sections 8 and 9, Tp. 26, R. 12, West of the 2nd Mer. and between Sections 4 and 5 and 8 and 9, Tp. 26, R. 12, West of the 2nd Mer.; and to open in lieu thereof the new roads in Sections 4, 5, 8, and 9, Tp. 26, R. 12, West of the 2nd Meridian.

5751—December 3—Dismissing application of the town of Port Arthur for an Order authorizing it to construct under the C.P.R. tracks, Port Arthur, a flume for the purpose of generating additional power at the power house for the applicant, on the shore of Thunder Bay.

5752—December 3—Authorizing the Commissioners of the Transcontinental Railway to take a portion of the lands of the Temiscouata Ry. in the town of Edmundston and partly in the Parish of Madawaska, N.B.

5753—Dec. 3—Dismissing application of C.P.R. Co. for an Order directing Messrs. McIntosh & Gullett so to construct a trestle over the siding at their premises at North Toronto that there will be at least a clear headway of seven feet between the top of the highest freight car used by the applicants and the lowest beams of the trestle.

5754—Dec. 3—Amending Order of the Board No. 5568, dated November 3rd, 1908, re inspection of electric bells at highway crossings, by adding after the word "is," in the fifth line, the words, "or other employee of the railway company specifically charged with such duty by the company."

5755—Dec. 3—Dismissing application of the Township of Grantham, District of Arthabasca, Que., for an Order authorizing it to cross the C.P.R. near Drummondville, Que.

5756—Dec. 3—Authorizing the Bell Telephone Co. to place its wires across the tracks of the W.E. and L.S.R. Ry. Co. at the private right-of-way at C.P.R. and Gravel Road, south-east of Windsor, Ont.

5757—Dec. 3—Rescinding Order of the Board No. 5512, in re application of the Grand Valley Ry. Co. to cross the track of the B. and H. Electric Ry. in the city of Hamilton, Ont.

5758—Dec. 3—Authorizing the C.P.R. Co. to construct its branch line across Alder Street, Vancouver, B.C.

5759—Dec. 3—Authorizing A. Broder, Morrisburg, Ont., to lay a two-inch water pipe under the track of the G.T.R. on Church Street, Morrisburg, Ont.

5760—Dec. 3—Dismissing application of the Ingersoll Telephone Co. for leave to erect a cable across the tracks of the T.L.E. and P. Ry Co. in the town of Ingersoll, Ont.

5761—Dec. 3—Authorizing the C.P.R. Co. to construct its railway across Park Street, in the city of Nelson, B.C.

5762—Dec. 3—Authorizing the G.T.P. Ry. Co. to construct its railway across certain highways in the Province of Manitoba and certain streets in the city of Winnipeg, Man.

5763—Nov. 23—Authorizing the town of Oshawa, Ont., to lay a water main under the tracks of the Oshawa Ry. Co., between Albany Street and First Avenue, Oshawa, Ont.

5764—Dec. 4—Authorizing J. P. Gordon, Portage la Prairie, Man., to lay a six-inch and eight-inch water main under the tracks of the C.N.R. at Gaddy Street, Portage la Prairie.

5765—Dec. 4—Authorizing J. P. Gordon, Portage la Prairie, to lay two water mains under the tracks of the C.N.R. where same crosses Main Street, Portage la Prairie.

5766—Dec. 3—Authorizing the Government of Alberta Telephone to place its wires across the tracks of the C.P.R. 2¼ miles west of Tabor, Alta.

5767—Dec. 3—Amending order No. 5669 by extending the time to January 1st, 1909, within which Supplement 4 to Canadian Classification No. 13 shall become effective.

5768—Nov. 30—Approving contract forms of the Pacific Express Co., and granting leave to the Pacific Express Co. to use said forms until the 1st day of June, 1909.

5769—Dec. 3—Authorizing the International Portland Cement Co. to construct a subway under the tracks of the C.P.R. in the city of Hull, Que.

5770—Dec. 3—Authorizing the Government of Alberta Telephones to place its wires across the tracks of the C.P.R. at mile post 84.

5771—Dec. 3—Amending Order No. 5672 by substituting mileage 0.00 to 188.77 for mileage 0.5 to 188.2 where it appears in said order.

5772—Dec. 3—Dismissing application of the Township of Tilbury, Kent County, Ont., for an Order approving plans of the "King & Whittle Improvement Drain" across the C.P.R. between Lots 14 and 15, Con. 4.

5773—December 3—Authorizing the C.N.R. to construct a branch line in the city of Brandon, Man., to a point on the line of the Morris-Brandon Branch of the Manitoba Railway Company, in Block 39.

5774—December 3—Granting permission to the Vancouver, Victoria & Eastern Railway and Navigation Company to make competitive tariffs for the carriage of freight traffic on certain routes described in the Order.

5775—November 30—Extending until June 1st, 1900, the time within which the contracts, by-laws, etc., of the National and American Express companies may continue in use and have effect.

5776—December 3—Granting permission to the Toronto Electric Light Company to rearrange the wires and install tile ducts under the C.P.R. tracks and G.T.R. tracks on the Esplanade, at the foot of Scott Street, Toronto.

5777—December 3—Authorizing the city of Winnipeg to place electric light wires across the track of the C.P.R. to reach pumping station No. 6.

5778—Dec. 3—Dismissing application of Jas. Overend & Son, of Ninette, Man., alleging that the rates charged by the C.N.R. on freight shipped from Winnipeg were excessive.

5779—December 4—Authorizing J. P. Gordon, Portage la Prairie, Man., to lay water mains under the C.P.R. tracks on Main Street, Portage la Prairie.

5780—December 4—Authorizing J. P. Gordon to lay water mains under the tracks of the G.T.P. where the same crosses Main Street, Portage la Prairie.

5781—December 4—Authorizing J. P. Gordon, Portage la Prairie, to lay water mains under the tracks of the G.T.P. Railway on Gaddy Street, Portage la Prairie, Man.

5782—May 18—Authorizing the G.T.R. Company to construct a branch line of railway to the premises of the Knechtel Furniture Company, Hanover, Ont.

5783—December 1—Directing the C.P.R. Company to clean out and put in good order all the ditches leading to and from culvert No. 89.9, as far as station 31+18, near Crookston, Ont.

5784—December 7—Dismissing application of the Government of Alberta for an order to place wires across the tracks of the C.P.R. at the Experimental Farm, 3 miles east of Lethbridge, Alta.

5785—December 8—Authorizing the C.P.R. Company to construct a branch line of railway or siding connecting with a siding already constructed for the Dominion Government coal shed.

5786—December 8—Rescinding Order No. 5511, dated 14th July, 1908, granting leave to the Grand Valley Railway Company to cross the tracks of the T. H. & B. Railway Company in the city of Brantford, Ont., provided crossing be protected by a half-interlocker.

5787—December 8—Authorizing the Cataract Electric Company, Limited, to place its wires across the tracks of the C.P.R. in the Township of Caledon, County of Peel, Ont.

5788—December 8—Authorizing the C.P.R. Company to construct a branch line of railway, or spur, to the premises of the Sherbrooke Machinery Company, Sherbrooke, Que.

5789—December 7—Dismissing application of the G.T.R. fo ran order extending time for the construction of the branch line and station authorized to be constructed by Order 2,333, dated December 16th, 1906, between the G.T.R. main line east of Port Hope viaduct and a point on the northern division of its line north of Ontario Street, Port Hope, Ont.

5790—December 7—Dismissing application of the Hawthorn Hill Rural Telephone Company, for leave to erect, place wires across the tracks of the G.T.R. in the 2nd concession of the Township of Minto, County of Wellington, Ont.

5791—December 7—Dismissing application of the Hawthorn Hill Rural Telephone Company to place its wires across the tracks of the G.T.R. on the 4th concession, Township Minto, Ont.

5792—December 7—Dismissing application of the Hawthorn Hill Rural Telephone Company to place its wires across the G.T.R. tracks on the 2nd concession, Township Minto, Wellington County, Ont.

5793—December 7—Dismissing application of the Hawthorn Hill Rural Telephone Company to place its wires across the G.T.R. tracks on the 4th concession of Minto, Wellington County, Ont.

5794—December 7—Dismissing application of the G.T.R. Company for an order varying Order No. 2,757, dated March 27th, 1907, authorizing the construction of a branch line between Caldwell and Penetanguishene, Township of Tiny, Simcoe County, Ont.

5795—December 7—Dismissing application of the G.T.R. for an order varying Order No. 2,759, dated March 27th, 1907, by extending the time for the construction of the branch line between Orillia and Midland, near Tiffin, Ont.

5796—December 7—Dismissing application of the city of Toronto for an order to vary order of the Railway Commission of the Privy Cuncil, dated March 11th, 1902, respecting the protection of Dowling and Dunn Avenues, Toronto.

5797—December 7—Directing the Pere Marquette and G.T.R. companies to put in effect on grain, C. L. Walkerville Elmstead, 3¼c.; to Belle River, 3¾c.; to St. Joachim, 4c.; Haycroft, 4¾c.; and Tilbury, 4¾. per 100 lbs.; minimum, 40,000 lbs. car, including delivery on transfer siding of Pere Marquette and G.T.R. at Walkerville; C.P.R. to absorb one-half switching charge of the G.T.R., the Pere Marquette agreeing to bear its proportion of such absorption upon the basis of the division of the through rate with the C.P.R.; the consignee to bear the remaining half of said switching charge.

PATENTS.

Below will be found the only complete weekly up-to-date list of patents recently granted to Canadian inventors in Canada and United States, which is furnished by Messrs. Fetherstonhaugh & Company, Barristers, Solicitors, etc. Head office, Royal Bank, 10 King Street East, Toronto. Offices in Montreal, Ottawa, Winnipeg, and Vancouver, in Canada and Washington, D.C., from whom all information may be readily obtained.

Canadian Patents.

G. M. Harris, Springfield, Ont., fuel saving steam generators; T. W. Hyde, Guelph, Ont., pattern attachment for casting drip channels in cement sills, cornices, and other such like articles; W. G. Ross, Montreal, Que., pay-as-you-enter-cars; J. C. Tarwood, Brockville, Ont., machine for molding blocks; R. F. Allmann, Hamilton, Ont., brick machines, N. Proulx, Ottawa, Ont., snow loaders; W. Northrop, Toronto, Ont., fishing rod; J. R. Ayotte, Montreal, Que., electric water heaters; T. L. Wilson, Ottawa, Ont., signal lights; B. A. Perry, Toronto, Ont., water controlling machinery.

United States Patents.

W. Cross, Winnipeg, Man., snow and ice scrapers; J. Lemire, Drummondville, Que., combination and management of electric circuits and their application to railway signalling systems; F. J. Watkinson, Strathroy, Ont., combined automatic duster and brake for iwdnow blinds and sades; J. T. Clark, Montreal, Que., automatic nut lock; H. Corregan, Whitemouth, Man., chimney and smoke stack; N. Lang, Vancouver, B.C., automatic railway alarm; R. Sampson, Montreal, Que., rubber lather; E. J. Thompson, Ottawa, Ont., carbureter.

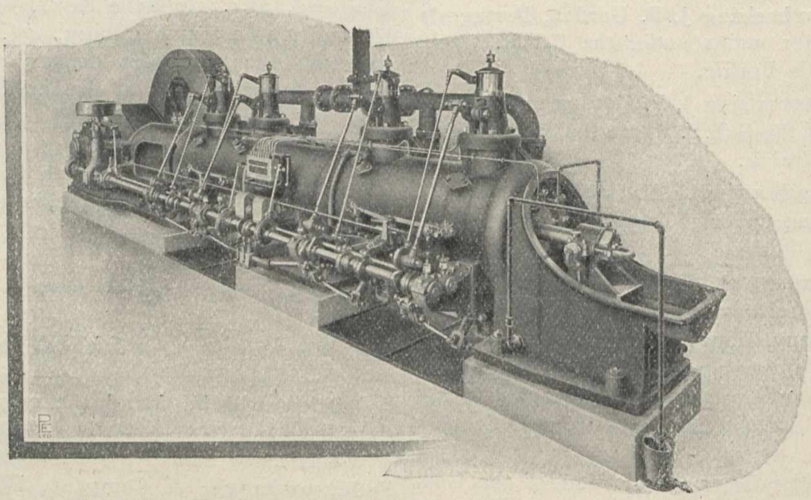
PRODUCER GAS ENGINES.

The Goldie and McCulloch Co., of Galt, has recently acquired the Canadian rights to the gas engine patents of Mr. L. F. Burger, of Beloit, Wis., and has designed a type of engine embodying the essential features of these patents. This company is widely known as builders of high-grade steam engines, and their wide experience in this class of work is evident in their gas engine design, so that the poor mechanical features so noticeable in most gas engines are not present.

The cylinders, frame, crosshead, connecting-rod and shaft have been built with a thorough knowledge of the strength of the various materials and the strains they are called on to stand, and at the same time the easy accessibility of parts is accomplished.

The special valve gear and governing devices are the result of many years' experience on the part of the inventor, and this, combined with the mechanical and engineering experience of the Goldie & McCulloch Co. has produced an engine that is in marked contrast to most engines now on the market.

As will be seen from the illustration this is a two-cylinder tandem double-acting engine, a type now generally adopted for high-power engines, as it has the advantage of obtaining power from four cylinders' ends without any increase in the size of frame, shaft or pins, and at the same time gives two impulses every revolution, a condition necessary to successfully run direct-connected alternating current electrical generators in parallel without the use of the enormous flywheels compulsory with single acting engines.



Valve Gear.—One of the most important features of the engine is the method of admitting the gas and governing the quantity. The governing is done by admitting suitable quantities of a constant mixture. This mixture is admitted through an auxiliary valve, whose time of opening is controlled by the governor. The valve is placed directly over the main inlet valve. The main inlet valve opens slightly before the piston reaches the end of its stroke, and admits free air to the cylinder, producing a scavenging effect. The auxiliary inlet valve is afterwards opened where determined by the governor, and closes at the end of the stroke. Variable quantity with constant compression is thereby obtained. The governor used is the celebrated "Rites inertia governor," which is particularly adapted to taking care of sudden changes of load with a minimum change in speed.

The main inlet and exhaust valves are of the mushroom type, with removable seats in water-cooled cages.

The main valves are operated from a cam shaft fitted with cams engaging with rollers on the ends of the valve rod levers. These cams and rollers are designed to give accurate timing to the valves, and have large wearing surfaces. The auxiliary valves are operated from a supplementary cam-shaft running parallel to the main cam-shaft and connected to it and the governor through a "floating" gear arrangement.

The pistons and rods are water cooled, and are supported by the main crosshead, and also intermediate and tail crossheads, thus keeping the weight of the pistons off the bottom of the cylinders and giving the packing and lubrication every chance to be effective. The lubrication of the pistons is effected by a positive feed oil pump, which is so arranged that the drop of oil can be delivered to the interior of the cylinder at exactly the right moment. The piston rod packing is metallic, of a design that has proved its worth on some of the largest engines built in America, and is extremely simple, and if properly installed and cared for should last indefinitely.

The cylinders are water jacketed, and the jacket is provided with a large number of manholes, which give easy access for cleaning out should the circulating water be of such a nature as to leave a deposit.

The frame-connecting piece between the cylinders and the tail crosshead support are heavy castings, with the metal properly distributed to carry the strains. The peculiar design of the cylinder connecting casting, with its large opening and removable strut, gives a most convenient access to the intermediate crosshead and cylinder covers. The frame is provided with a crosshead of large diameter, which enables the front cylinder cover and piston to be removed without disturbing the crank shaft, and the crank shaft is supported by a main bearing on each side of the crank pin, thus distributing the strains evenly about the centre line of the engine, and providing enough bearing surface to keep the unit pressure within safe limits for continuous service. The main bearings are provided with wedge adjustment.

The crank shaft is made from a solid steel forging, and is very liberal in its dimensions, and besides the two main bearings is provided with a large adjustable self-oiling outer bearing on the flywheel side. The crank carries counterweights of sufficient weight to properly balance the engine.

The starting device is extremely simple, and automatically admits compressed air to the two inner cylinder ends, so that these can be used to start the engine, and when well started gas can be admitted to the two outer ends and got under working condition, when the air can be shut off and the other two ends started firing.

The igniter mechanism is of the make-and-break type, and the timing of the spark is adjustable by hand when the engine is running. The engine is provided with two magnetos for supplying the current when the engine is up to speed, and a double set of batteries and spark coils for starting.

The water circulation is well arranged, so that each part can be given just the amount of water required. Discharge funnels are provided on all outlets, so that the operator can feel the temperature of the discharge water.

The engines are designed to run on natural, illuminating or producer gas.

The Goldie & McCulloch Co., Limited, are prepared to furnish producers with their gas engines which are to run on producer gas. These producers are built under Burger patents, and combine all the high-class features which are the result of the designers' long, practical experience in this class of work.

The generator is not provided with any grates, but the fire is built upon a bed of ashes, which rests on the foundation. The ashes can be removed at any time through the water seal without opening up the generator, and this feature makes it possible to run the producer continuously without any interruption whatever.

The vaporizer is in the shape of a shallow pan, placed directly over the fire at the top of the generator, and steam is admitted by a down pipe through a central tuyere casting with umbrella top. The sides of the generator lining are vertical, which allows the fire to be easily poked and eliminates any danger of "bridging." The vent valve is so arranged that when the engine is running the opening to the stack is water sealed. The scrubber is of the "wet" type, and a sufficient expansion tank is provided to keep the draft approximately constant.

AUSTRALIAN RAILWAYS.

The Victorian (Australia) Railway Commissioners, of which Mr. Thomas Tait, formerly of the Canadian Pacific, is chairman, has issued its statement for the year ending June 30th:—

Gross revenue	$18,849,745
Working expenses (including payment into Railway Accident and Fire Insurance Fund)	11,124,318
Net revenue	$ 7,725,427
Less deficit—St. Kilda and Brighton Electric Street Railway	19,101
Total net revenue	$ 7,706,326

The railways whose length is given as 3,401 miles, represent a capital charge of some $210,000,000 (£41,986,090), have now been under control of a commission for five years. The following table shows the improvement:—

	Last five.	Preceding five.
Gross revenue	$90,974,521	$76,167,484
Working expenses	48,835,532	45,544,907
Net revenue	$42,138,989	$30,622,577
Special expenditures and charges in liquidation of extraordinary liabilities	3,398,715	781,706
Balance of net revenue	38,740,274	29,840,872
Interest charges and expenses	36,095,984	35,688,837
Surplus credited to consolidated revenue	2,644,290	....
Deficit paid out of consolidated revenue	....	5,847,965
Traffic train mileage	48,007,400	52,459,079
Number of passengers carried	324,149,961	262,105,154
Tons of goods carried	16,942,845	14,445,830
Tons of live stock carried	1,521,265	1,241,705
Percentage of working expenses to gross revenue	53.68	59.80

These figures show increases of $14,807,000 in gross revenue, of $3,290,625 in working expenses, and $11,516,412 in net revenue. The deficit paid out of the treasury to meet the interest charges of the road, which was $5,847,965 in the early five years, was changed into a surplus to reduce taxation in the latter five years of $2,644,290.

RUBBER ASPHALTE PAVEMENTS.

The American Consul-General at Marseilles, France, has reported on the experiments carried on in that country for the last six years with rubber asphalte pavements. The success of this pavement in cities like Paris and Lyons has made it a competitor with the usual asphalt pavement.

At the present time most asphalte paving involves the use of costly installations for the heating of the powder, a considerable amount of material, and a special class of laborers, all of which tend to increase the cost. Under the new process it is possible to make cold applications of asphalte, which are said to possess all the advantages of hot compressed asphalte without its drawbacks.

The material used in a product resulting from the association of asphalte and rubber. Asphalte is a carbonate of lime impregnated with bitumen, with which rubber combines under certain conditions, thus effecting the cohesion of the calcareous molecules. This product is claimed to be more plastic and more adhesive than pure asphalte, and to be able to resist higher temperatures. To obtain the combination of bitumen and rubber they must be energetically mixed in special devices, in which the asphalte, reduced to fine powder, is in the presence of rubber swelled and softened by a solvent. The material thus obtained is a brown powder darker than the original asphalte, and it suffices to compress it in order that it shall set and harden rapidly.

It is alleged that when asphalte is applied hot, the heat of the application coming into contact with a concrete foundation containing more or less humidity vaporises the water contained therein, and the steam, by its force of expansion, escapes, thus destroying the compactness of the combination. This inconvenience does not present itself in the new system, which permits the application of a much thinner layer of asphalte and one which unites itself with the concrete, constituting a solid mass. The observations of this form of pavement, according to the Consul-General, satisfy those interested in the subject that its completed surface resists ordinary wear more satisfactorily than any other.

Rubber-asphalte must be applied upon a foundation of first-class concrete, consisting of 440 lbs. of good Portland cement and one cubic meter (35.31 cubic feet) of pebbles and sand, the proportions being one-third of sand to two-thirds of pebbles. The thickness of the foundation should vary from 15 to 20 centimeters (5.90 to 7.87 inches), and it should be rammed with the back of shovels used in this work, and given and given the exact form which the roadway is intended to have, without the necessity of making later additions of concrete to bring the surface to its proper proportions. The surface of the concrete should be regular, so that the layer of asphalte may have a uniform thickness. This foundation should remain three to five days, according to the season, until it has acquired sufficient hardness to support the ramming of the layer of asphalte. The surface of concrete having been well cleaned, is covered with a thin coating of special material, which is laid on with a brush upon which the rubber-asphalte powder is lightly sprinkled. Shortly after these preliminary operations the uniform layer of rubber-asphalte powder is spread to a thickness of 3.5 to 4 centimeters (1.37 to 1.57 inches), which is compressed progressively by means of a rammer. This done, the surface may be opened immediately to travel. It is said that by this process the top dressing of asphalte, when laid on hot, may be one-half the thickness necessary when the asphalte is laid on cold. The making of this new pavement is covered by a patent.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

Notice is given that under the provisions of The Dominion Lands Surveys Act, the Board of Examiners for Dominion Land Surveyors will meet at Ottawa on Monday, the eighth day of February next, for the examination of candidates for admission as articled pupils, for Commissions as Dominion Land Surveyors, or for certificates as Dominion Topographical Surveyors. Examinations will be held at Ottawa and Toronto, in the Province of Ontario, at Halifax, in the Province of Nova Scotia, at Winnipeg, in the Province of Manitoba, at Calgary and Edmonton, in the Province of Alberta, and at Vancouver, in the Province of British Columbia.

F. D. HENDERSON,
Secretary of the Board of Examiners
for Dominion Land Surveyors.

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.

Ontario.

TORONTO.—Public notice is hereby given that the time for receiving tenders for the supply of asphalt required by the city of Toronto for the year ending December 31st, 1909, has been extended to Tuesday, January 19th, instant. Tenders will be received by registered post only, addressed to the chairman of the Board of Control. Joseph Oliver (Mayor), Chairman Board of Control. City Hall, Toronto.

TORONTO.—Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, January 19th, 1909, for the following sewers: Gerrard Street, from Carlaw Avenue to Pape Avenue; Marlborough Avenue, from Avenue Road to Sidney Street; Sidney Street, from Marlborough Avenue to Cottingham Street. Tenders will also be received for 800 feet of rubber fire hose for flushing sewers. Joseph Oliver (Mayor), Chairman Board of Control.

CONTRACTS AWARDED.

Quebec.

MONTREAL.—The Water Committee decided to award the contract for a steel flume, with a sluice gate, to the John McDougall Co. for $1,639. The two large sluice gates, about nine feet in diameter, for the new water conduit were given to the Coffin Valve Co., of Boston, for $2,556. Both tenders were the lowest. Some thirty-inch and thirty-six-inch gate valves were divided up between Drummond, McCall Co. and the Canadian Fairbanks Co.

Ontario.

PORT ARTHUR.—The contract for the new house of the Thunder Bay Elevator Co. has been given to Barnet, McQueen Co., of Fort William. The contract price is $550,000, which includes the cost of site and all trackage. The capacity of the new elevator will be 1,500,000 bushels, and it will be constructed with a view of the fastest possible handling of grain, and will be able to unload 200 cars every ten hours, and to load into vessels at the rate of 50,000 bushels an hour. It will have three unloading tracks, each with a capacity of three cars, and will have nine interlocking pits, each with a capacity of 2,000 bushels. All the handling machinery will be of the latest design, and the tanks will be reinforced concrete. The contract calls for the completion of the whole plant ready for operation on September 15th next, in order that it may be ready for the crop of the present year. The officers of the Thunder Bay Elevator Co. are: President, W. H. McWilliams; vice-president, G. R. Crowe; secretary-treasurer, Clarence Piper.

Manitoba.

WINNIPEG.—The contract has been let for another big terminal elevator at the lake front. This is the new house of the Thunder Bay Elevator Co., Limited, which is to be erected 1,000 feet west of the Atikokan Iron Works' plant at Port Arthur.

WINNIPEG.—The Manitoba Iron Works, Limited, has received the contract for all the cast iron columns, amounting to over 200 tons, for the new Eaton buildings and extensions to be erected in the spring.

WINNIPEG.—Last week we gave the list of successful tenders, with prices, for the Point du Bois work. Herewith is a list of tenders received: General works—William Newman, $771,850; John Gunn & Sons, $779,100; Haney, Quinlan & Robertson, $785,150; Power Construction Department, $816,806; Thos. Kelly & Sons, $883,679; Hydraulic Contracting Co., $905,444. Transmission system erection—Power Construction Department, $89,680; Thos. Kelly & Sons, $111,435; R. McManus & Co., $182,892. Cable for transmission line—Northern Aluminum Co., aluminum cable, $148,050; Thos. Kelly & Sons, aluminum cable, $157,500; Eugene Phillips, copper cable, $219,710; Dominion Wire Manufacturing Co., copper cable, $222,250.

Foreign.

BOSTON, MASS.—The Converse Rubber Co., recently organized, of which Mr. M. M. Converse is president, has placed a rush contract with the Aberthaw Construction Co., of Boston, for the building of their fireproof building in Malden. The new building will be erected next the B. and M. Western Division tracks, near Edgeworth Station. The floors and interior columns and stairs will be of reinforced concrete. The exterior columns and roof trusses will be of steel and the walls of brick. The foundations for this building are nearly completed, and the work is to be pushed through with all despatch. The building will be fireproof, modern and up to date.

SEWERAGE AND WATERWORKS.

Quebec.

RIMOUSKI.—At a cost of somewhere in the vicinity of $600, Rimouski has just succeeded in getting its water supply increased twenty per cent. Messrs. Ouimet & Lesage have submitted their final report on the work, and entire satisfaction was the result. The town formerly drew some 266,000 gallons per day from its supply situated about six miles distant. It now draws about 320,000 gallons per day and is ensured of an ample supply for some time to come.

Ontario.

LONDON.—James Peat & Sons, drilling contractors of Petrolea, completed on December 31st, an eight-inch water well in this city and were successful in securing an excellent supply, which being tested pumped close on to 200,000 gallons in twelve hours. The water when analysed was found to be purer than the spring water used by the city and very much softer. The well was put down by a number of prominent and enterprising citizens, including the Hon. Adam Beck, to prove to the Water Commissioners that the much-needed addition to the present water supply could be easily and cheaply secured from artesian wells. As a result of the success with this well, the water by-law to spend $441,000 on extending the present spring water system was overwhelmingly defeated by the citizens on the first of January. The contractors have since been instructed to proceed immediately to drill a 12-inch well in the same neighborhood and the result is awaited with considerable interest.

Manitoba.

WINNIPEG.—The City Engineer has been asked to prepare a report showing cost of building a trunk sewer to carry sewage into the Red River, and thus avoid using the Assiniboine River for sewage disposal.

Saskatchewan.

SASKATOON.—Mr. Willis Chipman has been retained by Saskatoon until August, 1909, as consulting engineer in connection with waterworks and sewage works.

TELEPHONY.

Quebec.

MONTREAL.—The G.T.R. has decided to put the telephone on its single track for despatching purposes in place of the telegraph. This is the first time this road has tried it. The C.P.R. has at least 250 miles in operation, and purposes extending it. There are about ten thousand miles of telephone despatch in the United States.

Foreign.

ST. PAUL, MINN.—The Great Northern Railway has recently adopted the telephone for train dispatching on several of its divisions. On the Willmar division the line, 203 miles in length, has been completed and put into operation. Another line between Devil's Lake and Williston, North Dakota, 238.8 miles in length, is under construction, and the extension of this system over 944.2 miles of additional road is under consideration. These future extensions cover the following districts:—Williston to Cut Bank, Havre to Butte, Great Falls to Virden, Great Falls to Great Northern Junction, Gerber to Sand Coulee and Stockett. The total mileage, therefore, including that in contemplation, is 1386. The Union Pacific R.R. has been installing a telephone system between North Platte and Sidney, 123 miles, which is about to be put into operation.

RAILWAYS—STEAM AND ELECTRIC.

New Brunswick.

MONCTON.—The municipality of Moncton will apply at the coming legislature for power to construct and operate an electric street railway in the city of Moncton and in the parishes of Moncton and Shediac, to lease such railway and to grant the right to construct and operate such street railway to any other person or persons upon such terms as shall be approved of by the city council from time to time and to generate, use, sell or supply electricity for the purposes of such street railway. John S. McGee, City Clerk.

Ontario.

COBALT.—The Cobalt Range Railway Company gives notice of an application for an act to extend its line from Haileybury to Elk Lake and thence to Gowganda Lake; also to extend its line from Ville Marie to Opasitica Lake, and thence to the Transcontinental Railway.

COLLINGWOOD.—The Collingwood Southern Railway Company are applying to Parliament for an act extending the time within which it may construct the lines of railways which it has been authorized to construct by section 8 of chapter 77 of the Statutes of Canada of 1907.

KINGSTON.—Recently it was announced that the Grand Trunk Pacific Railway had placed an order for 25 locomotives with the Canadian Locomotive Company, Kingston, Ont. Herewith we give the principal dimensions and equipment of these locomotives:—

Engine.

Gauge—4 ft. 8½ inches.
Type of engine—Simple Mogul.
Fuel used—Bituminous coal.
Weight in working order, drivers—138,176 lbs.
Weight in working order, total—161,976 lbs.
Wheel base of engine, rigid—15 ft. 8 inches.
Wheel base of engine, total—24 ft. 3 inches.
Wheel base of engine and tender—53 ft. 10 inches.
Length over all, engine and tender—64 ft. 11½ inches.
Width over all, engine and tender—10 ft. 0 inches.
Height over all, engine and tender—15 ft. 2 inches.
Heating surface, fire box— 188.1 sq. feet.
Heating surface, tubes—1,688.5 sq. feet.
Heating surface, total—1,876.6 sq. feet.
Diameter of driving wheels—63 inches.
Material of driving wheels, centres—56 inches diameter, main, cast steel, other cast-iron.
Diameter and length of driving journals—9½ in. x 12 in.
Diameter of cylinders— 20 inches.
Stroke of cylinders—26 inches.
Type of boiler—Radial stay, extended wagon top.
Working pressure of boiler—200 lbs.
Number of tubes—271.
Diameter of tubes—2 inches.
Length of tubes—11 ft. 11 inches.

Injectors—Hancock.
Safety valves—"World."
Brakes—Westinghouse E. T.
Kind of packing—U. S. Multiangular.

Tender.

Weight of tender, loaded—143,300 lbs.
Capacity of tank in gallons—7,000 U.S.
Style of tank—Water Bottom.
Coal capacity—10 tons.
Style of truck—4-wheel, cast steel bolster.
Diameter of wheel—34 inches.
Kind of wheel—Steel tired, cast iron centre.
Diameter and length of journal—5½inch x 10 inch.
Brake beam—Steel, G.T.R. type.

TORONTO.—The Abitibi and Hudson Bay Railway Company are applying to Parliament for an act extending the time within which it may construct the railway which it has been authorized to construct by section 7 of chapter 55 of the Statutes of Canada of 1907.

TORONTO.—Toronto, Niagara and Western Railway Company are applying to Parliament for an act extending the time for the commencement and completion of the railways of the company, viz.: Toronto to Niagara Falls, Toronto to Windsor, St. Catharines to Port Colborne and increasing the bond issue.

TORONTO.—The Ontario Railway and Municipal Board Jan. 5th, ordered the payment of the cash subsidy and the handing over of the land bounty on 122 miles of Grand Trunk Pacific Railway completed from West Fort William northwest, the total issue being $248,000 and 66,000 acres.

Manitoba.

GIMLI.—R. D. Fry, of the Hudson Bay Railway surveyors, and Messrs. E. Morrier and Frank Peters, of the Dominion Survey, Ottawa, who have been surveying in the far north for the past year, reached here January 5th, from Fort Churchill, covering the 1,100 miles in the 45 days by dog train.

WINNIPEG.—The Great Northern Railway is advertising in the Manitoba Gazette certain applications for charters and incorporations, which indicate that the company is preparing to begin active construction in Manitoba to connect up the scattered links of its future system. The road is supposed to be in Winnipeg by midsummer next. The Northern Pacific will be associated with the Great Northern in the enterprises.

Alberta.

CALGARY.—Mayor Jamieson and City Commissioners Clarke and Graves are devoting their entire time to discussing the street railway proposition. They have been looking into the probable cost of the system with Chas. E. Taylor, superintendent of the Edmonton Street Railway, and Chas. S. Wright, of the Preston Car Company, of Preston, Ont. Mayor Jamieson said the ratepayers would be obliged to vote at least another $100,000 before the system could be properly and economically installed.

CALGARY.—There appears good foundation for the report that the Grand Trunk Pacific and Canadian Northern are negotiating with the Government for the purchase of the R.N.W.M.P. barracks property in this city on Eighth Avenue. The railways intend to use this property for a Union Station, the deal is likely to be closed in a few days.

EDMONTON.—An unofficial report, says that under an arrangement between Premier Rutherford, of Alberta, and the officials of the C.N.R., that company will build certain lines desired by the Provice of Alberta under a guarantee of bonds to the extent of $15,000 per mile, the Government to retain the first mortgage on the lines so constructed. Premier Scott also made Saskatchewan a partner to this agreement. The company solicited a cash subsidy, but neither Mr. Rutherford nor Mr. Scott would entertain such a proposal. About five hundred miles are to be in southern Alberta, and the company will be asked to invade the coal fields of the south, giving competition in rates.

British Columbia.

VANCOUVER.—The Pacific Northern & Omineca Railway will seek amendments to their charter giving the company power to construct, equip, operate and maintain a line of railway from the junction of the Skeena and Copper Rivers, or the vicinity thereof, in Coast districts, to the junction of the Bulkley and Telkway Rivers, or the vicinity thereof, in Coast district, in the Province of British Columbia.

VANCOUVER.—The Kettle River Valley Railway Company will seek incorporation at the next session of Parliament to operate a line of railway of standard gauge, commencing at a point at or near Midway, B.C., thence to Penticton, by the most feasible route, a distance of 120 miles, more or less; and commencing at a point at or near Penticton, on Okanagan Lake; thence to a point at or near Nicola, by the most feasible route, a distance of about 150 miles, more or less.

CURRENT NEWS

Nova Scotia.

SYDNEY.—The output of the Dominion Iron and steel plant for December was most gratifying and there is every prospect of the company maintaining the record as there are sufficient orders both domestic and foreign to keep the plant running night and day.

The output of pig iron for December amounted to 21,670 tons, an increase of 670 tons over November. The output of steel for December shows a total of 27,000 tons, an increase of 3,000 tons over the previous month. The shipments made during December show the record of 22,150 tons, while for November total shipments were 20,000 tons, being an increase in favor of last month of 2,150 tons.

New Brunswick

ST. JOHN.—Reports coming in daily add to the extent of the damage caused by the floods of Jan. 6th. One estimate is that $100,000 damage was done to Provincial Government bridges and other public works.

Quebec.

MONTREAL.—There is considerable talk already among the members of the C. S. C. E. in Montreal regarding the coming annual meeting of the Society. It is expected that a large contingent will go from here to attend the meeting and all are looking forward to having an enjoyable time.

Ontario.

BRANTFORD.—At the inaugural meeting of the City Council, Jan. 11th, Mayor Wood laid down a heavy platform, embracing market improvement, new civic and Government buildings, street paving, securing new industries, improved railway facilities, the power question and a new collegiate building. The Council organized without friction. Alderman Rastall was chosen chairman of the Finance Committee.

TORONTO.—The annual expenditure of the City Engineer's Department necessarily increases in consonance with the expansion of the city. The expenditure for ordinary works and services in 1908 amounted to approximately $3,000,000, this being the largest amount expended by the department in any one year during its history. In 1908 there were constructed 40 miles of pavements, 55½ miles of sidewalks, and 8½ miles of sewers.

SAULT STE. MARIE.—British capital to the extent of many millions is to be put into the Soo industries. Mr.

Robert Fleming of London, England, is said to represent the capitalists and Mr. F. S. Pearson of London and Nec York, it is expected, will also be associated with the work. The intention of the corporation is understood to be the extension of the Algoma Central Railway, and erection of another large industry. The corporation now controls the following industries: Algoma Central and Hudson Bay Railway Company, Manitoulin and North Shore Railway Company, Algoma Commercial Company, Limited, Algoma Iron Works, British American Express Company, Algoma Steel Company, Ltd., Lake Superior Power Company, Ltd., International Transit Company, Trans-St. Mary's Traction Company, Tagona Water and Light Company, Sault Ste. Marie Pulp and Paper Company, Michigan Lake Superior Power Company, Lake Superior Iron and Steel Company. The total number of men engaged at Sault Ste. Marie is approximately 4,000. The authorized capital was $40,000,000, on which there is outstanding $10,000,000 on first mortgage bonds and $3,000,000 income bonds. The prospects for the year are exceptionally bright. The last year's operations of the subsidiary companies showed a net surplus of $1,072,000.

MARKET CONDITIONS.

Montreal, January 12th, 1909.

It is stated that on the first of the year there were in operation in the United States, 220 coke and anthracite blast furnaces, with an aggregate productive capacity of 400,894 tons per week, or about 20,800,000 tons per year. At the first of December, about 210 furnaces were operating, so that the number increased during the last month of the year. As compared with the output of last June, the figures at the beginning of 1909 show an increase of about fifty per cent. Reports now arriving from the United States indicate that business in finished iron and steel is hardly up to expectations, railroad orders, particularly, being behind. However, this is a situation which may be altered at almost any time by the developments of a week. Doubtless the uncertainty of what may be done with the tariff and what the effect of lower duties would be, is having the effect of obstructing trade. There is some talk of price cutting.

Advices from Great Britain show that exports of Middlesboro were much lighter than expected. December showed smaller figures in this respect than any month in three years, while its record for increased stocks was the greatest. However, the situation seems to have considerably improved, inasmuch as 1908 opened amid general pessimism, whereas 1909 opens amid optimism. It is generally thought that the worst has been reached, in the hemitite market, stocks being light and prices relatively lower than Cleveland. In Scotland, there are now some 77 furnaces in operation, or one more than a year ago, and some may be blown in shortly.

The local market continues as dead as it could well be. There are practically no changes in prices from week to week, and the demand in confined to the most insignificant quantities. The hopeful feature is the fact that there are a number of enquiries in the market, and there seems to be good reason to expect that these will, in many instances, result in business before many months. The following list shows no change as compared with that of a week ago:—

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

Bar Iron and Steel.—Prices are steady all round, and trade is dull. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $2.00; sleigh shoe steel, $1.90 for 1 x ⅜-base; tire steel, $1.95 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $2.10; smooth finish, $2.75.

Boiler Tubes.—The market is steady, quotations being as follows:—2-inch tubes, 8½c.; 2½-inch, 10c.; 3-inch, 11½c.; 3½-inch, 14¾c.; 4-inch, 19c.

Building Paper.—Tar paper, 7, 10, or 16 ounce, $1.60 per 100 pounds; felt paper, $2.40 per 100 pounds; tar sheathing, No. 1, 55c. per roll of 400 square feet; No. 2, 35c.; dry sheathing, No. 1, 45c. per roll of 400 square feet. No. 2, 28c. (See Roofing; also Tar and Pitch).

Cement.—Quotations are for car lots, f.o.b., Montreal. Canadian cement is $1.55 to $1.65 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½c. extra, or 10c. per bbl. weight. English cement is $1.65 to $1.85 per 350-lb. bbl. in 4 jute sacks (for which add 8c. each) and $2.20 to $2.40 in wood. Begian cement is $1.60 to $1.65 in bags—bags extra—and $2.10 in wood.

Chain.—The market is steady as follows:—¼-inch, $5.30; 5-16-inch, $4.05; ⅜-inch, $3.65; 7-16-inch, $3.45; ½-inch, $3.20; 9-16-inch, $3.15; ⅝-inch, $3.05; ¾-inch, $3; ⅞-inch, $2.95; 1 inch, $2.95.

Copper.—The market is steady at 15 to 15¼c. per lb. Demand continues limited.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 18c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1. Electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3.50; 6-ft. wires, $4; 8-ft. wires, $4.50; 10-ft. wires, $5. Double strength fuses, 1$ extra, per 100 fuses. Fuses, time, double-tape, $6 per 1,000 feet.

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

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

Iron.—Prices are steady and unchanged, and the outlook is firm. The following prices are ex-store: Canadian pig, $18 to $19 per ton; No. 1 Summerlee, $21 to $21.50; No. 2 selected Summerlee, $20.50 to $20.75; Carron soft $20.25 to $20.75; No. 3 Clarence, $18.75 to $19 per ton.

Laths.—See Lumber, etc.

Lead.—Trail lead is unchanged and steady, at $3.70 to $3.80 per 100 pounds, ex-store.

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 rate of $1.50. At the moment, the market is exceptionally irregular and prices are uncertain. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $22 to $25. Spruce, 1-in. by 4-in. and up, $16 to $18 per 1,000 ft.; mill culls, $14 to $16. Hemlock, log run, culls out, $14 to $16. 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 moderate, but prices are steady at $2.30 per keg for cut, and $2.25 for wire, base prices

Pipe—Cast Iron The market continues steady at $33 for 8-inch pipe and larger; $34 for 66-inch pipe; $34 for 5-inch, and $34 for 4-inch at the foundry. Pipe, specials, $3.10 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

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

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 64c. per roll; three-ply, 86c. per roll of 100 square feet. (See Building Paper; also Tar and Pitch.)

Rope.—Prices are steady, at 9 1-2c. per lb. for sisal, and 12c. for Manila. Wire Rope, crucible steel, six-strands, nineteen wires: ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $6; ⅝ $7.25; ¾, $8.50; ⅞, $10; 1 in., $12 per 100 feet.

Shingles.—See lumber, etc.

Spikes.—Railway spikes are in dull demand and prices are steady at $2.40 per 100 pounds, base of 5½ x 9-16. Ship spikes are also dull and steady at $3 per 100 pounds, base of ½ 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.

Steel Plates.—The market is steady. Quotations are: $2.15 for 3-16, $2.25 for ⅛, and $2.15 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.05; and 16-gauge, $2.10.

Tar and Pitch.—Coal tar, $4 per barrel of 40 gallons, weighing about 500 pounds, roofing tar, $3.15 per barrel; roofing pitch, No. 1, $1 per 100 pounds; and No. 2, 50c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; pine pitch, $4 per barrel of 180 to 200 pound. (See building paper; also roofing.)

Telegraph Poles.—See lumber, etc.

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Toronto, January 14th, 1909.

As a rule, January is a slack month in lumber, but thus far this month there has been unusual demand for certain lines, such as southern pine 6 x 12, and certain sizes of hemlock. Bricks, too, have been more active than is usual at this time. Cement, however, is a disappointing element, it is still dull and depressed.

There seems no actual improvement in movement in metals here, but there are more enquiries and a better spirit. In copper and tin the course of the speculative market has been as disappointing as it was tortuous. People are still trying to predict impending changes. Lead is rather more active, and antimony exhibits a better feeling.

Much confidence exists in the United States of improved activity in business following the turn of the year, in spite of the disappointments which have there followed previous expectations of brisk business, and "in spite of the repeated failures in fulfilment of ill-judged predictions of business revival" for months past. When such an improved condition of affairs does come—which is not yet, apparently—advantage will be taken of it in various directions to advance prices. The volume of trade is only 60 per cent. of what was last year thought normal.

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

Antimony.—Slightly more active at 9¾c. per lb., and a better feeling in the market.

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

Boiler Plates.—1-4 inch and heavier, $2.40. Boiler heads 25c. per 100 pounds advance on plate.

Boiler Tubes.—Orders are active. Lap-welded, steel, 1 1-4-inch, 10c.; 1 1-2-inch, 9c. per foot; 2-inch, $8.75; 2 1-4-inch, $10; 2 1-2-inch, $10.60; 3-inch, $12.10; 3 1-2 inch, $15.30; 4-inch, $19.45 per 100 feet.

Building Paper.—Plain, 30c per roll; tarred, 40c. per roll. Business continues quiet.

Bricks.—Common structural, $9 per thousand, wholesale, and the demand moderately active. Red and buff pressed are worth, delivered, $18; at works, $17.

Cement.—Market still weak; cement can be had in 1,000 barrel lots at $1.70 per bbl, including the bags, which is equal to $1.30 without bags. At this time of year building operations are closing down, demand is therefore naturally limited.

Coal Tar.—Season about over, price still $3.50 per barrel.

Copper Ingot.—The close of the year found the feeling rather gloomy and the price none too firm. The course of the speculative market has proved disappointing. Price here is still 15c. to 15½c.

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

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

Roofing Felt.—Very limited request. Price $1.80 per 100 pounds.

Fire Bricks.—English and Scotch, $32.50 to $35; American, $28.50 to $35 per 1,000. Moderate demand and fair supply.

CONTRACTOR'S SUPPLIES

NEW INCORPORATIONS.

Berlin, Ont.—Berlin Central Heating Company, $80,000. J. D. Moore, P. S. Lautenschlager, A. Bricker.

Tomiko, Ont.—Tomiko Mills, $75,000. E. J. Bucknam, A. S. Duff, Tomiko; A. Anderson, Ottawa.

Peterborough, Ont.—G. Walter Green Company, $100,000. G. W. Green, T. O. Donaldson, P. J. Heaslip.

St. Catharines Ont.—A. H. Wallace Company, $40,000. M. J. O'Reilly, W. W. Osborne, G. H. Levy.

Alexandria, Ont.—McCrimmon Montreal River Mines, $250,000. A. R. Bickerstaff, F. H. Potts, A. W. Holmested.

Winona, Ont.—C. P. Carpenter and Son, $100,000. T. H. P. Carpenter, Winona; W. H. Magill, Hamilton; A. E. Jones, Fruitland.

Hannon, Ont.—Barton and Binbrook Telephone Company, $10,000. T. E. Tidey, Barton Township; H. Johnson, N. Laidman, Binbrook Township.

Winnipeg, Man.—Marks and Company, $100,000. J. C. Graham, E. E. Sharpe, Winnipeg; L. Marks, Plum Coulee.

New Liskeard, Ont.—Gow Ganda United Cobalt Mines Company, $1,000,000. W. J. Egan, S. Read, M. F. Pumaville.

Longue Pointe, Que.—Le Club Social Mille Fleurs, $20,000. L. A. Amiot, Longue Pointe; C. Lemay, Montreal; V. Lemay, St. Louis.

Montreal.—Red Cross Macaroni and Vermicilli Company, $100,000. J. B. D. Legare, J. N. Viau, J. Meilleur. Dougall Varnish Company, $150,000. J. S. N. Dougall, G. Gylling, J. H. Dougall. Scott Specialty Company, $10,000. S. B. Scott, J. B. Cantin, A. Askew. Compton Gold Dredging Company, $500,000. W. P. O'Brien, F. H. Manley, A. Wainwright. Gilmour Soap Works Company, $20,000. G. M. Gilmour, G. W. McClafferty, J. Jenkins.

Fuses—Electric Blasting.—Double strength, per 100, 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. Bennett's double tape fuse, $6 per 1,000 feet.

Galvanized Sheets—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.05; 12-14-gauge, $3.15; 16, 18, 20, $3.35; 22-24, $3.50; 26, $3.75; 28, $4.20; 29, $4.50; 10¾, $4.50 per 100 pounds. Fleur de Lis—28-gauge, $4.30; 26-gauge, $4.05; 22-24-gauge, $3.50. Queen's Head—28-gauge, $4.50; 26-gauge, $4.25. Sheets are in very active request.

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.

Bar Iron.— $1.95 to $2, base, from stock to wholesale dealer.

Iron Pipe.—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch $3.56; 1-inch, $5.11; 1¼-inch, $6.97; 1½-inch, $8.37; 2-inch, $11.16; 2½-inch, $17.82; 3-inch, $23.40; 3½-inch, $29.45; 4-inch, $33.48; 4½-inch, $38, 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.71; 1-inch, $6.76; 1¼-inch, $0.22; 1½-inch, $11.07; 2-inch, $14.76. Makers are holding prices stiff and anticipate a rise.

Lead.—Quiet and unchanged at $3.90 to $4.00. Old Country market quiet but steady.

Lead.—Rather more active at $3.90 to $4.00. Old Country market

Lime.— In adequate supply and brisk movement. Price for large lots at kilns outside city 22c. per 100 lbs. f.o.b., cars; Toronto retail price 35c. per 100 lbs. f.o.b. car

Lumber.—We quote dressing pine $32 to $35 per thousand; common stock boards as to grade $24 to $28; cull stocks $20; sidings, $17.50. Norway pine is neglected in favor of Southern, which is much stronger in fibre and the price well maintained. Hemlock continues to sell pretty freely, and in car lots brings $16.50 to $17.00. Spruce flooring is quoted at $22.00 in car lots. The season being practically over for shingles, there is but little movement in them, and prices are weak though unchanged at $3.20 for British Columbia. White pine lath are scarcer, No. 1 especially, we quote $4 for No. 1 and $3.50 for No. 2 firm. A good deal of varied stuff is moving, not so much good pine as cheaper goods, such as hemlock and spruce. But all kinds of Canadian lumber are likely to continue firm.

Nails.—Wire, $2.55 base; cut, $2.70; spikes, $3. There is a fair supply and no especial activity.

Pitch.— Very quiet; price, 70c. per 100 lbs.

Pig Iron.—Business continues quiet; prices are decidedly maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21.00; in Canadian pig. Hamilton quotes $20.00 to $20.50.

Plaster of Paris.—Calcined, wholesale, $2; retail, $2.15. Trade quiet.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05.

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

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.60	$0.75	$1.00	$3.25
Single junction, 1 or 2 feet long.	.90	1.35	2.70	3.40	4.50	14.63
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

In steady demand; price 70 per cent. off list at factory for car-load lots; 60 per cent. off list retail.

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

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over: Montreal, 12-lb. $45, 16-lb. $44, 25 and 20-lb. $43.

Sheet Steel.—Market steady, with fairly good demand; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2 65; 28-gauge, $2.85.

Tool Steel.—Jowett's special pink label, 10½c. Cyclops, 18c.

Tank Plate.—3-16-inch, $2.50.

Tin.—Markets abroad very irregular during week, but closed much steadier. Price here 31 to 32c., with more confident feeling.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.35 per dozen; set up, $22.35. Pan Canadian, navvy, steel tray, steel wheel, per dozen, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each.

Zinc Spelter.—Business fairly active at same prices, $5.25 to $5.50.

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Winnipeg, January 12th, 1909.

The chief topic of interest in the West this week is the letting of the contracts for the municipal power plant, which total over a million dollars. These contracts were let last week, the principal one being awarded to Messrs. John Gunn & Sons, of Winnipeg, for the general work at a cost of $779,100. The contract for the transmission line aluminum cable was awarded to The Northern Aluminum Company, of Shawinigan Falls, Que., at a cost of $148,050, while the Manitoba Iron Works, another local firm, secured the contract for the steel towers at a cost of $87,550. The awarding of these accounts will mean a renewed activity in contracting circles as this will be the largest work of its kind ever done in the West.

One or two corrections in prices are noted this week, that of cement, which, if anything, is lower than it has been. The demand is expected to be large in this line during the coming season as there are several large works on foot which will call for a great deal of cement. Conditions in all branches of building trade look very bright and the year is being commenced with a much stronger feeling of confidence than was evidenced in the beginning of 1908.

Local market quotations are as follows:—

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

Bar Iron.—$2.50 to $2.60.

Beams and Channels.—$3 to $3.25 per 100 up to 15-inch.

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

Bricks.—$11, $12, $13 per 1,000, three grades.

Cement.—$2.65 to $2.75 per barrel.

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

Dynamite.—$11 to $13 per case.

Hair.—Plaster's, 80 to 90 cents 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.

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

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

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, 6¼c. per lb.

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c per roll.

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, $27.25, 2 x 20 up to 32 feet, $38.

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

Tool Steel.—8½ to 15c. per pound.

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

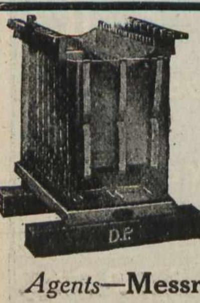
Boards.—Common pine, 8-inch to 12-inch wide, $38 to $45; siding, No. 2 white pine, 6-inch, $55; cull red or white pine or spruce, 6-inch, $24; No. 1 clear cedar, 6-inch, 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 6-inch, $55; No. 3, $45.

Flooring.—No. 2 red pine, 4-inch, $43; No. 3 red, 4-inch, $38; No. 4 red and white pine or spruce, 4-inch $28; ceiling, No. 2 white pine, 4, 5, and 6-inch, $55; No. 3 red pine, $38.

Lath.—No. 1 red and white pine mixed, $5.50; No. 2, $4.75.

Shingles.—No 1 British Columbia cedar, $4.25; No. 2, $3.75; band sawn, $6.

Rope.—Cotton, ¼ to ½-in. and larger, 23¼c. lb.; deep sea, 18c.; lath yarn, 9¼c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c.; sisal, 10¼c.



(Continued from page 7.)

tain a greater depth for the increasing mammoth liners frequenting the port. An idea of her proportions may be obtained by comparison between the already large dredgers in the service of the board, whose greatest capacity is 3,500 tons dredged in an average of 55 minutes, whilst the Leviathan will dredge almost three times as much (10,000 tons) in the same time. Her principal dimensions are 465 feet 9 inches by 69 feet by 30 feet 7 inches moulded, with a loaded draft of 23 feet and a displacement with a full load of about 18,000 tons. Her twelve hoppers, with a capacity of 180,000 cubic feet, are fitted with Lyster's patent valves, having an opening 5 feet 6 inches in diameter through the bottom of the vessel. Each valve is of a tapered cylindrical form, extending the full depth of the hopper, with open-bottomed valve at the lower edge, and having a lift of four feet, the whole being designed for the quick discharge of sand. For the purpose of rapid suction she is fitted with four centrifugal pumps, each 42 inches, to which are coupled four sets of inverted vertical triple-expansion engines. The pumps are connected to the special suction tubes, measuring 90 feet by 42 inches diameter, and are capable of working at a maximum depth of 70 feet. Her propelling engines will give her a speed of 10 knots when loaded, and consist of two sets of inverted vertical triple-expansion surface-condensing engines, each 22½ inches by 37 inches by 61 inches cylinders, and 45 inch stroke, with an indicated horse power of about 3,500.

WHERE TO BUY.

(Continued from page 2.)

Contractors
Cleveland Bridge & Engineering Co., Ltd., Darlington, England.
Metcalf Engineering Co., Ltd., Montreal, Que.

Converters, Rotary
Toronto & Hamilton Electric Co., Hamilton, Ont.

Conveyors
Babcock & Wilcox, Ltd., Montreal.

Cranes
Dominion Bridge Co., Ltd., Montreal.
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Structural Steel Co., Ltd., Montreal, Que.

Damper, Regulators
Babcock & Wilcox, Ltd., Montreal.
D'Este Co., Julian, Boston, Mass.

Derricks
Dominion Bridge Co., Ltd., Montreal.
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Structural Steel Co., Ltd., Montreal, Que.

Draughting Supplies
Berger & Sons, C. L., Boston, Mass.,
Hart Co., John A., Winnipeg, Man.

Drills
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.

Dynamos and Motors
Harpell-Stokes, Limited, Winnipeg and Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Economizers
Babcock & Wilcox, Ltd., Montreal.

Electric Apparatus
Harpell-Stokes, Limited, Winnipeg and Toronto.
Hill Electric Mfg. Co., Montreal, Que.
Toronto and Hamilton Electric Co., Hamilton, Ont.

Electrical Supplies
Harpell-Stokes, Limited, Winnipeg and Toronto.
Hill Electric Mfg. Co., Montreal, Que.
Phillips, Eugene F., Electrical Works, Ltd., Montreal, Canada.

Elevators
Northern Engineering Works, Detroit, Mich.

Engineers, Consulting
Beaubien, Gaspe de, Montreal.
Daw, Hilder, Montreal.
Francis, W. J. Montreal, Que.
Metcalf Engineering Co., Ltd., Montreal, Que.
Mitchell, C. H., C.E., Toronto, Ont.
Richmond, J. Stanley, Toronto.
Standard Inspection Bureau, Limited, Toronto, Ont.

Engines
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.

Feed Water Heaters and Purifiers
Babcock & Wilcox, Ltd., Montreal,

Fence, Fencing, Wire
Owen Sound Wire Fence Co.

Fire Brick and Clay
Leslie & Co., A. C., Montreal.

Forgings, Drop
Coghlin & Co., B. J. Montreal, Que.

Foundry Supplies
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.

Generators, Alternating and Direct Current
Harpell-Stokes, Limited, Winnipeg and Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Hoists, Electric an' Pneumatic
Northern Engineering Works, Detroit, Mich.

Iron Bar, etc.
Leslie & Co., A. C., Montreal

Inspections
Standard Inspection Bureau, Limited, Toronto, Ont.
Dominion Bureau, Montreal, Que.

Ladles
Northern Engineering Works, Detroit, Mich.

Motors
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Motors
Harpell-Stokes, Limited, Winnipeg and Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Patent Attorneys
Budden, Hanbury A., Montreal, Que.
Ridout & Maybee, Toronto, Ont.

Planer Tools
Armstrong Bros. Tool Co., Chicago, Ill., U. S. A.
Mussens Limited, Montreal, Que.

Poles, Telegraph and Telephone.
Sterling, W. C. & Son Co., Monroe, Mich.

Portland Cement
Hartranft Cement Co., Wm., Montreal, Que.
Western Canada Cement & Coal Co., Exshaw, Alta.

Preservatives
Carbolite Carbolineum Co., Toronto,

Presses, Hydraulic and Power
Mussens Limited, Montreal, Que.
Wood & Co., R. D., Philadelphia, Pa.

Pressure Regulators
D'Este Co., Julian, Boston, Mass.

Pulleys
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.

Pumps, Centrifugal
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.
Wood & Co., R. D., Philadelphia, Pa.

Purifiers
Babcock & Wilcox, Ltd., Montreal,
Wood & Co., R. D., Philadelphia, Pa.

Railway Supplies
Coghlin & Co., B. J. Montreal, Que.
Mussens Limited, Montreal, Que.
Koppel Co., Arthur, New York City.

Railways, Industrial and Portable
Koppel Co., Arthur, New York City.

Ratchet Drills, Universal
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.
Mussens Limited, Montreal, Que.

Rock Crushers
Mussens Limited, Montreal, Que.

Rope, Manilla and Wire
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.

Separators, Steam
Babcock & Wilcox, Ltd., Montreal,

Sewage Disposal
Cameron Septic Tank Co., Chicago, Ill., U.S.A.

Sewer Pipe
Hamilton & Toronto Sewer Pipe Co.

Shovels, Steam
Mussens Limited, Montreal, Que.

Springs
Coghlin & Co., B. J., Montreal, Que.
Montreal Steel Works, Montreal, Que.

Steel, Speedicut High-speed
Montreal Steel Works, Montreal, Que.

Steel, Structural
Cleveland Bridge & Engineering Co., Ltd., Darlington, England.
Dominion Bridge Co., Ltd., Montreal,
Harpell-Stokes, Limited, Winnipeg and Toronto.
Structural Steel Co., Ltd., Montreal,

Steel, Tool
Montreal Steel Works, Montreal, Que.
Mussens Limited, Montreal, Que.
Allen & Co., Edgar, Sheffield, Eng.

Stokers, Mechanical
Babcock & Wilcox, Ltd., Montreal,

Stone Crushers and Screens
Mussens Limited, Montreal, Que.

Surveying Instruments
Berger & Son, C. L., Boston, Mass.
Gurley & Co., W. & L. E., Troy, N.Y.
Hart Co., John A., Winnipeg, Man.

Tanks, Steel and Iron
Structural Steel Co., Ltd., Montreal,
Wood & Co., R. D., Philadelphia, Pa.

Tool Grinders
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.

Telephone Supplies
Kellogg Switchboard and Supply Co., Chicago, Ill., U.S.A.

Track Jacks
Montreal Steel Works, Montreal, Que.
Mussens Limited, Montreal, Que.

Transformers
Harpell-Stokes, Limited, Winnipeg and Toronto.
Toronto and Hamilton Electric Co., Hamilton, Ont.

Transmission Machinery
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.
Toronto and Hamilton Electric Co., Hamilton, Ont.

Trucks
Northern Engineering Works, Detroit, Mich.

Valves
Babcock & Wilcox, Ltd., Montreal,
Wood & Co., R. D., Philadelphia, Pa.

Waterworks Supplies
Wood & Co., R. D., Philadelphia, Pa.

Wire
Coghlin & Co., B. J., Montreal, Que.

Wire Rope
Coghlin & Co., B. J., Montreal, Que.
Harpell-Stokes, Limited, Winnipeg and Toronto.
Mussens Limited, Montreal, Que.

Wire, Switchboard
Harpell-Stokes, Limited, Winnipeg and Toronto.
Kellogg Switchboard and Supply Co., Chicago, Ill., U.S.A.