

PAGES

MISSING

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

C.P.R. directed to Build Spur Line in Lethbridge.

Windsor, Erie and Lake Shore allowed to Cross Michigan Central.

4342—Feb. 12—Authorizing Grand Trunk Railway to construct spur to premises of J. Duff & Son, Hamilton, Ontario.

4343—Feb. 12—Authorizing East Middlesex Telephone Co-operative Association, Limited, to carry its telephone wires over Grand Trunk Railway tracks at Kelly's Siding, Ontario.

4344—Feb. 12—Authorizing East Middlesex Telephone Co-operative Association, Limited, to carry its telephone wires over the Grand Trunk Railway tracks at Wyton, Ontario.

4345—Feb. 7—Extending the time till May 1st, 1908, with which the Grand Trunk Railway shall install gates and interlocking semaphores on its tracks where the same cross the Montreal Street Railway at the junction of St. Ferdinand and Notre Dame Streets in St. Henri, Montreal.

4346—Feb. 13—Authorizing the Canadian Pacific Railway to construct spur to the premises of the Inter-Ocean Pressed Brick Company, Pilot Butte, Sask.

4347—Feb. 14—Authorizing C.P.R. to construct ferry apron for use in connection with ferry slip at Vancouver.

4348—Feb. 14—Authorizing C.P.R. to construct ferry apron for use in connection with ferry slip at Prescott, Ont.

4349—Feb. 14—Authorizing the Byron Telephone Company to carry its wires across the tracks of the G.T.R.

1. At the first two subways under the G.T.R. tracks west of Komoka, Ont., on the 18th District.

2. At the first public crossing west of Komoka on the 17th District.

4350—Jan. 21—Approving branch line or spur of C.P.R. through Sections 14, 15, 16, 17 and 18, Township 53, North, Range 24, west of 4th meridian, Province of Alberta, commencing at a point on the centre line of the Grand Trunk Pacific main line, and being in the north-east quarter of Section 14, Township 53, North, Range 24, west of 4th meridian, known as the branch line north of Edmonton, Alberta.

4351—Feb. 12—Authorizing C.P.R. to construct spur in city of Winnipeg, Man., to premises of Oliver & Manson.

4352—Feb. 17—Authorizing the Municipal Council of the county of Victoria to lay sewer pipes under the tracks of the G.T.R. at Albert Street, Lindsay, Ont.

4353—Feb. 3—Directing the C.P.R. to construct, maintain and operate a branch of railway to the warehouse of the North-West Jobbing and Commission Company, Lethbridge, Alta.

4354—Feb. 17—Authorizing Bell Telephone Company to erect aerial wires across the Pere Marquette Railway at crossing $2\frac{3}{4}$ miles north of St. Thomas Station, Ont.

4355—Jan. 15—Directing the Windsor, Essex and Lake Shore Rapid Railway to provide and place upon its poles on Talbot Street, Essex, Ont., standard copper conductors for the purpose of enabling C. E. Naylor, of Essex, to transmit electric energy across the tracks of the railway at eight different points in the town of Essex.

4356—Feb. 18—Authorizing the C.P.R. to construct its railway across certain highways in the township of Albion, county of Peel, Ont.

4357—Feb. 18—Authorizing the Edmonton, Yukon and Pacific Railway Company to open for the carriage of traffic that portion of its line from Edmonton to Strathcona, Alta.

4358—Feb. 18—Authorizing the town of Aylmer, Ont., to lay a water main under the tracks of the Grand Trunk Railway at a point east of John Street, Aylmer, Ont.

4359—Feb. 19—Approving specifications and plan of trestles proposed to be used by the British Yukon Railway Company in the construction of its White Horse extension.

4360—Feb. 19—Authorizing Dr. E. T. Williams to erect a telephone wire across the tracks of the G.T.R. at public highway one mile north of Sunderland, Ont.

4361—Feb. 19—Authorizing Bell Telephone Company to erect its wires over the Grand Trunk Railway at siding at foot of Peter Street, Toronto.

4362—Feb. 19—Certifying corrections made in the location of Montreal, Quebec and Southern Railway Company, in the parishes of Gentilly and St. Pierre les Becquets, county of Nicolet, Quebec.

4363—Feb. 18—Approving Standard Passenger Tariff of C.N.R., providing for a standard passenger fare of three cents per mile between its stations in Canada east of and including Edmonton, Alberta, and rescinding Order of February 5th, 1908.

4364—Feb. 19—Authorizing the Burnt River Telephone Company to erect its telephone wires across the tracks of the G.T.R. at a point in the township of Somerville.

4365—Feb. 20—Approving location of Walkerton and Lucknow Railway between mile 36.44 and 37.5, near the town of Walkerton, Ont.

4366—Feb. 20—Authorizing Bell Telephone Company to erect its aerial wires across the G.T.R. at Grasshill, Ont.

4367—Feb. 20—Authorizing Mond Nickel Company to erect its transmission line across the Soo branch of the C.P.R., near Victoria Mines, Ont.

4368—Feb. 19—Authorizing the Windsor, Erie and Lake Shore Rapid Railway to cross with its track the track of the Michigan Central Railway at Erie Avenue, Leamington, Ont.

4369—Feb. 14—Authorizing the C.P.R. to construct a spur to the premises of E. A. Holstein, Winnipeg, Man.

A NEW CENTRAL POWER PLANT.

The Clark Thread Company, of Newark, N.J., which recently decided upon the complete "electrification" of its several large mills, located on either side of the Passaic River, has adopted plans drawn by Mr. Abercrombie, the Company's chief engineer, for a large central power house, equipped with steam turbines, to replace the various isolated plants now operated in connection with the mills.

When fully completed, the new station will consist of five modern units, having an aggregate capacity of 10,000 kw., the first of which is to be installed as soon as proper facilities for it can be provided. This is an Allis-Chalmers steam turbine and generator, rated 2,500 K.V.A. on normal load, delivering three-phase, 60 cycle current at a pressure of 600 volts. The condenser to be installed with this turbine is of the well-known Tomlinson type, built by Allis-Chalmers Company, who are also furnishing exciter units and other auxiliary apparatus, thereby placing the complete responsibility for the power equipment upon one contractor.

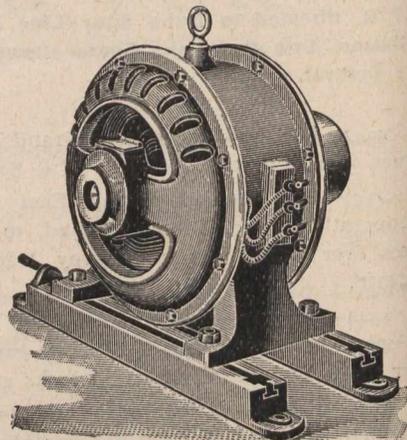
At the outset fully 2,500 horse-power in induction motors will be supplied from this station, about one-third of the power being distributed to the four plants on the east side of the river, known as the cotton, spooling, finishing and packing mills, and the remainder, through cables under the river, to the two cotton mills and the thread mills situated on the opposite bank. The intention is, of course, not to effect a complete revolution at once in the existing methods of power transmission and application, but to gradually change over to motor drive as circumstances permit. The entire plan is one which was under consideration for some time, and it has only been adopted after a careful study of operating conditions, both in this country and abroad.

In this Messrs. Clark and Abercrombie were able to draw upon the experience of J. & P. Coates, Limited, of Paisley, Scotland, the largest thread manufacturers in the world, with whom the Clark Thread Company is affiliated. This British company has a number of plants electrically operated, which are universally regarded as models of their kind, and it is stated that motor drive from current generated in steam turbine plants of the type above described will soon be introduced in all of the Coates properties on this side of the Atlantic.

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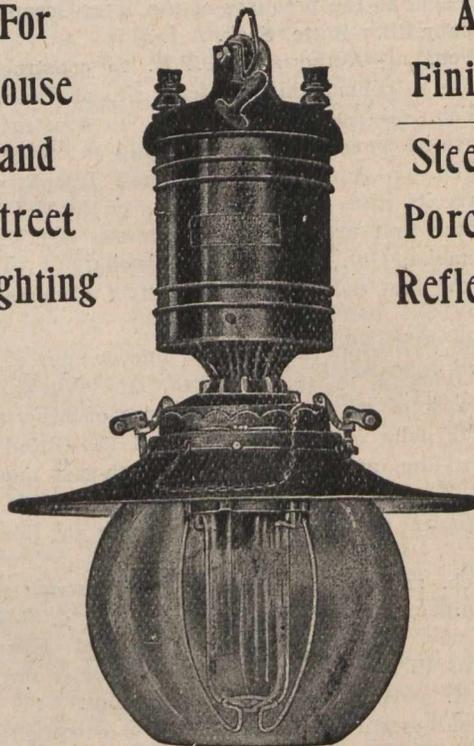
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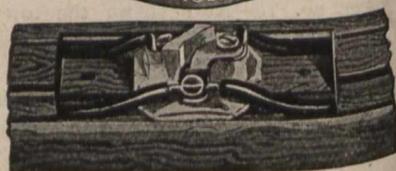
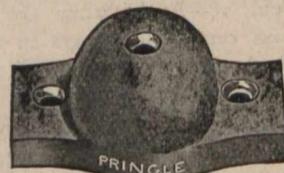
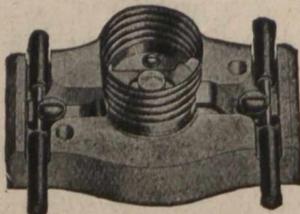
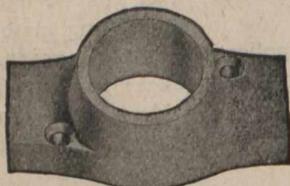
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The Canadian Engineer

WEEKLY

ESTABLISHED 1893

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Printed at the office of THE MONETARY TIMES PRINTING CO., Limited, TORONTO, CANADA.

A reader is anxious to secure copies of the Canadian Engineer for December 6, 1907 and January 3, 1908. Perhaps some of our subscribers can accommodate him. There is three months' extension of subscription in it.

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WHO MAY VOTE.

The present session of the Ontario Legislature propose revising the Act respecting elections. There are a few clauses engineers and surveyors are especially interested in, and should make sure they are clear and not open to misunderstanding.

Engineers and surveyors, from the nature of their work, are from home frequently and often for long periods. When he presents himself for his ballot at election time he is told that the clause "is a resident and domiciled" does

not cover his case. The new Act should make this plain, if it does apply, and if it does not, then exceptions similar in nature to those made for clergymen, school teachers, and militiamen should be made for surveyors and engineers.

A resident of the Province of Ontario should not be disqualified because of his occupation, nor should the meaning of the Election Act be so indefinite as to make it possible for his political opponents to make his voting, to say the least, inconvenient.

Some clause should be added making it clear that a Canadian, so long as he remains a British subject, may work temporarily in any part of Canada, and yet return and vote at his acknowledged home when his name is on the Voters' List for the subdivision which he acknowledges as his permanent abode.

SURVEYORS MEET.

A convention composed of representative men of a profession is sure to attract attention, their deliberation will strengthen their position and their discussion will be educational in effect on other members and the community at large.

This week the Ontario Land Surveyors are holding their annual convention in Toronto. Not only are their discussions dealing with questions peculiar to the surveyor, but questions of interest to the civil engineer are also dealt with. Organized in 1886 the Association have steadily raised the standard to be attained by would-be land surveyors until to-day the examination requirements are higher than those required by any similar association. Not only are the examination requirements higher, but the men practising throughout the province find they must, each year, improve the quality of their work, both in field and office if they wish to keep pace with the progress of the Association.

In our next issue we will give an extended report of the annual meeting.

ACCOUNTS OF TEMISKAMING AND NORTHERN ONTARIO RAILWAY.

The summary of the receipts and disbursements, on construction, of the Temiskaming and Northern Ontario Railway for the year ending December 31st, 1907, is as follows:—

Receipts.—Cash on hand, December 31st, 1906, \$152.81; Treasurer of Ontario, \$2,429,329.15; accounts collectable, \$5,660.02; accounts collectable, operation, \$134,863.37; town site sales and mining bonuses, \$25,000; deposits on contracts, \$15,500; interest, \$225.07; unclaimed wages, \$442.60; miscellaneous receipts, \$6,767.19; total, \$2,617,940.21.

Disbursements.—Disbursements as per statement, \$2,617,484.80; cash on hand December 31st, 1907, \$455.51; total, \$2,617,940.21.

The Kingston Shipping Company is having built at Dumbarton, Scotland, a steamer to be named the "Catarqui." A full sized Welland Canal freighter, with triple expansion engines, 18, 30, and 40-in. cylinders, 33-in. stroke. Her dimensions 256 ft. over all, beam 43 ft., moulded depth 22 ft. The owners of the company are H. A. Calvin, president; H. H. Richardson, vice-president; S. C. Calvin, secretary-treasurer.

**THE LAKEFIELD PORTLAND CEMENT WORKS,
POINTE AUX TREMBLES, QUEBEC.**

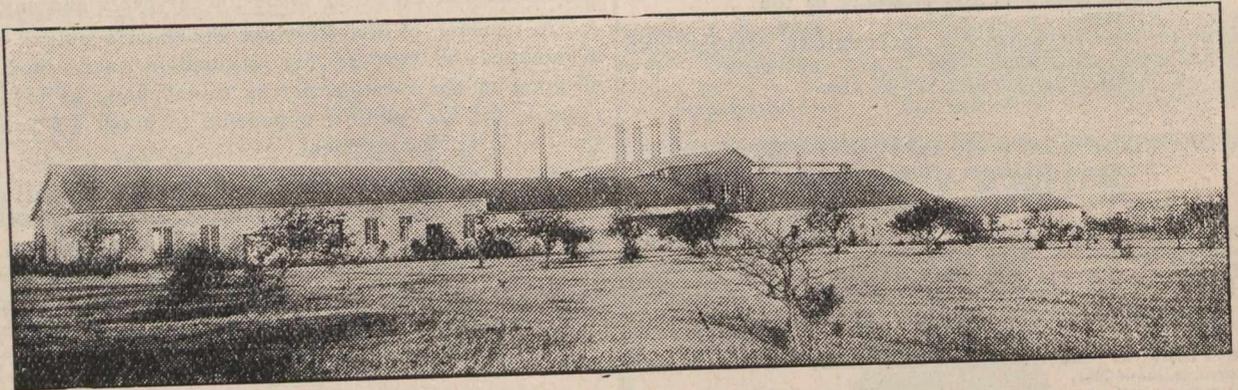
The ever increasing use of concrete as a material of construction has taxed to the utmost, in the busy season, the output of our cement plants. New plants are being erected in various districts of Canada, each with special features either of location, design or management. The works at Pointe Aux Trembles have two features that even the casual observer must have noticed, the ease with which the raw material is secured and the splendid transportation facilities afforded by the location.

Located on the bank of the St. Lawrence, cheap transportation to many districts is thus assured, while the question

separate motor. Having passed through the latter mills, it is elevated and conveyed to a series of ball grinding machines, sometimes called tube mills, which consist of steel cylinders twenty-two feet long and five and a half in diameter, lined with silex set in cement, the grinders consisting of a charge of small Icelandic flint balls. These pulverize the material so fine that 98 per cent. will pass a 100 sieve.

The material is then passed into storage bins. Over the storage hoppers are other conveyors, which pass the material on to the kiln feeders directly, when the storage bins are full.

The calcining is done in rotary kilns, which are one hundred and ten feet long, and eight feet in diameter. The calcining is done by the burning of pulverized coal which



View of Works, Lakefield Portland Cement Company.

of car shortage is not so likely to interfere for not only have the company competition by water but the Montreal Terminal Railway gives connection with all the steam roads that enter Montreal.

The limestone is quarried within three hundred feet of the cement plant. For the present, at least, the company are very fortunate in their location as the limestone now quarried does not require the addition of any clay as a corrective, the limestone holding in correct proportions all the ingredients of a good cement. Should clay be required later, quantities of the proper kind are close at hand.

From the quarry, which is in a hillside close to the plant, the limestone is conveyed in steel dump cars to the gyratory crushers, the location of which is shown in Plan. These crushers reduce the stone to cubes about two inches square.

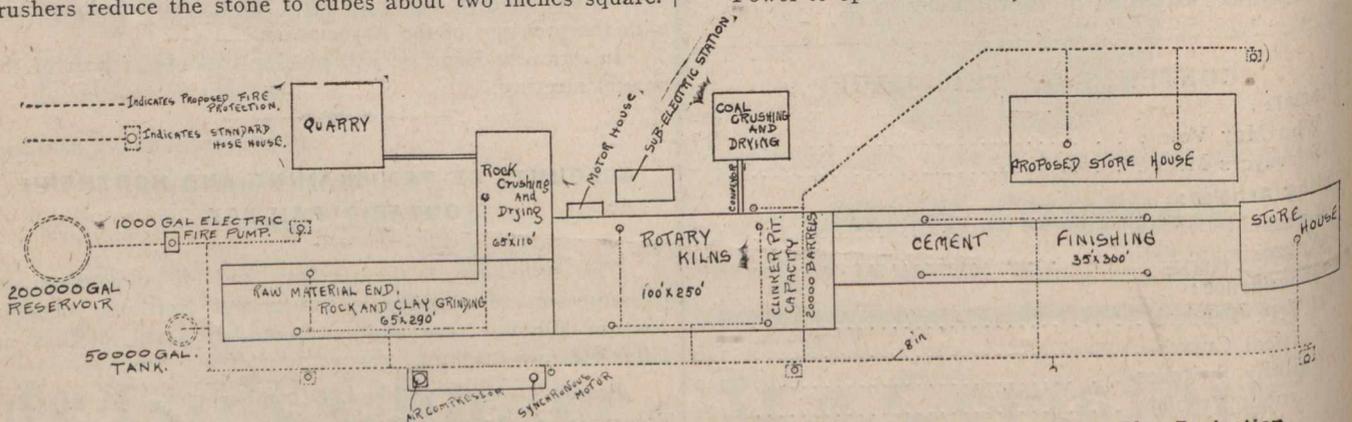
readily supplies the 3,000° F. required. The clinker as it leaves the kilns is cooled and stored ready for grinding.

The preliminary grinding is done by means of steel balls in a rotating cylinder, lined as before described, the finishing being done in ball grinding machines, similar to those described in the finishing room of the raw material building, lined with flint blocks.

The clinker having passed through the grinding process is then, as cement, conveyed by means of elevators and conveyors and discharged in and about the stock houses.

The coal of which about 30,000 tons will be used annually by these mills is ground in Raymond mills. Before being ground it is passed through a rotary furnace and thoroughly dried.

Power to operate the mill, between 2,500 and 3,000 horse-



General Plan of Lakefield Portland Cement Plant at Longue Pointe, Showing Water Service for Fire Protection.

The cubes then pass through furnaces and all moisture is driven off and they are now ready to be pulverized.

The pulverizing is commenced in Krupp Ball mills. A battery of three is now in operation. These are German mills, and consist of large cylinders lined throughout with heavy steel plates, the grinding being done by means of a charge of about eight tons of balls made of manganese steel, and varying in size from three to five inches in diameter.

The material having passed through these machines, is conveyed by archimedean screws to a series of ball mills of another type, known as Bonnot Ball mills, containing eight tons of three-inch chilled-iron balls, where it is still further reduced and mixed. These mills are run by seventy-five horse-power induction motors, each mill being driven by a

power, is supplied by the Montreal Light, Heat and Power Company, at a pressure of 10,000 volts. The company's sub-station receives the high pressure current and reduces it by means of three 1,000-K.W. transformers to 550 volts, in which form it is transmitted to the various motors throughout the works. The lighting is obtained at a pressure of 110 volts from two 15-K.W. transformers also placed in the sub-station. Some 50 "Jandus" arc lamps are scattered throughout the works, as well as from 600 to 700 incandescents. The electrical machinery throughout the plant was supplied and installed by the Canadian General Electric Company, and consists of some 32 induction motors of the latest type, and one 200 K.W. Synchronous motor.

The fire protection is a special feature of this plant. The Plan shows the location of reservoir, water tanks, stand-

pipes, hydrants and pipe line. The pipe line is to be underground, and automatic sprinklers are to be provided in the store-houses and at a few hazardous points in the other buildings. The usual rate for such risks as cement plants is 3 per cent., but because of the complete fire protection provided the insurance companies have set the rate on this plant at a fraction of one per cent.

The output of the factory, as now equipped, is 2,000 barrels per day, and it is expected this will be increased to 3,000 barrels per day shortly.

The first run from these kilns was unusually satisfactory giving hope that this plant will surpass the other Lakefield plants in increasing the popularity of Monarch Brand cement.

ENGINEERING SOCIETIES.

CANADIAN RAILWAY CLUB.—President, W. D. Robb, G.T.R.; secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, E. A. Evans, Quebec; 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. January 28th, 1908, annual meeting of the Society.

QUEBEC BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, E. A. Hoare; Secretary, P. E. Parent, Po. 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.

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

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

CANADIAN ELECTRICAL ASSOCIATION.—President, R. S. Kelsch, Montreal; secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN MINING INSTITUTE.—413 Dorchester Street West, Montreal. President, Frederick Keffer, Greenwood, B.C.; secretary, H. Mortimer-Lamb.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, R. McColl; Secretary, S. Fenn, Bedford Row, Halifax, N.S.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, TORONTO BRANCH.—Louis W. Pratt, secretary, 123 Bay Street, Toronto.

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

SOCIETY NOTES.

Quebec Branch, C. S. of Civil Engineers.

A strong branch of the Canadian Society of Civil Engineers has been organized at Quebec. Already they had forty-five members and applications are still coming in. The annual meeting is fixed for the third Friday of January of each year, and for the present year Mr. E. A. Hoare, chief engineer of the Quebec Bridge Company is chairman, and Mr. P. E. Parent, district engineer of the Department of Marine and Fisheries, Quebec, is acting secretary-treasurer. The headquarters of the society are at Room 40, City Hall, where meetings will be held twice a month.

Toronto Section of A. I. of Electrical Engineers.

After a luncheon at the St. Charles, at which some twenty-five members of the section and their friends were present, the Toronto section of the American Institute of Electrical Engineers held their regular February meeting at the rooms of the Engineers' Club, 96 King Street West, in conjunction with the Club, many of whose members were present. Over fifty in all attended.

After the formal business of the evening, the chief item of which was the presentation and carrying of a motion requesting the board of directors to take up the matter of the subdivision of the Associate group of the membership, the technical subject for the evening was taken up. This involved a paper presented by Mr. Walter S. Moody of the Schenectady section, who very thoroughly treated the subject in hand, namely, "Feeder Regulators." Mr. Moody, who is a chief designing engineer with the General Electric Company, of Schenectady, took up the history of the attempt to regulate the voltage of feeders in distributing and transmitting systems. He indicated the lines of development of this apparatus, from the earlier resistance methods of control in the case of direct current circuits, to the most recent outputs of the electrical manufactories, the automatic induction type of alternating current regulator. He then discussed at considerable length the latter type of regulator, showing its field of operation, its mechanical characteristics, and indicating some of the successful installations with records of their performance. The address was very fully illustrated by means of lantern slides, and at its close a considerable number of inquiries were made of Mr. Moody concerning the features which he had touched upon, and a considerable discussion followed.

The thanks of the Toronto section is due to the Engineers' Club for courteously postponing the subject which they had proposed to discuss, and accepting an invitation to join with the section in a reception to Mr. Moody.

A vote of thanks was proposed to Mr. Moody by Messrs. F. F. H. Wyse and H. F. Strickland and was most heartily supported by those present.

American Society of Mechanical Engineers.

The March meeting of the American Society of Mechanical Engineers will be held on Tuesday evening, March 10th, at 8.15 o'clock in the Engineering Societies Building, New York.

The meeting will be addressed by Dr. Charles P. Steinmetz, Member, A.S.M.E., Past President, A.I.E.E., and Professor of Electrical Engineering, Union University, the subject being, "The Steam Path of the Steam Turbine."

An instructive table appears in the American Contractor. It shows a remarkable shrinkage in the building business of the United States during January. In comparison with the same month of 1907, which showed the value of buildings erected to be \$30,720,000, in 45 cities, the buildings of January, 1908, amounted to only \$16,870,000. Among the big cities the greatest ratio of loss was in Baltimore, 38 per cent.; Buffalo, 41; Detroit, 55; Duluth, 71; Milwaukee, 21; New York, 45; Philadelphia, 61; Pittsburg, 21; Rochester, 25; St. Paul, 30; Seattle, 39; Toledo, 49. Among the cities which scored an increase despite the financial panic are: Bridgeport, with a gain of 22 per cent.; Denver, 9; Kansas City, 16; Little Rock, 6; Omaha, 10; Paterson, 28; Reading, 22; Spokane, 10; Topeka, 91. Greater New York shows a decrease of \$7,000,000, a loss of 50 per cent.; Philadelphia, 61; Chicago, 21; St. Louis, 51.

The Smart-Turner Machine Company, Limited, have received an order for a Side Suction Centrifugal Pump, from Messrs. T. McAvity & Sons, St. John, N.B., and are installing one of their Duplex Pumps in the steamer "Turret Crown," at Collingwood. They have received an order for an Automatic Feed Pump and Receiver, from Messrs. Seaman Kent, Meaford, Ont., and have supplied the E. Long Manufacturing Company, Orillia, with one of their Standard Duplex Pumps.

CORRESPONDENCE

[This department is a meeting-place for ideas. If you have any suggestions as to new methods or successful methods, let us hear from you. You may not be accustomed to write for publication, but do not hesitate. It is ideas we want. Your suggestion will help another. Ed.]

G. T. P. TENDERS.

Sir,—Some days ago I contributed a letter in reference to tenders on G.T.R., and have noticed some discussion, editorially, on this matter. To set myself right I ask further space to say that I did not desire to convey the impression that no deposit or security chèques should be asked to accompany the tenders for the six sections of the Grand Trunk Pacific, but I did, and do, object to the large checks required, on the ground that the ordinary or smaller but competent railway contractor or contractors are barred out from tendering, and, in the opinion of many, an accepted cheque for, say, twenty-five thousand dollars would serve the purpose as well as one for one hundred thousand dollars, for it must be remembered that 10 per cent. of the progress or monthly estimates are retained or held back from the contractor until the completion of the contract. This, on \$500,000 (five hundred thousand dollars) worth of work would amount to fifty thousand dollars, so that the Railway Commissioners would have ample security.

In the long advertisement of the Transcontinental Railway Commissioners there are other objections as well as the large security cheques and the long sections. I refer to the clause wherein, if a person or firm tender, and within ten days afterwards fail to give the additional approved security required, and decline the contract, the security cheque that accompanies the tender is forfeited to the Commission as "liquidated damages." Now, the dictionary gives the meaning of the word "liquidate" as follows: "To adjust, pay, wind up." What damage or loss does the Railway Commission sustain if a party tendering failed to furnish what to them might appear as satisfactory additional security, while the party tendering would be of the opinion that it would be sufficient security, and that it would be accepted? There is sometimes a wide difference of opinion between business men as to the value of certain securities. The Commission would not even sustain any loss or dignity. Would not, or is not, therefore, a fine, for that is the plain term of it, of one hundred thousand dollars, or one hundred and fifty thousand dollars, rather heavy under these circumstances?

While on the subject of security cheques to accompany tenders for public works, may I be permitted to refer to a case nearer home? Tenders are now being invited by the Department of Public Works for the much-needed improvements to Toronto harbor. An accepted cheque for forty-eight thousand dollars (\$48,000) is to accompany each tender sent in. Would not a cheque for the half of this amount answer the purpose as well, and serve as an evidence of good faith, etc., on the part of contractors tendering? The fact that the work is estimated to cost about four hundred and eighty thousand dollars (\$480,000) is no reason why ten per cent. (10 per cent.) should be required to be put up as security to tender on such a large contract. Why not let it be five per cent. (5 per cent.), which would be twenty-four thousand dollars (\$24,000), as in these days of close bidding 10 per cent. may more than represent the estimated profit.

Contractor.

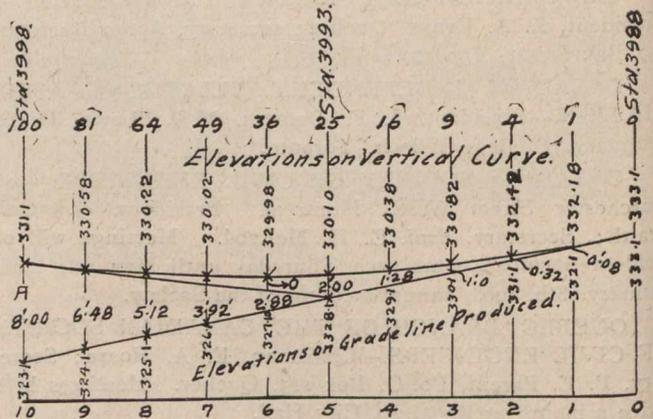
Feb. 24th, 1908.

RE VERTICAL CURVES.

Sir,—I suggest the following as a method which is both "accurate in mathematics and yet simple enough to be used in the field":—

Make all vertical curves conform to following formula and example, per annexed diagram. The algebraic difference between the rates of the grade, multiplied by half the length of the vertical curve equals A.

The ordinates O are each a fractional part of A; the length of the vertical curve in station (L), squared, is the common denominator of the fraction representing the



fractional part that any ordinate is of A, and the number of stations from the B. C. of the vertical curve, at which the ordinate height is required, squared, is the numerator of that fraction.

When an ordinate is required at a plus, as the plus of a pile bridge bent, consider the plus as a decimal of a station.

Formula: $O = \frac{X^2}{L^2} \times A$ where X = No. of sta. from B.C. of vertical curve.

Example.

Length of curve = L = 10 stations.

Rates of grade + 0.6 and - 1.0.

1.6 = algebraic difference; $(1.6 \times \frac{10}{2}) = 8.0 = A$.

$L^2 = 10^2 = \text{common denominator} = 100$.

Ordinate at Station 4 from B.C.

$$= \frac{4^2}{10^2} \times \frac{16}{100} \times 8 = 1.28$$

Elevation at Station 4 on the 1% grade = 329.10; this, plus 1.28 = 330.38, the elevation on vertical curve.

Yours,

A. L. Ford.

Eglington, Ont.

RAILWAY SWITCHES.

Sir,—"Transit" in his recent letter regarding wyes mentions that the degree of curvature was altered when the switches were put in.

During the past year I have had a number of spur lines to stake out, and have always had trouble in finding out where to put the switch. If "Transit" or any other of your readers can help me I shall be much obliged.

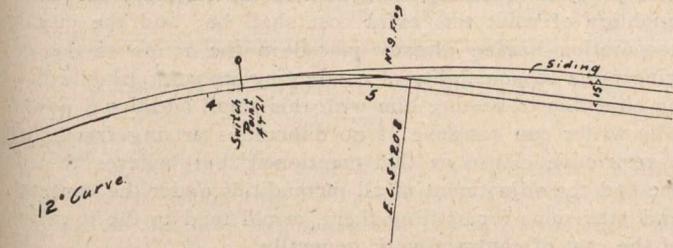
Yours,

C. R. S.

February 15th, 1908.

A TURNOUT PROBLEM.

Sir,—As is shown in the accompanying diagram, it is required to turn out from a main track to a side track, which shall be parallel to it and 15 ft from it in as short a distance as possible. The main track is on a 12° curve,



and the side track is on the outside of the curve, which ends 99.2 ft. from the switch point. No. 9 frog is to be used, and 12° is the limiting curvature.

I would be very pleased to receive a solution from some fellow-reader engaged in railroad work.

B. A. R.

February 20th, 1908.

APPROXIMATE ESTIMATES.*

By Alexander Potter, C.E., New York.

Misunderstandings and troubles have frequently arisen between engineers and contractors over the meaning of the term "approximate estimate," and a considerable number of law suits have resulted in which the exact meaning and use of this term have played an important if not a controlling part.

According to the standard dictionaries, the words "approximate" or "approximately" seem to be clearly defined as something "close to in equality, degree, or quantity"; as something "nearly but not exactly accurate; as an approximate estimate; an approximate result"; as "very nearly but not absolutely."

In engineering work when the quantity and character of the work cannot be absolutely and definitely determined beforehand, and competitive bids are required, the standard of comparison must be an approximate one. Bidders are invited to name prices per unit of measure, the quantities being given approximately only, to enable the contractor to determine at which price he will undertake a job of the size estimated, and it is customary to state in the invitation to bidders that the quantities named are approximate only. Now out of the different understandings of the meanings of this term "approximately only" have arisen the many disputes regarding claims for extra work, questions of fraud and misrepresentations on the part of the engineer, the interpretation of contracts in general, and of what constitutes balanced and unbalanced bids.

The Engineer the Arbitrator.

As the engineer is usually made the final arbiter of all questions arising under a construction contract, with power to make alterations, additions or omissions, and to determine the value thereof, the engineer's understanding of the meaning of the words "approximate estimate" becomes of the utmost importance, and some general rule should be adopted defining its meaning. Unless in engineering practice there is some well established rule to the contrary, the meaning of the word "approximate" must apply in engineering contracts and specifications which we find given in the dictionaries, i.e., that the engineer's estimates are "very nearly but not exactly accurate." The writer knows of no such rule in engineering as would warrant any other meaning being applied to this term in any of its connections.

We have always stated the purpose of an approximate estimate, viz., to obtain balanced bids for comparison in order to ascertain the lowest bidder upon any given piece of work. Unless, therefore, a uniformity of understanding as to the meaning of the word approximate exists, opportunity is afforded for misunderstanding between the parties,

which, while it may be honest, is none the less troublesome and may work great injustice.

In the first place, many contracts are let under an erroneous impression as to who is the lowest bidder. It is assumed in many cases that approximate estimates are set forth simply for the purpose of canvassing bids, and that the low bid is properly that one in which the summation of the items is the approximate estimate multiplied by the unit prices is less than all the others. This may or may not be true, and depends upon the accuracy of the approximate estimate. The truly lowest bid is that one in which the summation of items in the final estimate multiplied by the unit prices would have been the lowest. The necessity of accuracy and correctness in the approximate estimate is readily seen therefore. The main object in getting bids from contractors is not merely to determine who is lowest on the face of the returns but to ascertain who will complete the work for the least amount of money.

The Advertisement in the Contract.

Many engineers in advertising public work specify certain quantities of work to be performed, but in the subsequent contract presented to the successful bidder for his signature carefully omit the quantities advertised as approximate so that they form no part of the contract. It needs no argument to set forth how unjust and unfair this may prove to be. The advertisement and proposal should always be made a part of the contract and specification by specific reference thereto in the contract itself.

The powers and responsibilities conferred upon an engineer in connection with public work are often vastly greater than even the engineers themselves believe or realize to be the case. The importance of setting before the contractor proper and accurate data and estimates is one which the engineer must not lightly consider. If the engineer has any thought that the specifications and estimates do not represent or are not likely, clauses should be inserted in the contract as will give the contractor the right to demand that for unreasonable discrepancies the work shall be paid for at cost plus a reasonable margin of profit. This may to a certain extent suggest an innovation in the manner of letting contracts, but I believe that it is the only fair and just thing to do and will in the end save not only trouble and litigation, but be a financial saving to the communities or companies adopting it.

Under the average specifications the engineer is not only a court of last resort and final arbitration, with powers of final decision specifically delegated to him, but he is also in reality the attorney for the defence, for the reason that he has either himself prepared all the important and vital clauses of the contract and specifications, or has inserted them from contracts which other engineers have previously prepared. It is customary for the legal representatives of the city or company letting the contract to have little to do with the preparation of technical contracts and specifications for construction work, merely passing upon the correctness of their legal form, and not at all upon their subject matter and requirements.

The engineer is also practically a defendant in matters of dispute arising between his employer and the contractor, because it is upon the correctness of his estimates that the work is based. On this account the tendency is very strong and the temptation very great for the engineer to endeavour to "make good" his estimates by minimizing as much as possible the difficulties met in the construction of the work by endeavouring to force the performance of work which had clearly never entered into the mind of the engineer or the contractor when the contract was signed. Had it been foreseen the contractor would never have taken the contract under the conditions specified, and the engineer, had he known of such conditions being present should have forewarned the contractor, or given notice of them in his approximate quantities.

The engineer having assumed the high duties of judge, jury, defendant's attorney, and defendant in a court of last resort, should be a man of fearless justice, above suspicion or fear of himself, who will so write his specifications that he can with honour and fairness do right and justly by both

* Paper read before the Ohio Engineering Society, Columbus, Ohio.

the city or company who employs him, and the contractor who pleads for justice in his court. Until the engineering profession will rise to this high standard and condition it can never hope to stand where its mighty works should place it, not only a peer of the other professions, but on the top-most pinnacle of them all. In none of them is there a higher or a more urgent call for fearlessness, justice, and fair dealing.

Contracts written with double or uncertain meanings, evasive clauses, or unjust and arbitrary assumptions of power in the end bring no credit upon the engineer who writes them, nor profit to the corporation in whose favour they are enforced.

Allowable Variations.

There are, of course, allowable and unavoidable variations in contracts and approximate estimates.

In the fabrication of steel, in the manufacture of machinery, and in the erection of the superstructure of buildings, there are but few and minor elements of chance which would interfere with a contractor giving such an intelligent bid that, provided his bid is a balanced bid, no harm can come either to the city or corporation or to himself by reason of a large discrepancy between the approximate estimate advertised and the amount of work which the contractor is called upon to actually perform, saving only the fluctuation in the price of labor and materials. But in all work involving the uncertainties of excavation of any sort, whether it be in earth, quicksand, or rock, such as is encountered in the construction of reservoirs and dams, water works, sewers, railroads, canals, docks, or deep foundations, the actual cost of the work may differ very materially from what either the engineer or the contractor assumed the work would cost when the contract was entered into. The actual cost of removing earth and rock is in many cases from fifty to two hundred per cent. greater than the engineer deemed at the time to be fair unit prices for such work. In other cases the actual cost of performance of work has often proved to be from fifty to seventy-five per cent. less than the price bid upon the work, which price was based upon the best information at hand at the time the bid was prepared. Often, as the work advances, the actual conditions develop a state of things which prove that the information given in the first instance was entirely misleading. On this class of work, therefore, it is seen how important it is to have the approximate estimate of quantities approach the actual quantities which are to be required to be done as closely as possible, for if on the one hand the contractor has been led to believe that there is a certain amount of material to be handled and he is being greatly overpaid for the work performed, it is not fair to the city or corporation for whom the work is being done, that it should be compelled to pay such excessive prices upon an amount greatly in excess of the advertised quantities and on which the contractor estimated his profits. While on the other hand, if the contractor has agreed to the performance of work at a price which is grossly inadequate, under the honest misapprehension of conditions, it is unfair, under the omnibus clause in the contract providing for variations, additions, and changes, to compel him to perform work greatly in excess of the quantities upon which he was willing to risk his judgment and his capital as to the value of work.

The Limits of Approximate Estimate.

The limiting of the words "approximate estimate" to mean a quantity within a reasonable percentage above or below the amounts called for will tend to much more intelligent bidding, and also to the eradication and elimination of much of the trouble and litigation now occupying the courts of this country, due to the involuntary fraud upon or on the part of cities permitting or compelling contractors to perform work at absurdly high or absurdly low prices upon amounts which neither the engineer nor the contractor dreamed he would be called upon to perform at the time of the signing of the contract.

There should be no difficulty in inserting clauses in specifications providing that when the approximate estimate shall have been exceeded by a certain predetermined percentage, the unit prices bid upon the work shall no longer prevail, but that the balance of the work shall be performed at

cost to the contractor plus a reasonable percentage for profit on labor and material.

Under the ordinary form of contract the engineer is now empowered to make any and such changes as he may see fit in the work. In other words, he is given such extraordinary powers of control over the contractor, that the contractor can hardly object to having delegated to the engineer the determination of what this extra cost shall be; and the city or corporation having already placed in the hands of the engineer the responsibility of conducting its work, should have no objection to vesting him with this small additional power. The writer can conceive of no difficulties arising from such a restrictive clause as that mentioned, but believes that in the end the adjustment of all inequalities under the contract, and provisions for settling them, would tend to the lowering of the cost of contract work generally.

The question will, of course, arise as to what this limitation of the variation of each item over the approximate estimate should be. But this is not difficult to determine. Ideas will differ somewhat, but under the interpretation of the word as given in the dictionary, they can not differ to any great extent. In the writer's judgment there should not only be a limitation upon the gross amount of the contract, but also a limitation on each particular item of the estimate. The allowance of variance for any particular item would depend largely upon the factor of uncertainty involved and should of course be greater than upon the total amount of the contract. On a single item there might be conditions of variation of as much as fifty per cent., while on the total amount of the contract the variation allowed should doubtless never be more than twenty per cent. without some readjustment of prices upon such a basis as that mentioned, viz., that when the approximate estimate shall have been exceeded by a certain predetermined percentage, the unit prices bid upon the work shall no longer prevail, but that the balance of the work shall be performed at cost, plus a reasonable percentage of profit on labor and material.

NEW INCORPORATIONS.

Maple Creek, Sask.—Maple Creek Masonic Building Society.

Hanley, Sask.—Rollefson Brothers Company.

Moose Jaw, Sask.—Davidson Fraser Lumber Company.

Ottawa, Ont.—Ontario Gas and Oil Fields, \$1,000,000. J. R. L. Starr, T. B. McQueston, C. E. Hunter, Toronto.

Byron, Ont.—Byron Telephone Company, \$15,000. R. McEwen, A. J. Rollins, H. Wickerson.

Stratford, Ont.—Duggan & Gray Company, \$50,000. J. A. Duggan, J. A. Gray, W. J. Mooney.

Cobalt, Ont.—Cobalt Silver Hill Mines, \$1,000,000. C. F. Mitchell, W. R. Graham, J. J. Anderson.

Windsor, Ont.—Soo Copper Company, \$1,000,000. E. M. Day, A. C. Peoples, C. E. Day.

Peterborough, Ont.—Collier-Cunningham Company, \$40,000. A. B. Cunningham, W. H. Collier, M. A. Morrison.

Sault Ste. Marie, Ont.—Goulais River Land and Lumber Company, \$40,000. F. E. Baldwin, Petoskey, Mich.; T. Kirby, N. W. Kirby, Sault Ste. Marie.

Montreal.—Dominion Asbestos Mines, \$1,200,000. H. Robertson, Boston; R. T. Hopper, F. M. Markey. A. L. Pacaud, \$250,000. R. B. Hutcheson, E. N. Armstrong; C. S. Wallace.

Hamilton, Ont.—Oneida Lime Company, \$20,000. W. Anderson, A. Ward, W. B. Anderson. Young-Winfield, Limited, \$40,000. R. M. Young, H. Winfield, W. C. Plater.

Toronto.—Loughborough Mica Company, \$40,000. J. Dignum, A. S. Rogers, L. E. Auston. MacArthur, Limited, \$40,000. A. D. MacArthur, H. H. Dewart, G. S. Hodgson. Harris Patents, \$40,000. C. W. Kerr, C. S. MacInnes, C. C. Robinson.

*On February 5th, 1908, the Secretary of State of Canada issued Supplementary Letters Patent changing the corporate name of "The Locomotive and Machine Company, of Montreal, Limited," to that of "Montreal Locomotive Works, Limited."

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.

RAILWAYS—STEAM AND ELECTRIC.

Quebec.

MONTREAL.—The management of the Street Railway Company is considering the question of large extensions to its system, not only within the city limits, but on the Island of Montreal. It is understood that the Company has in view the expenditure of a large amount of money during the coming season. This expenditure will include the construction of several new lines to be built in the suburbs and along the lake shore. A new circuit will connect the Back River and the Cartiersville systems.

Ontario.

OTTAWA.—The Minister of Railways has given notice of a resolution providing for increasing the Board of Railway Commissioners from three members to six. The new appointees will be an assistant Chief Commissioner, at a salary of \$9,000, and two additional Commissioners at salaries of \$8,000 each.

Saskatchewan.

BATTLEFORD.—The Board of Trade has appointed E. H. White and A. Champagne as a delegation to interview the various railroad officials with a view to completing arrangements for the entry into the town of the lines projected in the direction of Battleford. They are also deputed to wait on the Ministers of the Federal Government on other matters of importance to the town and country.

British Columbia.

VANCOUVER.—The C.P.R. contemplate considerable expenditure in the Kootenays during the coming year. The building of the jetties on the harbor front here will be continued. Twenty-one miles of heavier steel will be laid west of Cascade and between West Robson and the foot of the grade. A large amount of bridge work will be done in the Kootenays. Particular attention will be paid to the improvement of the water transportation in the Kootenays. A tug, the same size as the "Valhalla," at present in use, is to be built on Kootenay Lake; also two fifteen car barges for the transfer of freight between Kootenay Landing and Proctor. On the Arrow Lakes a tug and one eight-car barge will be built; on Slokan Lake an eight-car barge will also be built, and on Okanagan Lake an eight-car barge will be built to care for the fruit traffic between Kelowna and Okanagan Landing. A deck barge will be built for Trout Lake to run between Trout Lake City and Gerrard.

NEW WESTMINSTER.—Four more modern up-to-date interurban cars, two work cars and twenty city cars, the whole valued at approximately \$200,000, is the output outlined for the B.C.E.R. car shops of this city for the present year.

LIGHT, HEAT, AND POWER.

Ontario.

HAMILTON.—The council here will be asked to appoint an engineer to draw up specifications for the street lighting plant.

HAMILTON.—Estimates made by Board of Works include \$44,380 for gas, arc and Nerst lamps.

STRATFORD.—A contract will likely be made with the Hydro-Electric Commission for the supply of Niagara power. Debentures will be issued for \$35,000 for the erection of a distribution plant.

GALT.—The town council have decided to take 600 horse-power from the Hydro-Electric Commission. A canvass of the town showed a possible sale of 1,200 horse-power. A vote of \$66,000 for a distributing plant has been passed,

and now the power to the extent mentioned will be applied for. It is the feeling of those who know the local situation that the 600 horse-power will easily be utilized. The town lighting and waterworks acquirement need a great part of it. In this connection the question of dealing with the existing lighting company with a view to acquiring their plant and water power will soon be an issue. It is believed that both parties will approach the matter in a good spirit, and that a mutually satisfactory deal will be the outcome.

Nova Scotia.

SYDNEY.—The recently constructed transmission line of the Cape Breton Electric Company to North Sydney was used recently for the first time, and from now on the residents of the town across the harbor are to be supplied with electrical energy generated in this city.

Manitoba.

MINNEDOSA.—The citizens of this town expect soon to have a waterworks and power system combined, and an electric plant of not less than 600 horse-power may be erected in the near future.

TENDERS.

Ontario.

HAILEYBURY.—Tenders are asked until March 6 for building of a public school here. J. I. Rankin, secretary, Haileybury.

CHUTE A BLONDEAU (County of Prescott).—Tenders will be received for the construction of landing pier here until March 18. Fred. Gelinis, Secretary Department of Public Works, Ottawa.

OTTAWA.—Tenders will be received until March 4 for the erection of a club house for the Ottawa Country Club on the Aylmer Road, near Ottawa. Darling & Pearson, architects, Toronto.

NEW LISKEARD.—Tenders will be received for the construction of timber bridges over the White River at Englehart and Hilliardton, in the District of Temiskaming, until March 4. J. O. Reaume, Minister of Public Works.

Quebec.

MONTREAL.—Tenders will be received until March 2 for rebuilding wall, Basin No. 2, and side Basin No. 1, Lachine Canal. L. K. Jones, secretary Department Railways and Canals, Ottawa.

New Brunswick.

FREDERICTON.—Tenders will be received until March 9 for rebuilding the Fraser Bridge over Bay du Vin River, Northumberland county. C. H. LaBillois, Chief Commissioner, Department Public Works, Fredericton.

HILLSBORO.—Tenders will be received until March 23 for building Mill Creek Mouth Bridge, Albert county. C. H. LaBillois, Department Public Works, Fredericton.

RENFREW.—Tenders will be received until March 13th for construction of a public building here. F. Gelinis, Secretary Department Public Works, Ottawa.

VICTORIA.—Tenders will be received until March 16 for supplying the following cast-iron water pipe: 33,000 feet, 12-inch; 18,000 feet, 8-inch; 36,500 feet, 6-inch; 25,000 feet, 4-inch. C. H. Topp, city engineer.

NEW BUILDINGS.

Quebec.

QUEBEC.—A new post-office building will be erected here. The site has already been chosen at the corner of St. Joseph and Dorchester Streets.

British Columbia.

NELSON.—A large rink is one of the new buildings contemplated for this city. The building will be the largest of its kind in British Columbia.

VANCOUVER.—A new Y.M.C.A. building is under consideration here. A building is contemplated to cost at least \$250,000.

MISCELLANEOUS.**Ontario.**

BARRIE.—A grant of \$2,000 is under consideration by the Roads and Bridges Committee of County Council for the purpose of improving certain roads here.

HAMILTON.—The Board of Works in the estimates made for the coming year ask for an appropriation of \$294,000. Of this amount \$250,000 is the estimate for permanent road work.

ELMIRA.—A test of the new pumping machinery of the Elmira waterworks was made recently. The engine is an oil engine, belted to a horizontal duplex power pump, and exceedingly satisfactory results were obtained.

BRADFORD.—The County Council of Simcoe has set apart the sum of \$7,000 for the permanent repair of roads already built under the good roads system. The county engineer was instructed to carefully examine county roads early in the spring and report as to the sum of money to be expended on permanent construction of roads.

ST. CATHARINES.—The St. Catharines Board of Trade are endeavoring to make the deepening and enlargement of the Welland Canal, in preference to the Trent Valley Canal project, a live issue. A resolution is to be prepared and sent around to the various Boards of Trade for their sanction, and then a memorial on the subject will be drawn up and presented to the Dominion Government.

Manitoba.

WINNIPEG.—The city proposes to spend from a million to a million and a half on local improvement works this season.

PERSONAL.

MR. D. SINCLAIR, B.A. Sc., of New Liskeard, contributed to a recent number of "The 'Varsity" an interesting article on "The Young Graduate and the Engineering Profession."

MR. S. B. CODE, B.A. Sc., town engineer for Smith's Falls, was on the last ballot elected an associate member of the Canadian Society of Civil Engineers, but because of a typographical error his name did not appear in the list published in the "Canadian Engineer."

MR. ARTHUR D. LITTLE, chemical engineer of Boston, has just been re-elected official chemist of the American Paper and Pulp Association, at the recent meeting of which he read a most enlightening paper upon recent developments in the manufacture of paper and pulp.

MR. A. W. ROBINSON, M. Can. Soc. C.E., of Montreal, sailed from New York, February 26th, having been commissioned to examine and report on the River Niger with a view to improvement of navigation by dredging. He has also in hand the design of dredging plant for the extensive improvements on the Upper Nile, which the Egyptian Government are entering upon for irrigation purposes.

TRADE INQUIRIES.

A London firm manufacturing electric and hydraulic lifts, revolving shutters, collapsible gates, staircases, petrol and electric motors, and general machinery, desires to be placed in touch with Canadian importers of the same.

Inquiry has been received from a London firm for the names of Canadian importers of gas retort carbon for the manufacture of calcium carbide, electrodes, etc.

A Dutch firm is desirous of getting into touch with Canadian exporters of timber.

Inquiry has been received from a firm in Holland for the names of Canadian importers of building materials.

A London firm desires to appoint a sole agent in British Columbia for their improved opal glass wall tiles.

An English firm manufacturing goods handled by the hardware and builders' trades desires to appoint agents in British Columbia.

A firm of commercial agents at Montreal desires to secure the representation of United Kingdom exporters of hardware.

A manufacturers' agent in Vancouver, B.C., desires to obtain the representation in British Columbia of United Kingdom manufacturers of hardware and other goods. He also desires to act as buying agent for English importers of British Columbia timber.

A well-established firm in London, having agents in various parts of the world, is anxious to get into touch with Canadian manufacturers of wood pulp who require representation.

A Midlands firm wishes to purchase Canadian cobalt ore, and would like to get into communication with Canadian mine owners and shippers.

An English manufacturer of fog signals desires to hear from Canadian importers of the same.

Inquiry has been made by a London firm for Canadian importers of aneroid barometers, compasses, surveying instruments, and scientific instruments of every description.

A North of England firm manufacturing cement-making machinery and supplying complete cement-making plants desires to get into communication with interested parties in Canada.

A Glasgow firm of shipbuilders and engineers is open to build all descriptions of light draft vessels, including lighters (complete or in sections for shipment abroad), steam tugs, river and coasting steamers, etc., not exceeding 200 ft. in length, desires to hear from interested parties in Canada.

MARKET CONDITIONS.

Toronto, February 27th, 1908.

The snow which just now covers most of Southern Ontario does not easily permit construction work, consequently heavy materials are scarcely moving. Contractors as well as merchants look forward, however, to a very fair season's activity once the spring opens.

British advices describe the pig iron market as firm, manufactured iron dull, steel decidedly hopeful. American makers of constructional steel are still trying to maintain prices in the face of slack trade and accumulating stocks, but without conspicuous success. Local conditions for metals may be obtained from our price list.

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

American Bessemer.—Fourteen-gauge, \$2.45; 17, 18, and 20-gauge, \$2.60; 22 and 24-gauge, \$2.65; 26-gauge, \$2.80; 28-gauge, \$3.

Antimony.—Quiet, but inquiries are coming in more freely; we quote 11½ to 13c.

Bar Iron.—\$2.20 base, from stock to the wholesale dealer. No great activity.

Beams and channels, \$2.75 to \$3, according to size and quantity; angles, 1¼ by 3-16 and larger, \$2.65; tees, \$2.90 to \$3 per 100 pounds. Extras for smaller sizes.

Boiler Heads.—25c. per 100 pounds advance on boiler plate.

Boiler Plates.—¼-inch and heavier, \$2.50. Supply probably adequate and quotations still firm.

Boiler Tubes.—Lap-welded steel, 1¼-in., 10c.; 1½-in., 9c. per foot; 2-in., \$9.10; 2¼-in., \$10.85; 2½-in., \$12; 3-in., \$13.50; 3½-in., \$16.75; 4-in., \$21 per 100 ft.

Building Paper.—Plain, 32c. per roll; tarred, 40c. per roll, and the market decidedly strong at these prices.

Bricks.—Common structural \$10 per thousand, wholesale; small lots \$12 to \$13, and the demand moderate. Red and buff pressed are worth \$18 at Don Valley Works.