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MISSING

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The Canadian Engineer

ESTABLISHED 1893.

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TORONTO, CANADA, OCTOBER 8, 1909.

CONTENTS OF THIS ISSUE.

DIVIDED RESPONSIBILITY.

For efficient work, a department must have but one head. Divided authority in street control or any other work is to be regretted, and must lead to no end of trouble.

Just recently one of our most important Western cities decided that from this time forward the city engineer was to have full charge, and to be wholly responsible for the condition of the city streets. It is hard to imagine that for years the city engineer, the waterworks commissioner and the gas and light commissioner could each do as he liked with that part of the city street he required for his own work.

The water commissioner would open a trench for a main; the gas commissioner would tear up a street to make a gas connection, and in neither case could the city engineer—the man who was supposed to provide good pavements—interfere. As a result, complaints as to the manner in which the streets were left were frequent. Responsibility could not be fixed, and wrangling and discontent resulted.

The city engineer should have full control of city streets; he should be the man of authority and responsibility. Let the other departments using the streets do so at the option of the city engineer.

CONGESTION ON YONGE STREET, TORONTO.

The congestion of certain parts of Yonge Street, Toronto, has led the city engineer's department to make a count of vehicular and foot traffic passing a certain point.

The day on which one count was made was September 28th, an ordinary day in the city's affairs. It was found that the greatest vehicle traffic at Queen and Yonge Streets was between 4.30 and 5.30 p.m., when the count was 97 going north and 120 going south. Although the Queen and Yonge Street corner (the departmental store district) was the centre of congestion in the afternoon, yet it was found that King and Yonge Streets corner was the centre of traffic in the forenoon. The hour between 10.30 and 11.30 a.m. gave the maximum of traffic.

Between 6.30 a.m. and 6.30 p.m. about 22,000 people walked down Yonge Street past Adelaide.

The eccentricities of city traffic are many, but in large centres of population it is the duty of the city engineer to be prepared with information as to the traffic not only this year, but in previous years.

Figures of traffic at any period are of more value if there are available other data for comparison.

THE ELECTRIC FURNACE.

Elsewhere in this issue we give considerable space to an extract from the report of Dr. Eugene Haanel, Director of Mines for Canada, in which he deals with the Swedish electric furnace, its design and efficiency.

Although electric smelting is still in the experimental stage, the measure of success that has attended the working of this new furnace leads one to expect that within a few years it will be perfected so that as a commercial scheme electric smelting will shortly be established in Canada.

EDITORIAL NOTE.

The Department of Trade and Commerce, Ottawa, are preparing a list of Canadian firms, their addresses and the articles they manufacture. With this list as a basis they expect to be able to assist the export trade of Canada in addition to being able to assist in the inter-provincial trade. It is to be hoped Canadian manufacturers will assist, as the Department has taken upon itself a large task, but if carried out should do much for Canadian trade.

OCTOBER MEETINGS OF A.S.M.E.

Meetings of the American Society of Mechanical Engineers are to be held during the month of October as follows:

In New York, on Tuesday evening, October 12th, at 8 o'clock, in the Engineering Societies Building, with a paper by Prof. R. C. Carpenter, of Cornell University upon the High-Pressure Fire System of New York City.

In St. Louis, jointly with the Engineers' Club of St. Louis, on Saturday evening, October 16th, when Prof. Carpenter will again present his paper upon the high-pressure fire system.

In Boston, on Wednesday evening, October 20th, at 8 o'clock, jointly with the Boston Society of Civil Engineers in Chipman Hall, a paper will be presented by Prof. Gaetano Lanza and Lawrence S. Smith on Comparison of Results obtained by the Use of Three Theories of the Distribution of the Stresses in Reinforced Concrete Beams, with the experimental results.

In conducting meetings in St. Louis and Boston the Society is entering into broader activities than ever before and affording the membership a greater opportunity to attend meetings, participate in the discussion of papers and meet members and engineers in attendance at the meetings. The meetings in St. Louis and Boston as well as in New York are to be regular meetings of the Society, with the same standards maintained in regard to papers, discussion and general conduct of the meetings that have been established by the conventions and other regular meetings of the Society held in previous years.

Of the two papers to be given in October, that by Prof. Carpenter, gives a technical description of the high-pressure fire system of New York City and the results of tests made upon the pumps and distributing mains. The first high-pressure fire system in the country was installed at Detroit in 1888, where it was designed to fill the mains by means of steam-driven pumps on boats. There are now systems installed or in process of construction in Philadelphia, Brooklyn, Baltimore, Boston, Buffalo, San Francisco, Toronto, and possibly other places. In some of the installations multi-stage centrifugal pumps are employed and in others plunger pumps are used. There is, therefore, an opportunity for discussion of high-pressure systems, as such, and also of the relative advantages and characteristics of different types of pumps for high-pressure work.

The paper by Professor Lanza and Mr. Smith gives the results of extended experiments upon full-sized reinforced concrete beams with well-developed theories, forming an important contribution to the all-important subject of reinforced concrete construction.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.

The second general annual meeting of the Royal Architectural Institute of Canada was held at Toronto, October 5th and 6th.

Mr. A. F. Dunlop, the president, in his opening address, remarked that the main object of the Royal Architectural Institute of Canada is the better education of its members in the principles of coming art. The society has this one great object in view, and is bending all its efforts to the accomplishing of it. He also referred briefly to the association's position in the Province of Quebec, and gave an emphatic contradiction to the rumor that members had been taken into the association from that Province illegally.

Addresses were also made by Mr. Eden Smith, President of the Toronto Society of Architects, and by Mr. G. W. Gouinlock, President of the Ontario Association of Architects. Mayor Oliver was to have made an opening address to the society, but in his absence the President read a letter of congratulation and regret from him. Routine business occupied the balance of the session.

The Treasurer's report showed total receipts of $1,032.-10, and a balance on hand of $803.61. Last year's balance was only $190.85.

Most of the afternoon was taken up with a discussion on the federation of the various architectural bodies. Last April a conference took place in Toronto between representatives of the various architectural associations in Canada, and five resolutions were drawn up to be submitted to the present meeting of the Canadian Institute. The resolutions of the joint meting were finally approved, and will now come before the council or executive of the Institute for consideration. They are as follows:—"(1) The conference recognizés the necessity of the Architectural Institute of Canada as a representative Canadian body. (2) The conference considers that each province should have an official body and that membership in the Architectural Institute of Canada should be composed solely of members of the Provincial bodies. (3) That architects should qualify for and pay entrance and annual dues to the Provincial bodies only, and the Provincial bodies contribute a per capita fee to the Architectural Institute of Canada. Members of the Provincial bodies shall thus become members of the Dominion body. That voting in the Architectural Institute of Canada should be by delegates of the provincial bodies. That provision should be made for existing members of the Architectural Institute of Canada who do not now belong to Provincial Associations."

A discussion then took place on "The possibility of a national status for architects in Canada." Papers were read by Messrs. J. W. H. Watts, of Ottawa, and J. P. Hynes, and H. B. Gordon of Toronto.

The Treasurer's report showed total receipts of $1,032.10, and a balance on hand of $803.61. Last year's balance was only $190.85. The present session of the association is attended by about 30 delegates from all parts of the Dominion.

The National Association of Railway Commissioners will hold their annual meeting at Washington, D. C., beginning Tuesday, November 16. The secretary is William H. Connolly, Washington.

RELATION OF LOAD FACTORS TO POWER COSTS.*

J. M. S. Waring.

I have so interpreted this title as to include in the power costs the fixed charges incident to the generating, transmission apparatus, etc., as well as the operating expenses, for there is a relation between the load factor and these fixed charges as well as between the load factor and the actual operating cost.

The fact that these relations exist (and that, other things being equal, the higher the load factor the less the fixed charges and operating expenses for any given energy output), is so well known that an attempt to prove these facts would result in a demonstration of a self-evident proposition, and I will, therefore, begin with the assumption that the fact is admitted, and will devote the major part of this paper to the description of a comparatively novel application of storage batteries where the ultimate benefit is an improvement in the load factor.

As a matter of fact, the installation of all storage batteries for railway and central station service has been made with a view of improving the load factor of the entire system or of some part of the system.

Most of these varied applications are well known to-day, and the time is too limited to make more than a passing reference to them. There is an application, however, that until recently has received comparatively little attention, but whose field is constantly enlarging, and will, I believe, result in more battery installations for railway, lighting and power service than any other single application. In order to obtain a comprehensive understanding of this application it will be necessary to lead up to it by a brief and necessarily academic discussion of power rates. This, I feel, will be justified in view of the facts that the value of the battery installation is here dependent on the nature of the rate, and that the result in this case, as in all the others cited, is the betterment of the load factor.

It is needless to say that for a power company to be on a paying basis, its total revenue must be more than sufficient

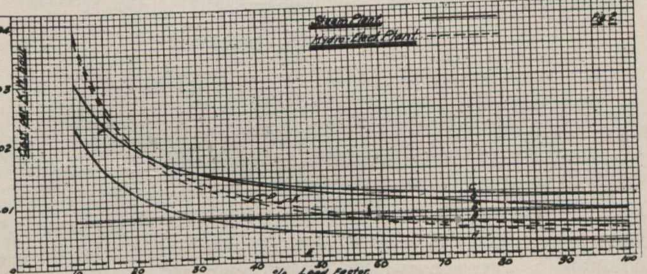

Fig. 1.

to cover all fixed charges and operating expenses. The total expenses of a power company may be divided as follows:—

(A) Fixed charges on equipment, including power house apparatus, transformers, transmission lines, etc., namely, interest, depreciation, taxes, insurance, etc.

(B) Operating expenses made up of such items as fuel and feed water, if it is a steam plant; oil, waste, incidentals, repairs and labor, including power house force, linemen, etc.

(C) Organization expenses, including salaries of officials, clerks, solicitors, etc., office rents and such expenses.

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* Paper read before the Western Society of Engineers.

If each customer of a power company is paying annually an amount sufficient to cover the fixed charges, operating and organization expenses, incident to his demand only, plus a reasonable profit to the power company, his rate is a just one, and every well organized power company knows that an unfair discrimination in rates must finally be disastrous. Power companies are, therefore, realizing more and more the necessity of adopting a form of rate which will do justice to all of their customers as well as to themselves, and the tendency to-day is the adoption of a form of rate which will pro-rate the total expenses of the operating company as equitably as possible among its customers. In order to accomplish this: First—All fixed charges and fixed expenses, namely, those that are constant and irrespective of the

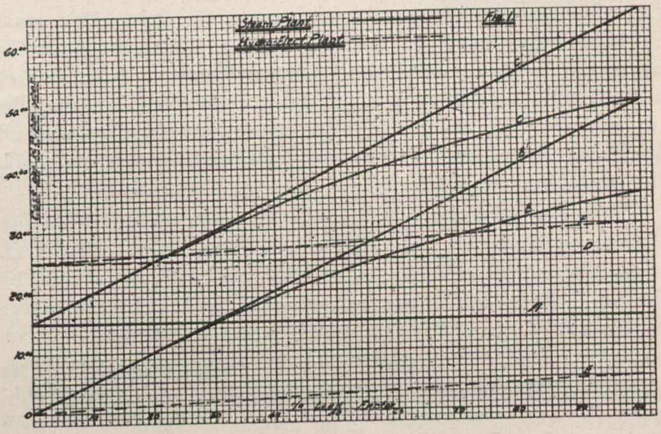

Fig. 2.

energy output of the plant should be divided among the customers in proportion to their maximum demand for power; then each customer pays the fixed charges and fixed expenses on the apparatus set aside for his use.

Second—All variable expenses, namely, those varying with the energy output of the plant should be divided among the customers in proportion to the energy they consume in a fixed time.

Of the various expenses under the headings, "A," "B" and "C," referred to above, the only variables in the case of a hydro-electric plant are the repairs, oil, waste, incidentals, and probably only a small part of the power house force, all the other expenses being practically fixed and independent of the load factor. In the case of a steam plant, however, the variables would include oil, waste, incidentals, fuel, feed water, repairs and a larger percentage of the power house force than would occur in the hydro-electric plant. Therefore, in general, the operating expenses, that is, the variable charges, are a greater percentage of the total operating cost in the hydro-electric than in the steam plants. Now, the total fixed charges of the plant divided by its kilowatt capacity will give the amount per kilowatt which each customer should be charged for each kilowatt of his maximum demand. By doing this, the total fixed charges are properly pro-rated among the customers in the manner outlined above. The total operating expense of the plant for a fixed period of time, divided by the kilowatt hours output for that period will give the cost per kilowatt hour of the actual operating expenses, exclusive of the fixed charges, and this amount plus the company's legitimate profit would be the kilowatt hour rate that the customers should pay for their energy consumption. In other words, an equitable basis of power rates is the one where a customer is billed annually a fixed amount per kilowatt of his maximum peak, which we may call a primary charge, and is billed in addition to this a fixed amount per kilowatt hour, which we will call the energy charge. Power rates may apparently differ from this in form, but to be equitable they must be reducible to this basis, and a rate which is not reducible to it is not equitable. In order that this form of rate, or its equivalent, may be put in force it is necessary that the consumer's load factor be known in each case. His average load may, of course, be determined by an integrating watt meter. His maximum load, however, must be determined in order to establish the load factor. Usually the most accurate way of determining this maximum is by means of a meter, such as the Wright Demand meter, or a recording instrument.

Notwithstanding the fact, that the number of equitable rates in force is constantly increasing, I could cite actual cases of rates in force to-day, varying from the equitable basis referred to above to the other extreme of the flat rate of a fixed amount per month per lamp connected. It may be interesting to mention several of these cases with a view of analyzing them, and determining how nearly they approach the equitable basis.

These analyses will, I believe, be made clearer by using the curves shown on Figs. 1 and 2 as illustrations. On each sheet the curves relating to steam operation are shown by the solid lines and those referring to hydro-electric plants by the dotted lines. In Fig. 1 the curves are plotted between per cent. load factor and cost per horse-power per year, curve A representing the fixed charges of a steam plant; curve B, the variable expenses; curve C, being a summation of A and B. Curve D represents the fixed charges of an hydro-electric plant; curve E, the variable expenses; curve F being a summation of D and E. All of these curves may be reduced to curves as shown on Fig. 2, which is plotted between per cent. load factor and cost per kw. hour, the cost per kw. hour, at any load factor being equal to the cost per horse-power per year at the same load factor, divided by 8760 and multiplied by 0.746, multiplied by the load factor. Thus, curve A, Fig. 2, is deduced from curve A, Fig. 1, the other curves in Fig. 2 being obtained in the same manner; the factor 8760 is the number of hours in a year. It should be understood that the values shown by these curves have been taken arbitrarily, and are not intended to represent any specific case, nor should any meaning be attached to the relative costs of steam and hydro-electric plants as shown by these curves.

1. Water Power.—A primary charge of a fixed amount per kw. per year of the maximum kw. plus a fixed rate per kw. hour.

This coincides with the rate basis referred to. The maximum is taken as the average of the ten highest fifteen minute averages occurring during the year.

2. Steam.—Same as 1, except that the maximum is determined as follows: The highest one hour average of every peak throughout the year is noted, and the highest average that can be obtained by averaging any six consecutive peaks is taken as the maximum.

3. Steam.—Different rates per kw. hour specified for various load factors. Such a basis of rates could be fixed for the steam plant illustrated in the curves by specifying the costs per kw. hour shown on curve C, Fig. 2, for various load factors, plus a profit.

This form of rate could be reduced to the general form by reducing curve C, Fig. 2, to curve C, Fig. 1, and separating this into curve A, Fig. 1, and B, Fig. 2.

4. Water Power.—A fixed rate per horse-power per year times the maximum one hour peak. Such a rate is reasonably equitable for a water power plant. It would be quite so if curve F, Fig. 1, were horizontal; that is, if all expenses were fixed.

5. Water Power.—A reservation charge of a fixed rate per horse-power of motors connected per month, plus a fixed rate for power per kw. hour.

This offers no inducement to the purchaser to improve his load factor, as would be the case were the reservation charges based on the maximum load instead of the rated capacity of motors installed. It is not fair to those customers who operate a number of motors, each of which may at times operate up to its rating, but where the simultaneous operation of all of the motors at their rated capacities would never occur.

6. A Fixed Rate per Kw. Hour.—This rate is not a just one, as no consideration whatever is given to the customer's load factor.

7. Steam.—$0.15 per kw. hour for the first 30 hours of the maximum demand, plus $0.10 per kw. hour for all in excess of the first 30 hours' use per month of the maximum demand. This is equivalent to:—

(1) The maximum kw. x 30 hours at 15c. per kw. hour, plus

(2) The total kw. hours minus (the maximum kw. x 30) at 10c. per kw. hour.

The Wright Demand meter records the maximum amperes (at 115 volts) during the month; (1) then becomes equal to the Max. Amp. x 0.115 x 30 x 0.15 = Max. kw. x 4.5, and the customer's bill is, therefore, 4.5 x Max. kw. plus 0.10 x (total kw. hours — 30 x Max. kw.) = 4.5 x Max. kw. plus 0.1 x total kw. hours — 3 x Max. kw. = 1.5 x Max. kw. plus 0.1 x total kw. hours; or, in other words, he is billed at $1.50 per month per kw. of the maximum peak plus a charge of 10c. per kw. hour, which is the same as the general form of rate referred to.

8. Water Power.—A reservation charge of a fixed amount per kw. per month times the maximum kw. plus a charge for power made up of a fixed amount times load factor times maximum kw.

If such a rate were adopted for the water power plant illustrated by the curves, the reservation charge should be approximately $2.79 per kw. per month

$$= \frac{\$25.00 \text{ per H.P. per year}}{12 \times 0.746}$$

the figure $25.00 being taken from curve D, Fig. 1), and the monthly charge for power would be $5.00, plus a profit times load factor times maximum kw. The figure $5.00 is the variable expense per horse-power per year at 100 per cent. load factor as illustrated by curve E, Fig. 1. The company's revenue would have been the same if their monthly power charge had been made equal to $0.00076 per kw. hour, plus a profit times the number of kw. hours' output for the month, since the figure $0.00076 is taken from curve E, Fig. 2, which gives the equivalent costs per kw. at various load factors of the costs per horse-power per year shown by curve E, Fig. 1.

Hence, this rate is directly reducible to the general form of rate previously referred to. The maximum in this case is arrived at by taking the average of the maximum two minute peaks for all the days in the month.

It is evident from the above that the equitable basis of rates or its equivalent offers an inducement to the purchaser of power to improve his load factor. The battery application that I have been leading up to is that of a storage battery installed by the purchaser of power to reduce his maximum demand, and consequently his annual primary charge. From his point of view, the battery proposition to be attractive must insure him a reduction in his annual power bills sufficient to pay the annual fixed charges and expenses incident to the battery, plus a fair return on the battery investment; or, in other words, the yearly fixed charges and operating expenses per kilowatt of the battery (meaning the total annual cost of the battery divided by the maximum number of kilowatts cut off the peak), must be less than the fixed charges and fixed expenses per kilowatt per year of the power company.

The power company's method of determining the peak has a distinct bearing. For instance, if the peak load of a railway is assumed to be the maximum one hour average load in one case, and the maximum five minute average load in another, the same size of battery might meet both conditions, and, therefore, cost the same, but it could reduce the peak more in the latter than in the former case, thereby effecting a larger return on the investment.

The power company's method of determining its fixed charges per kw. is also pertinent to the battery situation. In the case of a steam plant these charges can often be based on the overload rating of the generating units, while with a hydro-electric plant they can figure on very little, if any, overload capacity, as the generator would probably be installed with a continuous rating nearly equal to the water wheel capacity. If the charges are based on overload ratings, the reduction of a certain amount in the peak would result in less reduction in the consumer's bills than if based on continuous ratings.

In conclusion, I would say that I have only attempted to point out in a necessarily brief way a just basis or form of power rate, and the discussion of such kindred subjects as off-peak loads, wholesale rates to large users, etc., are hardly within the scope of this paper. Local conditions may arise, and do arise, in specific cases necessitating some departure from this general form, but the fact remains that the nearer rates in force approach this basis the more equitable they become.

RAILWAY ACCIDENTS FOR SEPTEMBER.

Record for Month Shows Improvement in One Direction.

So far as passengers are concerned, signs of a welcome improvement are noticeable from a glance at a record of the accidents which occurred on Canadian steam railways during September. It is worthy of note that not a single passenger was killed, while only five were injured. This is gratifying. But the figures which relate to employees do not compare with the record for August nearly so favorably. The totals for the two months are as follows:—

	Passengers		Employees		Others.		Total.	
1909	K.	I.	K.	I.	K.	I.	K.	I.
September	0	5	18	15	15	7	33	27
August	4	5	6	8	22	2	32	15
	—	—	—	—	—	—	—	—
Difference	—4	0	+ 12	+ 7	— 7	+ 5	+ 1	+ 12

It should be possible to prevent many of the accidents to employees. Five brakesmen lost their lives by falling from freight cars, two deaths were caused by defective equipment, and four men were killed while shunting operations were in progress. There is much room for improvement in this direction. Fourteen of the accidents, due to trespassing, could have been avoided. Five persons were killed at grade crossings. Here is the month's record for the steam railways:—

	Passengers		Employees		Others.		Total.	
Character of Accident	K.	I.	K.	I.	K.	I.	K.	I.
Derailment	..	..	2	..	..	..	2	..
Head on Collision	..	..	..	1	..	..	..	1
While Shunting	..	..	4	..	..	..	4	..
Highway Crossing	..	..	..	..	5	3	5	3
Fell off Freight Cars.........	..	..	5	6	..	..	5	6
Trespassing	..	..	..	..	10	4	10	4
Pitch in with hand car......	..	..	..	1	..	..	..	1
Adjusting Couplings	..	..	..	2	..	..	..	2
Passengers falling off	..	2	..	..	..	..	..	2
Working on track	..	..	2	..	..	..	2	..
Attempt to board moving train	..	1	..	..	..	..	..	1
Unclassified	..	..	1	1	..	..	1	1
Working on Cars	..	..	1	..	..	..	1	..
Suicide (attempted to)	..	1	..	..	..	..	..	1
Side ladders	..	..	..	1	..	..	..	1
Jumping off train	..	1	..	..	..	..	..	1
Collision (rear end)	..	..	..	1	..	..	..	1
While Switching	..	..	..	1	..	..	..	1
Working under cars	..	..	..	1	..	..	..	1
Struck by switch stand	..	..	1	..	..	..	1	..
Locomotive Explosion	..	..	2	..	..	..	2	..
	—	—	—	—	—	—	—	—
Totals	0	5	18	15	15	7	33	27

In the United States.

Railway loss and damage claims and injuries to persons cost the railway companies of the United States $56,700,000, according to statistics collected by Mr. Slason Thompson of the Chicago bureau of railway statistics. This is an increase of nearly $10,000,000 over the amount paid in 1907, while ten years ago, in 1898, the payments were only $12,182,000. These payments now absorb nearly 2% of the gross earnings. In some sections the damage claims are much heavier than in others. In Texas, in 1908, 5.19% of the railways' revenue went to pay claims for losses, damages and injuries to persons. In Pennsylvania alone, 26 were killed and 109 injured in six months, at grade crossings.

The statistics for the electric, which we give below, for August and September, are not so encouraging. Comment is unnecessary:—

	September, 1909.	
	Killed.	Injured.
Run over	1	5
Fell off	3	7
Struck	2	7
Derailment	—	2
Attempted suicide	—	1
Alighting from moving car	1	4
Attempting to board moving car	—	3
Collisions	—	3
	——	——
	7	32
August '09 totals	3	27

Recent action of the Winnipeg Board of Control is to be commended. Following the death of the victim of a street car accident, they asked the provincial government to take up the question of compelling the use of the most modern fenders and wheel guards on all street cars in operation in the province of Manitoba. It is the opinion of the board that the frequency of fatal accidents and accidents which inflict grievous bodily injury calls for radical measures to be taken.

(Continued on Page 411.)

ENGINEERING SOCIETIES.

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THE
Sanitary Review
SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

FILTRATION FIRST, STERILIZATION SECOND.

Apropos of the position which this Review has taken up, "That sterilization cannot be looked upon as a complete method of purifying water, but only as a supplementary method," it may be well to note what has been done at Chartres, France, in connection with an ozone treatment plant recently installed.

The town of Chartres depends for its water supply upon the River Eure, this being a polluted source. The plant has a capacity of 1,600,000 gallons per day.

The sterilization of one cubic metre (265 gallons) of water requires 370 litres of air containing 5/6th milligram of ozone per litre. A little more than two grams of ozone are required, therefore, for each cubic metre of Eure water treated. The raw water contains about three milligrams of organic matter per litre.

The water, before it is subjected to the above sterilizing influence, is first treated by an elaborate system of sand filtration. There are ten sand filters, 6 by 7 metres, with a sand bed one metre thick, supported on iron grills, which allow the escape of the water and facilitate mechanical cleaning of the filters. The capacity of these filters is about 15 to 20 cubic metres per square metre of filter surface per day. Before reaching the sand filters the water passes through biological filters filled with coke, two of which precede each sand filter, and are operated alternately. In them the water is subjected to a nitrifying action, and about 80 per cent. of the bacteria are removed. The first cost for the filter plant amounts to 25 francs ($5.00) per cubic metre of water treated per day, while the first cost of the combined filter and sterilizing plant totals 50 francs per cubic metre per day.

Referring to a pamphlet recently published by the "United Water Improvement Co., Philadelphia," entitled "Ozone in Water Purification," we find the opening remarks as follows: "The city of Paris, after many years' experience with sand filtration, has recently adopted a process of purifying its water supply, derived from the Marne River, by means of electrically produced ozone. This decision has been reached after ten years of careful experiments, in which ozonization has been placed in competition with filtration in all its forms."

Now, the natural conclusion which anyone would deduct from the above statement must only be that sand filtration is a defunct process in Paris, and is superceded by ozone treatment.

If we read a little further on in the pamphlet we find another statement as follows: "The ozone purification plant has been planned to treat 24,000,000 gallons a day of water which has hitherto been imperfectly purified by an elaborate system of slow sand filtration at St. Maur a suburb of Paris."

Surely the meaning which this sentence is intended to convey is that ozonization is planned to supersede and replace the slow sand filtration plant.

At the top of page 5 of the same pamphlet we read also that "Recent improvements in the art . . . have brought the cost of ozone purification far below that of either slow sand filtration or mechanical filtration." Indeed, the difference in favor of ozonization is now so great that if costs alone were the chief consideration no community would be justified in spending the enormous sums of money required to treat public water supplies by any of the old methods."

Here, again, one system is quoted as in competition with the other, and the inference to be drawn is that it is a question of choice between filtration and sterilization.

Let us turn, however, to the "Journal of the Royal Sanitary Institute," February, 1909, and quote from Dr. Samuel Rideal, page 48: "The Paris municipality have decided to ozonize the whole of their Marne supply at St. Maur, equal to 90,000 cubic metres per day. The water to be treated will pass through the existing filters at twice the present rate."

We find, therefore, that this ozone treatment is not intended to supersede the sand filtration, but to merely form an adjunct.

It is admitted on every hand that, although sand filtration may arrive at near perfection, one hundred per cent. efficiencies are not obtained in bacterial removal, and that sterilization can only be relied upon for absolute purification. It is not sufficiently admitted, however, that sterilization only becomes possible after thorough filtration, and to be effective the two processes must go hand in hand. It is not a question of comparison of efficiency between the two processes. Those who for trade or other purposes are taking up this position are doing more harm to the problem of sterilization than open antagonists to the whole principle.

In the London "Times" (Engineering Supplement), August 4th, 1909, a chemical correspondent concludes an article on "Ozone for Water Purification" with the remark: "It should not be inferred from these observations that the adoption of the ozone process will abolish the necessity for the use of filter beds."

As a matter of fact, purification by ozone does not affect the turbidity of water, this remaining constant.

In the case of the tests made by Mr. A. E. Walden at Baltimore ("Engineering News," March 18th, 1909), with 59,000 bacteria per c.c., 98.85 per cent. were removed, there being 680 bacteria per c.c. in the raw water. The turbidity of the raw water is given at 400 and the turbidity of the ozonized water at 400. An explanation of the poor result of this test has been given that it is no indication of what ozone can accomplish with a clear but bacterially impure water.

Here we have it all in a nutshell. Suspended matter must be first removed before it is practical to sterilize water with any degree of efficiency. Removal of suspended matter can only be obtained by sedimentation in storage with or without coagulants or by straining through filters.

We are constantly being asked the question: "Which is the best, ozone treatment or filtration?" Our answer is, without doubt the first duty of any municipality is to provide efficient filtration of water first, and if sterilization is required as an extra safeguard, only then can it be considered as a method of further treating the filtered water to kill off, if possible, any of the few bacteria remaining.

AUTUMN AND TYPHOID.

The autumn and early winter seasons are more associated with typhoid epidemics than any part of the rest of the year.

Typhoid in many places is practically endemic; that is, the germ of infection is always present. Given the suitable conditions for the spread of the germs, the disease, if not closely watched and guarded by quarantine laws, becomes epidemic.

It may be possible in some instances to determine the cause of the beginning of an epidemic, by means of milk or water coming in contact with excreta, or some other defined cause. The continuation of an epidemic is generally due to want of care in isolating a patient, and a lack of knowledge of the proper precautions to take in preventing the spread of infection.

A list of instructions issued by the Saskatchewan Government for the public guidance in the form of a leaflet is well worth consideration and practical attention:—

Instructions in Cases of Typhoid.

1. Typhoid fever is contracted solely by the mouth. If you do not put the poison of typhoid fever into your mouth you will never contract typhoid fever. Therefore, watch the mouth.

2. Do not eat or drink anything (water, milk, oysters, fresh vegetables or anything else) unless it has been first boiled, broiled, baked, roasted, fried or otherwise thoroughly heated through and through.

3. Do without all food or drink which has not first thus been heated. (Canned or bottled foods or drinks, other than milk or water, are not included in this.)

4. If living in the same house with a typhoid fever patient, do not handle your own food, or food intended for anyone else, even if it has been heated, except with hands that have been thoroughly washed with soap and very hot water. (Preferably also with antiseptics—ask your physician about the antiseptic to use.) Wash before every meal in this way and before cooking, serving or eating anything or putting the fingers in the mouth.

5. If there are flies about, see that all food and drink is protected from them at all times. Flies often carry typhoid poison to foods and drinks.

6. The poison of typhoid fever does not show itself for two weeks after it enters the body. Therefore, for the next two weeks typhoid cases may develop from typhoid poison already taken in. But any case which develops on or after......................will be due solely to neglect of this notice and failure to carry out minutely the directions here given.

SEWAGE DISPOSAL.

Removal of Putrescibility.*

Chapter VII.

Percolating Filters.

In the issue of September 24th, it was concluded that certain points must be observed in order to obtain the maximum efficiency in purification of sewage by means of percolating filters.

The points noted were:—

(a) Even distribution of the sewage over the whole surface of the filter.

(b) That the sewage be not presented in the form of bu'k, but broken up into drops or spray.

(c) The porosity be of open character, that the drops of sewage will not fill the pores to the exclusion of air.

(d) That the passage of the drops of sewage through the filter be sufficiently slow, to give ample time for the absorption film to extract from each drop of sewage, the organic impurities contained.

(e) That the liquid supplied to the filter never be under pressure, beyond the gravity inherent to each independent drop, so that there is no flushing of the filter.

We will now proceed to deal with the above points in the or'er named, and leave the important subject of the effect of frost and protection from frost for subsequent consideration.

Even Distribution.

Under this heading the points (a) and (b) will be dealt with together.

It has been previously pointed out that the contact bed was the result of an effort to get over the difficulty of even distribution. Even distribution was obtained by filling the contact bed to the point of saturation, that is the sewage was presented in the form of bulk to the exclusion of air. This produced conditions unfavorable to nitrification, air being necessary to this fermentative process.

A number of devices have been brought out with a view to solving the difficulty of even distribution, combined with the view of presenting the sewage in the forms of drops or spray. Generally speaking, these devices partake of two forms, either as fixed sprays, or revolving sprinklers.

Outside these two main divisions, sewage has, on a small scale, been distributed by means of perforated corrugated iron troughs, and by means of automatic tipping tanks. In the latter connection, the Fifth Report of the Royal Commission on Sewage Disposal states, "Tipping troughs and dripping trays are, in our opinion, more suitable for small

*These articles are specially prepared for this Review by Mr. T. Aird Murray, Consulting Engineer, Toronto.

than for large installations. They can adapt themselves to large variations of flow, and in the case of small or medium-sized works, where constant supervision is not available, this is a great advantage. We may add that these trays are better suited for the distribution of a large volume of weak liquid than a small volume of strong liquid.

"The distribution is seldom perfect by either of these forms of distribution, and consequently it is advisable to have deep beds where they are adopted. Further, owing to the fact that the delivery of liquid in both cases is more or less constant, medium-sized or coarse material should be used, to prevent ponding.

"A certain amount of supervision is necessary as a tray may become blocked or a trough may fail to tip."

The above conclusions appear to be fair, apart, however, from the classifying of drip trays along with tipping troughs. Drip trays have, to our knowledge, proved satisfactory in many small installations, when the tipping trough has failed. The best form of drip tray is that invented by Mr. F. Wallis Stoddart, which will be understood from the accompanying sketches The distributor consists of corrugated sheet-iron plates laid evenly over the surface of the bed in the form of channels with perforations on top. On the lower face of the channelling there are placed at intervals projecting points from which the liquid drops to the surface of the bed.

Messrs. Galt and Smith (Engineers, Toronto), have recently installed the above method of distribution in connection with a biological filtration plant at Vernon, B.C. They claim that its chief advantages apart from distribution are,—no moving parts which can be affected by frost, and that in the case of a small installation, it can be readily covered in and protected. There is no doubt that the simplicity and effectiveness of the method recommend themselves for small beds. In the case of large works, however, difficulty is encoun.ered in laying the channelling evenly, and maintaining the proper levels, so as to prevent overdosing at certain points to the exclusion of others. The system has been successfully applied at numerous country houses, and private and public institutions, but has had no wide adoption in the case of larger works.

Stoddart's method of distribution came into vogue in 1898, and was preceded by a somewhat similar method adopted at Salford, (England), by Corbett, the city engineer, who conceived the method of leading sewage into percolating filters by means of wood troughs or channels placed about 3 feet above the filters, the sewage overflowing the troughs and splashing in the surface of the filters. Corbett, however, replaced his distributing troughs by fixed perforated pipes, through which the sewage was discharged periodically by aid of a syphon. This is really the parent of the fixed spray principal. It was not long before Corbett improved the form, resulting in the fixed fountain spray (which has become known as the Salford spray), and adopted by Watson, if Birmingham, on a large scale, at Columbus, Ohio; and at Hamilton, Ontario; etc.

The fixed spray necessitates a working head of from two to eight feet. The sewage is distributed from a collecting tank, (after the solids have been removed), by pipes either placed on the surface of the filter or within the bed of the media. From these pipes perpendicular junctions, pieces are led to above the surface of the bed, terminating with a spray nozzle. The sewage is emitted from the nozzle by virtue of the head pressure in the form of a circular fountain spray. The surface of the filter presenting any number of these circular sprays as arranged. Usually the filter beds are arranged as squares or rectangles, and each separate spray being a circle, the intervening space between each circle receives no sewage, consequently a large area of the filtering material is continually out of use.

Further, in spite of all efforts to vary and improve upon the form of nozzle, an even and equal distribution of sewage over the surface, contained in the circle area has been found impossible.

The fact that there are no moving parts connected with the fixed spray has led the Massachusetts Board of Health to make a number of experiments in this direction; it being thought, that, where it is a question of frost, the fixed spray presented advantages over the revolving sprinkler. In this connection we would quote the conclusions arrived at, published in 1907, State Board of Health Report.

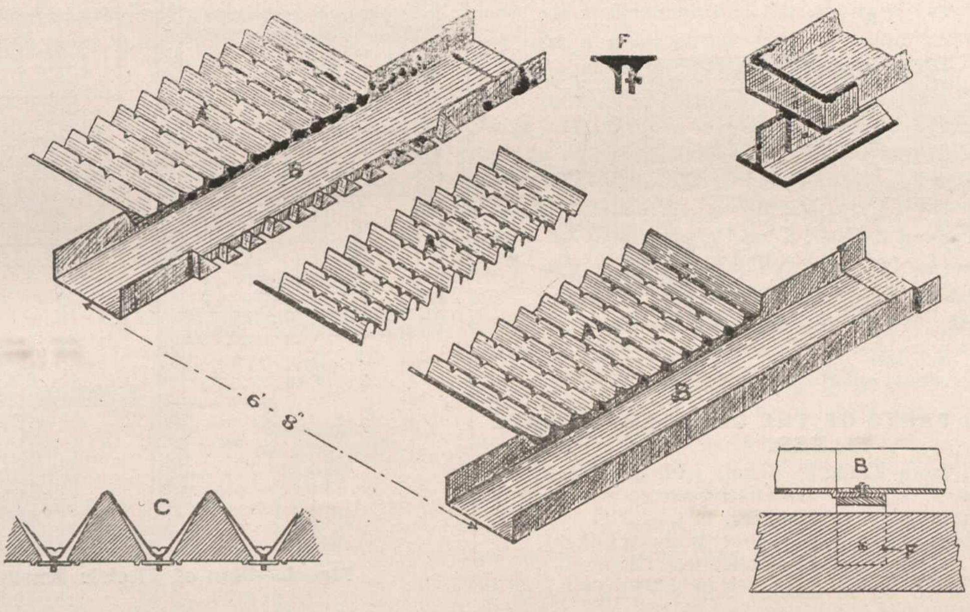

FIG. I.—SKETCH OF THE STODDART SEWAGE DISTRIBUTOR (PATENT).

A—Distributor.
B—Supply Channel
C—Attachment of Distributor to Channel.
F—Chair with Set Screw.

"From the experiments with the sprinklers it is seen that, while the mean rate upon the area wet may be kept down to the point where good purification is assured, small portions of this area are receiving the bulk of the sewage at rates many times greater than practical, while the larger portion of the filter is being operated at a very low rate. The result is that a considerable proportion of the sewage may pass through the filter practically unchanged, and a small portion be highly purified; in other words, the effluent from the filter may be a mixture of highly purified effluent and of practically unpurified sewage, rather than a uniformly purified effluent."

"The sprinkler tests have shown that, as the head is increased, the size of the area covered by any sprinkler, and the rate of discharge by the sprinkler increase, but that, the mean rate on the area wet diminishes. These tests have shown, also, that nearly all sprinklers are more efficient in producing uniform distribution when operated at the higher heads, and that only a small variation in this efficiency is produced by elevating the sprinkler above the surface. The rates obtained with nearly all of the sprinklers have been so large that they could not be operated continuously without causing the filter to be flooded at much higher rates than are

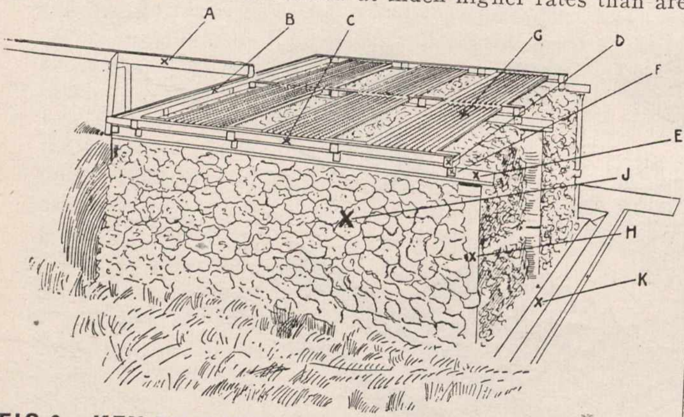

FIG 2.—KEY TO PARTS OF THE STODDART SEWAGE FILTER.

A—Feed Channel from Tank.	F—Chair with Set Screw.
B—Main Channel	G—Distributor.
C—Supply Channel.	H—Pier.
D—Stopend or Penstock.	J—Filter Body (clinker).
E—Iron Tee.	K—Collecting Channel.

at present believed to be advisable; and for this reason a system of distribution by sprinklers of any of these types should also include some device for producing intermittent operation. Operating the sprinklers under variable head has resulted in wetting the portion of the surface adjacent to the sprinkler which was entirely overthrown by the same sprinkler under constant head; but this more complete wetting has not resulted in any material increase in the uniformity of distribution, since a greater volume of sewage is concentrated upon a smaller overdosed area."

The Royal Commission dealing with the above question have to state (page 92, 5th report), "Distribution by means of perforated pipes or nozzles laid over a filtering area is almost always rather unequal, and this would be a disadvantare, except in the case of fairly deep beds, constructed of fine or medium material, or deep beds, (say eight feet or more), of coarse material. This method of distribution, moreover, needs a considerable head of liquid for proper working, and also requires constant attention to keep the pipes and distributing holes clean and free. At Birmingham, where the nozzle form of distributor is in use on a large scale, for each acre and a half of filter, one man is constantly employed night and day in cleaning nozzles."

(To be Continued).

THE ELECTRIC FURNACE AT DOMNARFVET. SWEDEN, ETC.*

By Eugene Haanel, Ph.D. (Director of Mines for Canada).

In the winter of 1905-6, a series of experiments in electric smelting were conducted at Sault Ste. Marie, Ont., under the auspices of the Dominion Government, with the object of establishing the feasibility of economically smelting Canadian magnetic iron ores comparatively high in sulphur, but free from manganese; and using charcoal as the reducing agent.

As a result of these experiments, the electro-metallurgy of the reduction of refractory iron ores without the use of coal or coke fuel was established; and—as far as could be expected from a small, experimental furnace—the output of pig iron per electrical horse-power-year, determined. Moreover, based upon the experience thus gained, certain fundamental changes and improvements necessary in the construction of an economic electric furnace in the future were

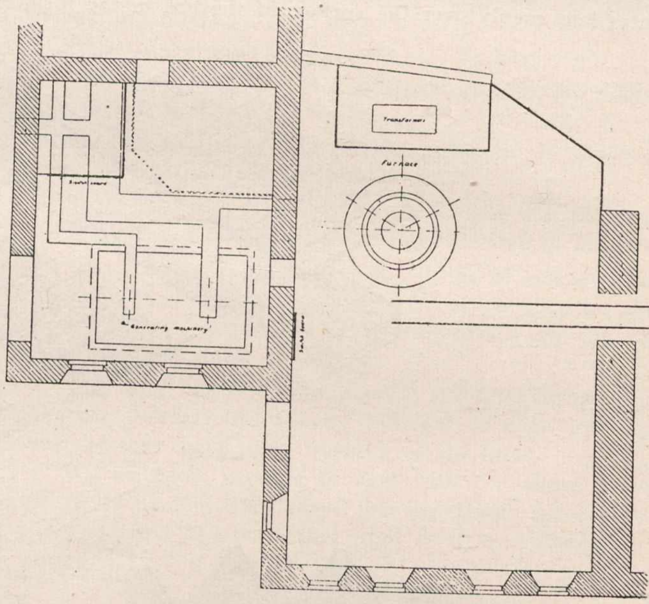

Fig. I.—Plan of Electric Smelting Plant.

suggested, in order to render it suitable for the production of pig iron on a commercial scale.

Although the Canadian experiments of 1905-6, proved entirely successful as regards the special objects aimed at, and while considerable interest in the reduction of iron ores by the electro-thermic process was manifested at the time, no additional experimentation of any significance has been undertaken in Canada, along the line suggested in the Mines Branch report, to ensure the commercial success of electric smelting. In Sweden, however, where the conditions governing the economical use of the raw materials necessary for an iron industry are very similar to, and in many respects identical with, those existing in several of the provinces of the Dominion of Canada, the importance of an economic, commercial, electric smelting process was fully realized by three young Swedish engineers some two years ago. These engineers, viz., Assar Grönwall, Axel Lindblad, and Otto Stalhane—stimulated by the successful results of the work done at Sault Ste. Marie—undertook to solve the problem of designing and constructing a commercial electric furnace.

* Report to the Department of Mines, Canada.

Inasmuch as the electro-metallurgy of the reduction of iron ores had been established by the Canadian experiments, these Swedish inventors concentrated their entire efforts in an attempt to solve the practical, commercial problem, along the lines suggested in the official report. In carrying out their plans to a successful issue, they were ably assisted by the ironmasters of Sweden, who manifested great interest in this question. Special assistance was rendered by the able, and far-sighted director, E. J. Ljungberg, and the vice-director, Lars Yngström, of the largest and most influential industrial company in Sweden, the Stora Kopparbergs Bergslags Aktiebolag. The inventors made an agreement with this company, and the Trafikaktiebolaget Grangesberg-Oxelösund (owners of the largest iron ore deposits in Sweden), to carry on smelting experiments on a large scale at the Domnarfvet Ironworks.

In order to concentrate their individual attention on this problem, the inventors formed a company called the Aktiebolaget Electrometall, to which the patent rights were assigned.

Evolution of the Electric Shaft Furnace.

The construction of the specially designed electrical machinery, and the preliminary work necessary for the construction of the furnace, were commenced in April 1906; and

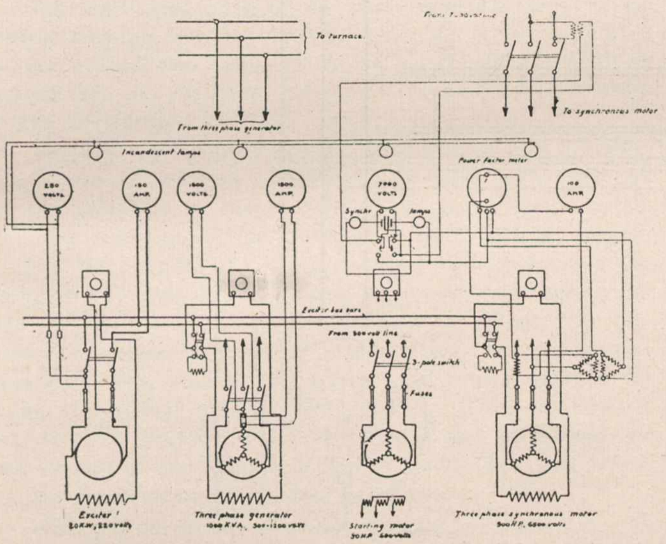

Fig. 2.—Diagram of Switchboard Connections in Generating Station.

towards the end of that year—when the installation of the electrical machinery and high-tension cables, etc., was completed the construction of the first electric shaft furnace was begun.

This furnace was put in operation April 1907, and from that time experiments were continuously carried on and improvements made; the daily experience thus gained being utilized in successive changes in design and reconstruction towards perfection. All experimentation was conducted along scientific lines, and has yielded a rich fund of usable knowledge and instructive data as follows:—(1) On the construction and operation of electrical furnaces; (2) on the conductivity and other characteristics exhibited by materials when subjected to high temperature; (3) on the qualities of the refractory lining materials; and (4) on the most suitable manner of designing and constructing the masonry of the furnaces. In addition to this, different methods of supplying the current and of various contact devices, etc., were tried and tested. In these initial steps the experimenters did not confine their entire attention to the practical side of electric smelting, but carried on laborious researches and investigations concerning the solution of purely theoretical problems; and the determinations made and data gathered will doubtless form an important contribution to the electro-metallurgy of iron and steel.

Taking into consideration the fact that the inventors have signified their intention of writing a detailed account of all the experiments conducted by the mduring the past three years, it will be unnecessary for me to enter into minute details; but to set forth only such facts as have a direct bearing on the experimental trials witnessed at Domnarfvet.

With a view of elucidating a number of disputed technical points involved in the smelting process itself, initial experiments were conducted at Ludvika during the summer of 1907, with a small furnace of 300 horse-power capacity. During these preliminary experiments many difficulties were encountered which had to be overcome; and it was not until the summer of 1908 that they succeeded in designing and constructing a furnace which, in their opinion, could be economically used in practice. Towards the end of the summer a number of experiments were made with this furnace, which demonstrated that the type evolved was durable, and that a good output could be obtained therefrom, notwithstanding the fact that the furnace was constructed with a relatively low shaft in order to reduce the building expense. On account of this low shaft, which was open at the top—as in the case of the furnace employed at Sault Ste. Marie—the consumption of charcoal was large, viz., 9 cwts. 6 lbs. per metric ton of pig iron produced. A considerable portion of this charcoal was consumed at the top of the open shaft, and the gas escaping from the furnace consisted almost wholly of carbon monoxide. Hence, notwithstanding the excellent results obtained with this furnace, the inventors conceived that by utilizing the waste gases, even more economic results could be attained; they consequently decided to construct a new one of larger capacity, with a higher and more rationally designed shaft.

The new furnace was completed early in December 1908, and the intention was to at once begin an extended trial run; but owing to a severe drought this extended trial had to be postponed. Some time previous to the completion of this furnace the inventors tendered the writer an invitation to witness a short trial test to take place early in December. Although little rain had fallen up to this time, hopes were entertained that by the middle of December there would be sufficient water to carry on the contemplated experimental trials.

Soon after receiving the invitation, I received official instructions to proceed to Sweden to investigate and report upon this new electric shaft furnace, and sailed for Europe via New York, on November 25, 1908. Immediately on my arrival in Stockholm, where I met Mr. Grönwall—one of the inventors of the furnace—it was arranged that we should go to Falun for the purpose of placing before Mr. Ljungberg, the general director of Stora Kopperbergs Bergslags Aktiebolaget—at whose works the furnace was erected—the great importance to Sweden, as well as other countries, of making, if possible, the contemplated special trials. As a result of this conference, he very generously allowed the use of power to operate the furnace for twelve days. The inventors informed me, however, that they did not expect entirely satisfactory results as regards the output of pig iron per electrical horse-power year, since a furnace of this size could not possibly arrive at its normal working condition in the short time allowed for the test inasmuch as the walls are so thick that it takes a comparatively long time to heat them entirely through; and acceleration of the heating could only be accomplished at the risk of damaging the furnace walls. In addition to this, the shaft should not be filled to the top until after several days' working.

In concluding this preface, it may be mentioned that the experimental trials witnessed were not conducted for the purpose of determining the output of pig iron per electrical horse-power year—this had been satisfactorily determined by the experiments at Sault Ste. Marie, as well as by the Swedish inventors in their experiments with the furnace preceding the one investigated at Domnarfvet—but to demonstrate the commercial feasibility of the furnace, and to prove whether uniform working without disturbance could be expected.

Description of the Plant.

The experimental plant (Fig. 1) was installed in an old building adjoining the basic-Bessemer converter house. The machinery, which was specially designed and constructed for the experimental trials, consists of a three-phase synchronous motor of about 900 horse-power, supplied with a current of 7,000 volts, and 60 periods, from a three-phase cable line in the ironworks. This motor is directly coupled to a three-phase generator, which supplies current of 25 periods, adjustable to between 300 and 1,200 volts, through small intervals to the transformers erected in the immediate vicinity of the furnace. By means of this extensive regulation it is possible to determine the most suitable voltage to be employed with furnaces of different construction, and operating under various conditions.

The fields of both the synchronous motor and the generator are fed with current at a tension of 220 volts, from a direct-current generator of 20-kw. capacity, directly coupled to the system. For starting the system a three-phase synchronous motors, directly coupled is employed. This is fed with a current stepped down to 500 volts. The arrangement for controlling the machines may be seen from the coupling scheme shown in Fig. 3.

From the switchboard the current is conducted through copper bars, laid in cement channels, to the three-phase transformers. The capacity of these transformers is 1,500 K.V.A., and their ratio of transformation 14: 1. By regulating the tension of the generator, the low tension sides of the transformers can be altered, through small intervals, from 20 to 85 volts. The ratio of transformation can be altered to 7: 1 by means of certain easily performed changes of coupling in the transformers; in which case the low tension can be varied between 40 and 170 volts. The transformers are cooled with air supplied under pressure by two electric blowers. A switchboard is situated conveniently near the furnace for controlling its operation. On it are mounted the following instruments:—One three-phase precision wattmeter for differently loaded phases; three ampere meters—one for each phase, and one voltmeter. The ampere meters, and the wattmeter, are connected to the current system by means of transformers. The voltmeter and tension terminals of the wattmeter are directly connected to two of the conducting bars.

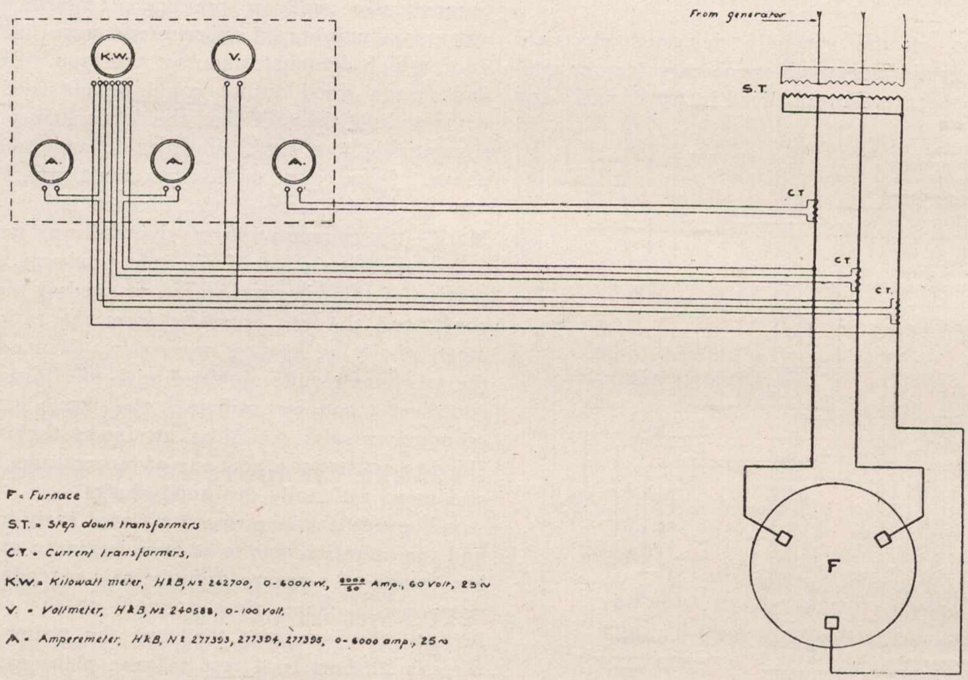

Fig. 3.—Diagram Showing Connections of Instruments Controlling the Furnace.

To protect these instruments from heat when tapping, an iron curtain, which may be lowered or raised, is placed in front of the switchboard. The connection of the instruments is shown by the connection-diagram, Fig. 3; while the external appearance of the arrangement is shown by the photograph, Fig. 4. It will be seen that the wheels—by which the electrodes are adjusted—are placed under the instruments in such a manner that the wheel and ampere meter opposite to each other belong to the same phase.

Description of Electric Furnace.

In general appearance this electric shaft furnace is unlike any hitherto constructed, being very similar in design to an ordinary blast furnace, in which the tuyeres are replaced by electrodes.

A vertical section of the furnace is represented by Fig. 5; and Fig. 6 shows a plan with the shaft and electrodes removed. The height of the furance above ground level is about 25 feet. The melting chamber or crucible containing the electrodes is about 7 feet high, and is of greater diameter than any other part. The shaft is about 18 feet high, the lower end of which—for about 4 feet—has the form of a truncated cone; for the purpose of directing the charge into the crucible in such a manner that the electrodes, lining, and descending charge, could not come in contact. This special feature in the design was introduced by the inventors after repeated experiments, which demonstrated that the upper surface of the column formed by the materials charged into the furnace assumes a definite angle, viz., 50 degrees to 55 degrees to the vertical, when the materials—crushed to normal size, and at the same temperature as that existing in the melting chamber—are allowed to fall through a circular aperture into a free space. In Fig. 5 the slope is indicated by dotted lines.

It is this isolation of the descending charge from the lining at the point where the electrode enters the furnace that constitues the particular economic advantage of the construction, since it prevents the destruction of the lining, which occurred in all previous furnaces where the electrode came directly in contact with the melting charge and the lining; for the temperature of the brickwork in close proximity to the electrodes becomes so great that the most refractory lining materials are rapidly destroyed—even when the electrodes are cooled by the water jackets.

The contracted neck of the shaft immediately over the central opening into the melting chamber is not supported by the arched roof, but the entire weight of the shaft is carried by six cast-iron columns arranged symmetrically around the furnace hearth.

The melting chamber is made in the form of a crucible, and is covered with an arched roof provided with openings for the reception of the electrodes and descending charge. The roof and walls of the crucible are lined with magnesite.

For the purpose of cooling the brickwork composing the lining of the roof of the melting chamber, and thereby increasing its life, three tuyeres are introduced into the crucible—just above the melting zone—through which the comparatively cool, tunnel-head gases* are forced against the lining of the roof into the free spaces. This gas absorbs heat from the exposed lining of the roof and walls, and the free surface of the spreading charge, thus effectively lowering the temperature of the roof and exposed walls.

With the exception, however, of radiation from the tuyeres, no heat is lost by this method of cooling or lowering of temperature, since the heat given up by the lining of roof and wall to the comparatively cool gas introduced through the tuyeres, is imparted in passing upward through the shaft to the cooler portions of the descending charge. This effects not only a better utilization of the reducing power of the CO, but in addition, produces a better distribution of heat throughout the charge in the shaft than in any electric furnaces previously constructed.

The tuyeres are provided with sight holes, covered with mica, through which the interior surface of the arched roof can be observed. By means of this device it is possible to determine approximately the necessary quantity of gas required to effectively cool the roof lining at the mouth of the melting chamber.

Each electrode was built up from two carbons 11 inches square × 63 inches long, making the total cross section of the built-up electrode 11 inches × 22 inches. The electrode holder is made of a strong steel frame, forming a support for the wedges by means of which the copper plates conducting the current from the copper cables are pressed against the faces of the electrode. The electrode is clamped in the steel frame mentioned above, and slides on two guides, which serve the two-fold purpose of keeping the angle of inclination to the vertical constant and relieving the arched roof of any undue strain which would arise from the weight of the electrode—if insufficiently supported. A steel cable, secured to the top of the electrode holder and passing over a system of guide wheels or pulleys to the drum operated by the hand-wheel on the switchboard, serves to lower and raise the electrode, by winding or unwinding the drum. In order to protect the parts of the electrodes outside the furnace from the oxidizing action of the air, a suitable covering is provided.

The water-cooled stuffing boxes, through which the electrodes enter the melting chamber, are provided with special devices (not shown on the drawing) for preventing the gas under pressure within the melting chamber from leaking out around the electrodes.

The shaft—as previously mentioned—is supported by an iron plate, resting on six cast-iron pillars arranged symmetrically around the furnace hearth. To prevent the pillars from being cut off in the event of the molten iron accidentally finding its way to them, the lower parts are protected by sand enclosed in a sheet-iron casing. This mode of construction enables the operator to repair or replace—without removing the shaft—those parts of the furnace needing the most frequent repairs, viz., the lower part of the shaft, and the melting chamber.

In order to collect the waste gases at the throat of the furnace—with the object of utilizing them economically for the purposes specified, and at the same time to protect the charcoal fuel from premature combustion—the top of the shaft is closed by an iron cover, fitted with a charging bell and hopper, covered in by means of a specially constructed sheet-iron hood, designed to prevent gas explosions caused by the intrusion of atmospheric air into the shaft when a charge is being introduced.

The collected gases at the throat of the furnace are discharged into a downcomer pipe, provided with a dustcatcher, from which the gases—largely denuded of dust—are drawn by means of a fan, and forced down into the smelting chamber through the tuyeres. With a view of preventing excessive pressure in the interior of the furnace, an uptake pipe—provided with loaded, self-closing valve—is placed at the junction of the outlet pipe and top of downcomer, for conducting the gases generated in the furnace (when the pressure reaches a certain point) to apparatus designed for the utilization of the waste gases, or to the atmosphere.

Raw Materials Used.—The iron ore placed at the disposal of the inventors for the trial run was magnetite from Grängesberg, and had the following compostion:—Fe_3O_4, 66.46 per cent.; Fe_2O_3, 21.21 per cent.; MnO, 0.30 per cent.; MgO, 0.98 per cent.; CaO, 3.84 per cent.; Al_2O_3, 1.07 per cent.; SiO_2, 3.16 per cent.; P_2O_5, 2.34 per cent.; S, undetermined; metallic iron, 62.96 per cent.

During the first part of the trial run, coke containing 85 per cent. C and 0.55 per cent. S was used. This, however,

* During the run of the furnace now in progress (July 7) an examination of the tunnel-head gases was made, resulting as follows:—The escaping gases were kept (by regulating the circulation) at a temperature of 200° to 300°; and the following is an analysis when using:—

Hematite:	Per Cent.	Magnetite:	Per Cent.
CO_2	40	CO_2	25
CO	50	CO	65
H	10	H	10

had been exposed for a long time to the open air and rain, which made its percentage of moisture unusually high. Lime was used as a flux. The raw material—crushed to pieces of about 1 inch diameter—was conveyed to the charging floor of the furnace, where it was weighed, and charged by hand. The instruments were read every half-hour, the product of each tapping carefully weighed, and samples of both the iron and slag taken for analysis. The iron and slag were tapped through the same hole, but no difficulty was encountered in separating the iron from the slag after cooling. The men operating the furnace were divided into two shifts, each shift being of twelve hours duration, and consisting of four labourers and a foreman.

Heating of the Furnace.—Notwithstanding the fact that the furnace was new in every respect, only one week was allowed for heating from the time the first coke fire was lighted in the melting chamber to the time of the first tapping. Experience with blast furnaces has proved that at least three weeks should be devoted to the drying of the linings in furnaces of this size, prior to charging, otherwise, the heat energy which should be utilized in the reduction and dissociation of the ores will be expended in converting the moisture in the brickwork into steam, resulting in the chilling of the iron, and consequent reduction of the output. The unavoidable neglect of this precaution in the present instance interfered materially with the normal thermal working condition of the furnace throughout the entire trial—especially at the beginning—as the output tables clearly show.

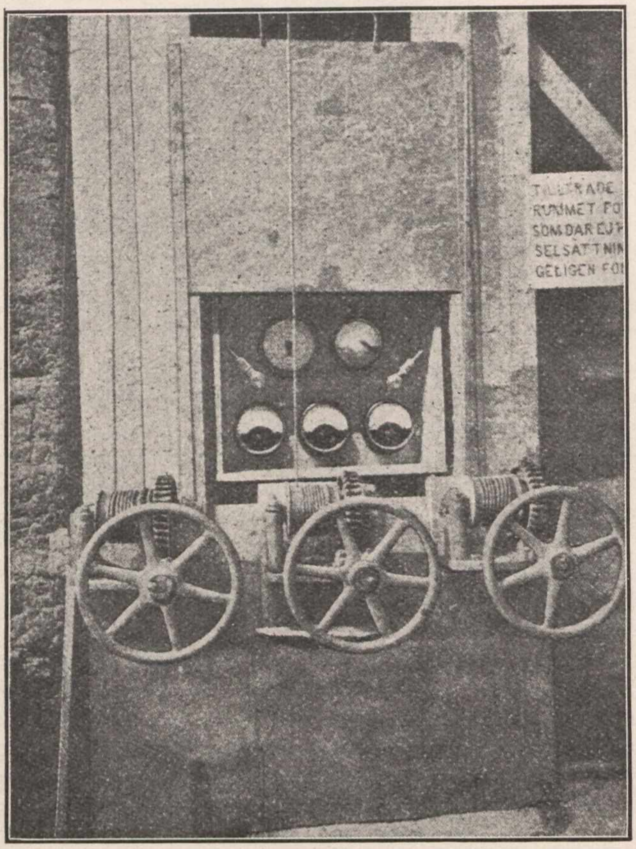

Fig. 4.—Wheels and Instruments for Controlling the Electrodes.

Power Supplied to the Furnace.—Although the furnace was designed for a much larger capacity, the power available at the time was only 400 to 450 kw. The tension was kept at between 40 and 50 volts, and the power factor—which, with the lower tension during the first part of the run was 0.85—rose to 0.90 with the higher tension.

A point in the construction of the furnace deserving of special attention is the almost complete absence of fluctuation in the instruments for recording the current and tension delivered. This, in former electric furnaces, occasioned a serious difficulty, and necessitated either the installation of automatic electrode regulators, or the constant presence of a man at the switchboard for adjustment and regulation. In this case, however, the only regulation required is that corresponding to the consumption of the electrodes, which requires to be done once a day, and sometimes for slightly longer periods. The cost of the electric installation for this furnace, compared with that of other types, is therefore cheaper, inasmuch as the costly apparatus for controlling the electrodes is dispensed with. Since the fluctuation of power is almost negligible, and current shocks do not have to be taken into consideration, this type of electric furnace constitutes an ideal load for a power station.

The Trial Run.

The trial run was started at 6.30 a.m., December 27, when the readings of the different measuring instruments were taken and recorded every half hour. Samples of the pig iron and slag were taken for analysis, and the iron—after the slag had been entirely removed—carefully weighed. During the first part of the trial the composition of the charge was: Ore, 209.0 lbs.; coke, 48.4 lbs.; lime 11.0 lbs. The coke used in this charge corresponds to a consumption of about 810 lbs. per ton (2,240 lbs.) of pig iron. During tapping, however, carbon was observed to escape through the tap-hole with the slag, which, in addition, contained a considerable amount of carbide. This indicated an excess of carbon. The charge was, therefore, altered the next morning to the following composition: Ore, 209.0 lbs.; coke, 42.0 lbs.; lime, 4.4 lbs.; corresponding to a consumption of carbon of about 704 lbs. per ton of pig iron. On the evening of the same day the charge was again changed to: Ore, 220.0 lbs.; coke, 41.8 lbs.; lime, 4.4 lbs.; which corresponds to a consumption of carbon of about 671 lbs. per ton of pig iron.

The coke used up to this time was very wet, having been exposed to rain and snow. As, however, dry coke, which consequently contained a higher percentage of carbon per unit weight, was now available, the charge was again changed to: Ore, 220.0 lbs.; coke, 37.4 lbs.; lime, 4.4 lbs.; which corresponds to a consumption of coke of about 605 lbs. per ton of pig iron. This might be further reduced when the furnace is working normally, and the gases circulated as previously described. However, this consumption of carbon must be considered as extremely satisfactory.

Analyses of the pig iron from six different tappings, and of the slag from tapping No. 4, are given below. From an inspection of these analyses it will be seen that the sulphur content, especially in the last one, is exceedingly low. During the last tapping the temperature of the furnace was higher than in the former tappings, which accounts for the low sulphur content.

Analyses of Pig Iron Produced.

Cast. No.	C	Si	Mn	P	S
2	3.20	0.056	0.32	1.80	0.015
3	3.20	0.103	0.37	1.50	*—
4	3.40	0.065	0.34	1.64	0.015
5	3.20	0.075	0.32	1.80	*—
9	3.20	0.075	0.39	1.90	0.015
13	3.15	0.070	0.24	2.06	0.005

* Undetermined.

The analysis of slag from cast No. 4 was as follows: SiO_2, 26.54 per cent.; CaO, 54.48 per cent.; S, 0.78 per cent.; Fe 0.35 per cent.

The readings of the volts and amperes, and the consumption of energy, are given in the following table. As previously explained, these figures cannot serve as a criterion for judging the process commercially, and are only inserted here as they may be of some interest from a technical point of view:—

Electrical Measurements.

Date	Time	Amperes. I.	II.	III.	Volts.	Kw.	Remarks.
Dec. 27	6.30 a.m.	6,800	6,800	6,800	41	400	
"	7.00 "	6,800	6,800	7,000	42	415	
"	7.30 "	7,000	7,000	7,000	40	400	
"	8.00 "	7,000	7,000	7,000	41	405	
"	8.30 "	6,800	7,000	6,800	42	415	
"	9.00 "	7,000	7,000	7,000	40	400	
"	9.30 "	6,800	7,000	7,000	40	395	2,860 lbs. of
"	10.00 "	6,800	6,800	6,800	40	385	pig iron cast.
"	10.30 "	7,000	7,000	7,000	40	400	
"	11.00 "	7,200	7,000	7,600	38	380	
"	11.30 "	7,200	7,000	7,200	38	375	
"	12.00 "	7,200	7,200	7,400	33	325	
"	12.30 p.m.	7,200	7,200	7,400	39	390	
"	1.00 "	7,200	7,200	7,400	38	380	
"	1.30 "	7,200	7,600	7,200	36	360	
"	2.00 "	7,400	7,400	7,200	36	360	1,067 lbs. of
"	2.30 "	7,400	7,200	7,400	38	385	pig iron cast.
"	3.00 "	7,200	7,200	7,200	40	400	
"	3.30 "	7,400	7,200	7,400	39	395	
"	4.00 "	7,400	7,400	7,600	40	415	
"	4.30 "	7,200	7,200	7,400	38	380	
"	5.00 "	7,200	7,200	7,400	40	405	
"	5.30 "	.....	.....	.....	..	...	Power off, due
"	6.00 "	.....	.....	.....	..	...	to change on
"	6.30 "	.....	.....	.....	..	...	switchboard
"	7.00 "	6,200	6,400	6,600	42	380	wiring.
"	7.30 "	6,600	6,800	7,000	40	380	
"	8.00 "	6,800	7,000	7,000	40	385	
"	8.30 "	7,200	7,200	7,000	36	350	1,411 lbs. of
"	9.00 "	7,200	7,200	7,000	36	350	pig iron cast.
"	9.30 "	7,400	7,400	7,400	36	365	
"	10.00 "	7,400	7,400	7,400	36	365	
"	10.30 "	7,400	7,400	7,200	37	370	
"	11.00 "	7,200	7,400	7,200	36	355	
"	11.30 "	7,200	7,400	7,000	36	350	
"	12.00 "	7,200	7,400	7,000	36	350	
Dec. 28	12.30 a.m.	7,000	7,400	6,800	40	395	
"	1.00 "	7,000	7,400	7,000	40	400	
"	1.30 "	7,000	7,400	7,000	40	400	
"	2.00 "	7,000	7,400	6,800	40	395	1,650 lbs. of
"	2.30 "	7,000	7,400	7,000	40	400	pig iron cast.
"	3.00 "	7,000	7,200	7,000	38	375	
"	3.30 "	6,800	7,400	7,000	39	385	
"	4.00 "	6,800	7,200	6,800	39	375	
"	4.30 "	7,000	7,400	7,200	36	355	
"	5.00 "	7,200	7,400	7,200	36	355	
"	5.30 "	7,400	7,400	7,600	37	380	
"	6.00 "	7,200	7,200	7,400	36	360	
"	6.30 "	7,200	7,400	7,400	38	385	
"	7.00 "	7,200	7,400	7,400	38	385	
"	7.30 "	7,400	7,600	7,600	36	370	
"	8.00 "	7,400	7,400	7,600	36	365	1,870 lbs. of
"	8.30 "	7,400	7,400	7,400	38	385	pig iron cast.
"	9.00 "	7,200	7,200	7,400	38	380	
Dec. 28	9.00 a.m.	7,200	7,200	7,400	38	380	
"	9.30 "	7,400	7,400	7,400	36	365	
"	10.00 "	7,200	7,200	7,200	38	375	
"	10.30 "	7,200	7,400	7,400	38	385	
"	11.00 "	7,400	7,400	7,400	36	365	
"	11.30 "	7,400	7,400	7,600	38	390	
"	12.00 "	7,400	7,600	7,800	38	400	
"	12.30 p.m.	7,600	7,800	7,600	40	430	
"	1.00 "	7,600	7,600	7,800	38	406	
"	1.30 "	7,600	7,400	7,600	38	395	
"	2.00 "	7,600	7,400	7,600	38	395	
"	2.30 "	7,600	7,600	7,400	40	425	
"	3.00 "	7,200	7,400	7,600	36	365	
"	3.30 "	7,200	7,600	7,400	38	385	
"	4.00 "	7,200	7,200	7,400	45	406	
"	4.30 "	7,400	7,400	7,800	38	395	
"	5.00 "	7,400	7,400	7,800	40	425	
"	5.30 "	7,400	7,400	7,600	40	415	1,430 lbs. of
"	6.00 "	7,400	7,400	7,600	42	440	pig iron cast.
"	6.30 "	7,200	7,200	7,600	40	410	
"	7.00 "	7,200	7,200	7,400	40	405	
"	7.30 "	7,200	7,400	7,400	40	410	
"	8.00 "	7,200	7,400	7,200	38	380	
"	8.30 "	7,400	7,400	7,600	38	390	
"	9.00 "	7,200	7,200	7,600	38	385	
"	9.30 "	7,000	7,400	7,400	38	380	
"	10.00 "	7,200	7,200	7,600	37	370	
"	10.30 "	7,400	7,400	7,400	38	380	
"	11.00 "	7,200	7,600	7,600	38	390	2,343 lbs. of
"	11.30 "	7,200	7,600	7,400	38	385	pig iron cast.
"	12.00 "	7,400	7,200	7,400	39	395	
Dec. 29	12.30 a.m.	7,400	7,200	7,600	39	400	
"	1.00 "	7,600	7,400	7,800	39	410	
"	1.30 "	7,400	7,400	7,600	39	405	
"	2.00 "	7,400	7,400	7,600	38	390	
"	2.30 "	7,600	7,400	7,600	38	395	
"	3.00 "	7,400	7,400	7,600	38	390	
"	3.30 "	7,600	7,200	7,600	37	380	
"	4.00 "	7,800	7,800	8,000	37	400	
"	4.30 "	7,800	7,600	7,800	36	380	
"	5.00 "	7,800	7,600	7,800	36	380	1,562 lbs. of
"	5.30 "	7,800	7,400	7,800	36	375	pig iron cast.
"	6.00 "	7,800	7,400	7,800	35	365	

It may be pointed out that the output continued to steadily rise as the furnace more nearly approached its normal working condition—even with the inadequate power supplied—until an unfortunate accident occurred to one of the water-cooled stuffing boxes, necessitating the removal of one electrode.

Towards the end of the run, one of the cast-iron water-cooled stuffing boxes developed a bad crack, which allowed large quantities of water to escape into the furnace. This would not have occurred had sufficient time been allowed for the thorough testing of all the castings, and cannot happen in the future, since the design of these water-cooled stuffing boxes has been changed. But even while running with only two electrodes, the output again began to rise when the heat lost by the water escapting into the furnace was partially restored to the walls of the furnace, and to the wet charge in the shaft.

The time limit set by the director of the company for the delivery of power to the furnace, was January 1, 1909; it was necessary, therefore, that the latest charge in the furnace should be all melted down, and tapped out, prior to that date. This was accordingly anticipated, and the official trial run was discontinued at 6 a.m., December 29, 1908.

In the following table is given the number of tons of pig iron produced per electrical horse-power-year, in casts Nos. 2 to 10, inclusive:—

Cast No.	Tons of pig iron per E.H.P. year
2	0.744
3	1.870
4	2.180
5	2.360
6	2.440
7	1.120*
8	3.160
9	1.950
10	1.030

From the foregoing table it will be seen that the output before the leakage of water into the furnace became serious was 2.44 metric tons per electrical horse-power-year. This figure—considering the disadvantages† under which the trial was made—may be deemed very satisfactory. Owing to the short duration of the trial, it was impossible to determine the consumption of electrodes per ton of pig iron produced. According to former tests, however, this may be placed at about 11 lbs. per metric ton (2,204 lbs.) of pig iron produced.

The trial run was intended to elucidate the following

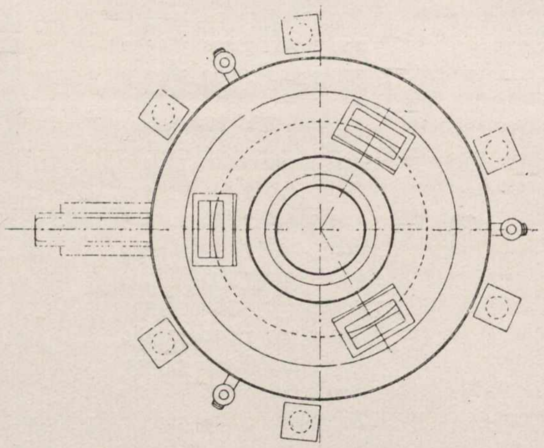

Fig. 6.—Plan of Furnace with Shaft and Electrodes Removed.

points: (1) Whether undisturbed and uniform working without troublesome regulation of the electrodes could be obtained. (2) Whether great variations in the consumption of energy would occur. (3) Whether the free spaces within the melting chamber would be maintained with a shaft considerably higher than in the furnaces of earlier design and construction. (4) Whether the contraction of the shaft would prevent the charge from sinking uniformly, or cause hanging. (5) The durability of the arched roof, and the possibility of cooling it by means of the circulating gas.

Deductions from Observations.

The following is a summarized statement of practical deductions drawn from observations made during the trial run, having regard to the objective points specified above:—

(a) It was observed that the furnace operated uniformly and without trouble of any kind, and that the electrodes required absolutely no regulation, in one case, for five consecutive days. In any case, the only regulation required is that corresponding to the consumption of the electrodes, and is necessary only once a day, and sometimes not for much longer periods. On account of this expensive regulation can be dispensed with.

(b) During the short trial, even though the furnace did not approach its normal working condition until towards the end, it was observed that the consumption of energy was remarkably uniform. This can readily be seen from an inspection of the readings of the different instruments.

(c) Free spaces were maintained between the linings of the roof and walls, and the electrodes and charge at the openings where the electrodes enter the melting chamber.

(d) It was found that the charge did not jam in the lower contracted neck of the shaft, as had been feared, but moved with regularity into the melting chamber.

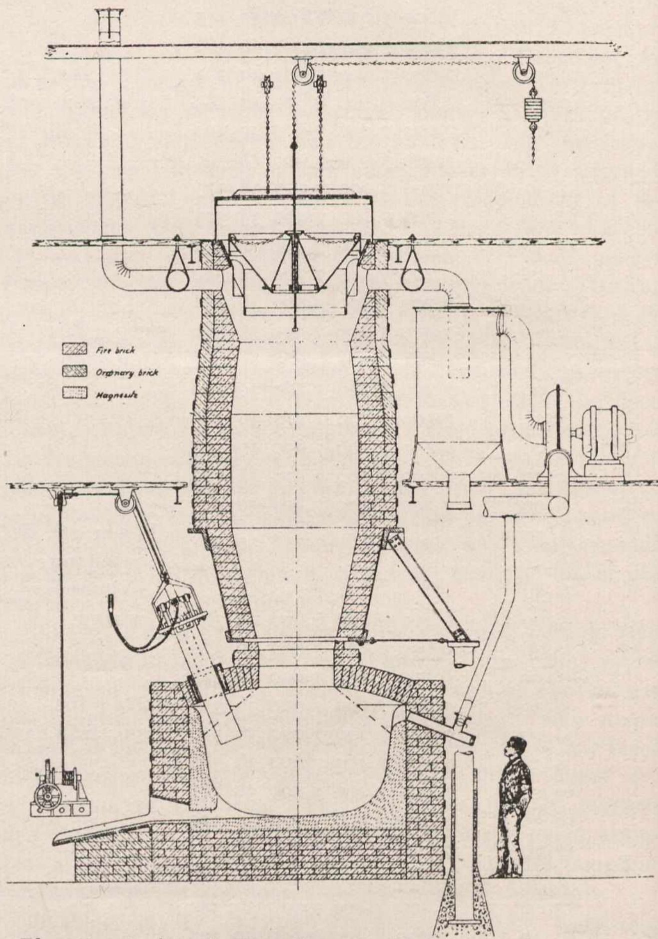

Fig. 5.—Sectional Elevation of Electric Shaft Furnace.

(e) Although the gases generated by the reduction of the ore were not circulated through the cooling tuyeres until near the end of the trial run, it was demonstrated that the lining of the roof of the melting chamber was effectively cooled by this means.

* Electrode holder began to leak badly.

† Water leaked into the furnace in small quantities from the beginning of the trial, but was not so noticeable until after the seventh cast.

Comparison of the Cost of Production of Pig Iron in the Charcoal Blast Furnace with that Produced in the Electric Shaft Furnace.*

By Professor von Odelstierna (Stockholm).

If we take as a basis for our comparative study an ordinary charcoal blast furnace, and the electric shaft furnace

* Based upon conditions in Sweden.

erected at Domnarfvet, and suppose the iron ore used in these furnaces to contain 60 per cent. metallic iron, and the charcoal 83 per cent. carbon, then it should be possible to make a reliable comparison. It should be pointed out, however, that in this comparison no account is taken of the fact that the gases produced in the electric shaft furnace contain a higher percentage of CO—probably 60 per cent. more—than the ordinary blast furnace gases.

In regard to the labor charges and general expenses, I make the supposition that these charges are the same for both the electric shaft furnace and the charcoal blast furnace, if the contrasted furnaces are of such capacity as to produce the same quantity of pig iron per year. A charcoal blast furnace of medium capacity produces in Sweden about 8,000 to 10,000 short tons (2,000 lbs.) of pig iron per annum—a quantity which, I believe, can also be produced in a properly constructed electric shaft furnace of the type of that of the Aktiebolaget Electrometall.

Cost of Pig Iron per Short Ton (2,000 lbs.).

Charcoal Blast Furnace.

	s.	d.
Charcoal 0.95 ton at 32s. per ton	30	6
Labor	4	0
Repairs and general expenses	6	0
	40	6

Electric Shaft Furnace.

	s.	d.
Charcoal 0.27 ton	8	8
Electrical energy, 0.3 E.H.P.-year at 48s.	14	4
Labor	4	0
Electrodes, 10 lbs. at 1½d. per lb.	1	3
Repairs and general expenses	6	0
	34	3

In this calculation the price of ore and limestone and the royalty are not given, as the former varies with the locality and the character of the ore, and the latter has not yet been determined. From this calculation it is apparent that in Sweden, under the above mentioned circumstances, a saving of 6s. 3d. should be effected in the production of pig iron by the electro-thermic process.

CONCRETE FAILURES.*

By Frank M. Okey, Engineering Experiment Station, Iowa State College.

In presenting a discussion of this subject to the Association of Iowa Cement Users, it is not the purpose of the writer to make any hostile attack upon concrete, nor to enter into any controversy in regard to its merits or demerits. In fact, it is not my purpose to make any attack at all, but rather to present a discussion of those causes which result in failure, in the hope that workers with this most modern of building materials may profit therefrom by seeking to eliminate such causes as are apt to result more or less disastrously.

The two words "concrete" and "failures" when used in the connection in which they appear in my subject have more or less of a funeral sound, and I doubt not that more than one cement user is harboring hostile thoughts of which the writer is the subject. But let me ask you to be lenient and reserve your judgment till I have done. Then I hope to have dispelled any attitude of hostility on your part, and to appear not in any sense an enemy of concrete, but a warm friend who has concrete interests deeply at heart.

The concrete industry is to-day occupying a very large place in the minds of the American public, and well it may, for none other of the materials of construction has made such giant strides in demonstrating its suitability and adaptability as a building material. One has to make but little search to prove that the fields in which concrete is demonstrating its advantages are indeed wide and varied. The discovery of uses to which this much used and much abused material may be adapted seems to continue without end, and perhaps therein lies a menace. The industry is confronted with a situation both gratifying and alarming. The products are growing in favor, but there is great danger, only temporary, I am sure, but none the less real, from the friends and advocates, some of whom in their zeal, inexperience and unlimited confidence, attempt the impossible, or perhaps are quite impossible in the attempt, however legitimate.

The over-zealous advocate, in seeking new worlds to conquer, imagines that a certain thing would be much better if made of concrete, and straightway, without further investigation or proper preparation, proceeds to demonstrate. Not infrequently the result is disastrous failure, and the zealot calls down condemnation not upon himself, but upon a good thing, which if rightly managed could have been only commended. It is against such foolish ventures as this that the concrete worker should guard. He must be conservative and use good sense and good judgment; make or have made the proper plans and designs, investigate thoroughly the use to which the material is to be put, select good ingredients, carefully inspect construction and the result will be concrete that will not only add to its already great host of friends, but will prove to its enemies that their calamity howling is very ill advised.

In the words of a prominent engineer, "The great problem confronting us now is to properly and adequately meet, foster and encourage the wide spreading interest in this industry and yet not permit it to grow beyond a safe control. By this, I mean that every effort should be made to avoid and prevent the mistakes and failures and disappointments that surely attend undue haste and want of preparation in the way of proper design, intelligent supervision and employment of trained and experienced men. All this has been found necessary to avoid failure in the use of other materials of construction, then why not in the use of the plastic materials."

Coming specifically to those causes whose result is failure, there are two sources to be investigated, the materials themselves, and the workers; the latter including not only those who actually mix the concrete and deposit it in place, but the foreman, the contractor, the inspector, and the engineer and designer.

It goes without question that to obtain good concrete, good Portland cement must be used. I heard a contractor make the statement not long ago that the manufacturers of cement were reaching so high a standard nowadays, and their product was running so uniform, that it was almost a waste of time to have a shipment sampled and tested. I am sure that the manufacturers will appreciate this compliment, but nevertheless we must not think for an instant that vigilant inspection should be relaxed, nor that we should fail to

* Read before the Iowa Cement Users Association.

have even a single car of any shipment tested. There is always chance of a slip, and that slip may prove highly expensive. Facilities for cement testing are available nearly everywhere, and the cost of the tests is not a penny compared to the damage resulting from a single car of bad cement. However, it is seldom that a sample fails to pass the requirements. The specifications of the American Society of Civil Engineers are made lenient enough that a cement failing to pass them ought to be rejected. Many cements pass above even the highest limit required in tensile strength. This statement is based on the results of about forty tests made on twelve or fourteen different brands of Portland cement during the past year. More than sixty per cent passed the higher limit for tensile strength and only three samples failed to pass at all.

So I am firm in my stand that all cement used should be subjected to all the tests required by the American Society specifications, and it is up to the contractor to have the cement on hand long enough for complete tests to be made, which means not less than thirty days.

Mr. W. A. Aiken, V. P. of the Spackman Eng. Company of Philadelphia makes the following statements in the Concrete Age for January 1909, relative to cement inspection: "The place to inspect cement, and incidentally to test it, is at the point of manufacture, and not after the material has been delivered on the work, where even if condemned on test, and tests alone without intimate acquaintance with the product means less than generally thought, it is a difficult and expensive operation to prevent its possible use, either through the instance of the manufacturer's agent or the demands of construction. .... The necessity for inspection in no way reflects on the manufacturer, since intelligent inspection is valuable to both producer and consumer, and must of necessity result in raising the quality of the product, no matter what the material. While the percentage of cement rejected through inspection is not large, as a rule, taking the whole volume of the industry into account, every one engaged in using this material should realize the value of inspection and appreciate that the discovery of and prevention in the use of even a small per cent. gives the purchaser an assurance of quality that can be accomplished in no other way."

But to make concrete an aggregate is necessary; sand and a coarser material, usually gravel or broken stone, and occasionally, when a concrete of lighter weight is desired, cinders.

The important part sand plays in concrete work is not generally recognized, and even among contractors and engineers who have at some time experienced trouble directly traceable to the sand used, there is found the tendency to depend too much at times on a superficial examination. It is certainly marvellous to observe what wonderful binding qualities cement has when it is mixed in the proportion of one to three of sand and five or six of stone. But we must note, however, that the cement must be spread out pretty thin to fill the interstices of the sand and coat the surface of the individual grains three times in volume the cement used. If the sand, however, be poor by reason of its geological origin, mineral composition or decomposition, or because of excessive fineness or its content of fine material of a non-siliceous nature, then it is useless to expect good results of such proportions as three of sand to one of cement. Only careful analysis and tests of the sand will enable us to judge as to whether it should be used at all, and, if so, in what proportions to attain the desired results within the required working limits of seven or twenty-eight days.

Sand should be clean and coarse, and the individual grains should be firm. If the grains are covered with a thin film of dirt or clay, the cement can not get a bond and when concrete made with such sand is broken, the fracture shows that the grains pull out of the cement and leave little pits lined with a film of clay. Undoubtedly, such concrete is weak. I know I am treading on dangerous ground when I say that clay in sand is a detriment for many tests have shown that sand that contained a considerable percentage of clay and loam developed a higher strength than sand that was clean. But I believe as a usual thing clean sand is the safer. In a piece of recent concrete construction, it was found when removing the forms from a column that between the batches of concrete there was a thin layer of what proved to be clay. The sand used contained quite a percentage of this substance, and in tamping the concrete, which was quite wet, the clay had come to the top and formed a layer of appreciable thickness. The column was of course torn out and rebuilt. Further, if the grains are weak individually, and easily fractured, such a sand should be discarded as dangerous.

Coarse sands give a stronger concrete than fine. Tests made by Peret, a Frenchman, showed that in mixtures of one cement to two and one-half sand the coarse sand developed a strength of 421 pounds per square inch in five months, medium sand 168 pounds, and fine 300 pounds. The variation in crushing strength was more marked, showing 5,200 pounds per square inch for coarse, 3,400 pounds for medium and 1,900 pounds for fine.

The best sand is that which is so graded that the voids are at a minimum, or according to M. Peret, where the proportions of coarse grains to fine is two to one. One of our eminent authorities on concrete, Mr. Sanford E. Thompson, states that sharpness is not an essential characteristic of sand. He says: "The majority of specifications still call for 'sharp' sand, and yet I have never known a sand to be rejected because of its lack of sharpness. As a matter of fact, if two sands have the same sized grains, and contain an equal amount of dust, the one with rounded grains is apt to give a denser and stronger mortar than the sharp grained sand. A sand with 'sharp' feel is preferable to another, not to any extent because of its sharpness, but because the grittiness indicates a siliceous sand which is apt to have no excess of fine material."

Much care should be taken in the use of gravel. In some of the gravel used for concrete, many of the pebbles are of very soft composition and easily broken, and some in fact can be crumbled between the fingers, while not a few which seem quite hard are only a shell surrounding a very soft interior. Concrete made with gravel of this kind is weaker than it appears, for every poor pebble reduces the area of the member by an area equal to its own cross-section. That the individual pebbles should be clean goes without saying, for cement can not gain a good hold on a surface that has a coat of clay or loam, however thin, and when the strain comes, the pebbles pull out, leaving pockets lined with a film of the dirt.

The hardness of the stone used, the shape of the particles, their maximum and relative size, materially effect the resulting concrete. I refer now to broken stone. When there is opportunity for choice, the best is that which is hard, with cubical fracture, and with particles whose size is as large as can be handled in the work. Crushed limestone is most used. as the coarser aggregate in this part of the country, and Thompson rates it fifth in his scale of values of aggregates, which is as follows: Trap rock, granite, gravel, marble, limestone, slag, sandstone, slate, shale, and cinders. Mr. Thompson gives this classification as the result of a large number of tests, which showed that the hardest stone produced the hardest concrete. He says further that the hardness of the stone grows in importance with the age of the concrete. Thus gravel concrete, because of the rounded surfaces, at the age of one month may be weaker than a concrete made with comparatively soft broken stone, but at the age of one year it may surpass in strength the broken stone concrete because, as the cement becomes hard, there is a greater tendency for the stones themselves to shear through, and the hardness of the gravel stones thus comes into play. This would certainly be equally true of the harder broken stones. It is best to avoid the use of a stone that breaks into flat pieces, for such material packs less closely and is generally inferior to stone of cubical fracture.

Of cinders, I have little to say, other than that they should be free from partially burned coal and fine ashes. Thompson rates them as the poorest material for an aggregate, and I believe their use should be undertaken with much caution.

However, while many failures of concrete structures are directly traceable to faults in the materials used, by far the greater number are due to poor workmanship and poor design. A certain man, who, by the way, is hardly to be classed as a friend of concrete, distorts Punch's famous advice to apply to concrete construction, thus: "Building with concrete, whether reinforced or not, is an undertaking not to be attempted rashly, but prayerfully, and the petition of salvation should never be so intent as when centres are about to be struck."

There is scarcely a field of building operations in which at first glance it seems simpler for the relatively inexperienced to do satisfactory work than in the use of concrete. Here are simple materials—sand, gravel and cement—mixed by crude labor, usually handled in a crude way, and not infrequently the results are equally crude. I have seen and so have you, many a man posing as a concrete contractor who has no more business in that line of work than a brick mason at a jeweller's bench. It is greatly to be regretted that it is a popular idea that a very low grade of labor may be employed in mixing and placing concrete; and it is equally regrettable that this idea is carried out in practice. While it is true that the greater amount of the hard work necessary in concrete construction can be performed by men relatively inexperienced and unlearned in this occupation, the engineer and inspector should insist that the contractor place over them a foreman who thoroughly understands the principles of mixing and placing. Not only must the foreman be capable, but he must be honest, and I am sure you will agree with me that it is materially to the contractor's advantage to have a man of that kind in direct charge of work. I do not wish to be understood to say that the majority of foremen are dishonest, but I have seen men in charge of construction who, the minute the inspector's back was turned, began skimping. A little of the cement was left out or an addition made to the aggregate; reinforcement was carelessly spread or wrongly set; sawdust and chips were left in the forms and dirt was shoveled up with the sand and rock. It is not necessary to further enumerate these things, for many of you are more familiar with them than I, but more than one failure has been directly traced to the skimping of the foreman who did it thinking, not only that he was "slipping one over" on the inspector, but that he was saving money for the contractor who employed him. The sooner the minds of such foremen are disabused of these mistaken ideas, the better it will be, not only for the contractor, but the concrete industry in general.

While, however, the contractor is held directly responsible for failure, it is highly desirable that the engineers who have in charge the execution of the designer's plans, be most efficiently schooled in the business, and know for a certainty what to allow and what not to allow in construction. For the very flexibility and facility for rapid working of concrete invite disaster, if even the most responsible designs and installations be placed in inexperienced hands.

As a final word, let me insist on conservatism. I firmly believe that more detriment is being done to-day to the concrete industry by its friends through over-zealousness than by all the calumny and ridicule heaped upon it by its opponents. Poor concrete must be relegated to the past, and the maker of poor concrete must be made to come to time or be outlawed and forced to quit.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

8137—September 14th—Directing that in the operation of railway lines where the snowfall is such as to require the running of snowplows or flangers, the company may remove the planks from farm crossings; provided that no such planks shall be removed unless necessary, and shall be replaced by the company in the spring, or as soon as the snow is off the ground.

8138—September 21st—Granting leave to the C.N.Q. Railway to permanently open for traffic that portion of its line from its connection with the line of the Quebec and Lake St. John Railway in city of Quebec, to Garneau Junction, a distance of 78.76 miles.

8139—September 15th—Refusing the Toronto Railway Company leave to appeal Order of the Board No. 7,813, dated the 3rd July, 1909, authorizing the city of Toronto to construct a bridge across its tracks where the same crosses Queen Street East, in the said city.

8140—September 14th—Granting leave to the Nipissing Central Railway to construct its railway across the track of the Temiskaming & Northern Ontario aRilway by means of an overhead crossing, in the town site of Argentite, Ont.

8141—September 22nd—Granting leave to the Rural Municipality of Macdonald, to place its wires across the track of the C.N.R. Company at public crossing ¾ mile north-east of Sanford, Manitoba.

8142—September 14—Ordering the G.T.R. to clean present station at Seguin Falls, Ont.; to provide and maintain proper station seats and lamps; and to construct platforms, etc., at above point.

8143—September 22—Directing that the time for the completion of the work in connection with the bridge (No. 1.65 C.P.R.) carrying St. Catharines Street, Montreal, P.Q., over C.P.R. tracks be extended until first day of May, 1910.

8144—September 21—Authorizing the G.T.R. to operate its trains across the track of the Winnipeg Electric Street Railway at Pembina highway, Winnipeg, Man., without being brought to a stop.

8145—September 14—Ordering that all railways subject to the jurisdiction of the Board equip, before the first day of April 1910, its freight vans with coupler-operating levers, and the cupolas of its cabooses with air-gauges and air-controlling valves.

ENGINEER'S LIBRARY

A SUBJECT FOR WINTER STUDY.

It is just as true of engineering as of any other profession that advancement comes with study and much reading. So long as the engineer has to do with the detail of design and construction he must continually familiarize himself with theories, failures and successes of others. He must compare his results with what has been accomplished elsewhere.

Miscellaneous reading is good. One must be informed on many questions that have but a little bearing on their regular work.

To become master of a particular subject the study must be regular, well directed and continuous, and for the engineer anxious to widen his range of information and to train himself for new problems we know of no better way than to choose a subject for winter reading, map out a course of reading on that subject and religiously follow it for several months. Not only must he read, but he should prepare notes, and even—when the subject lends itself to this treatment—design and work out in some detail plans.

Sometimes one reads to find out **where** certain information is. That kind of reading is quite necessary, but the mind needs other training, and that must be secured by the more laborious method of close study, repetition, note-making and review.

Several engineers have already chosen their subject for this winter's reading, and will greatly profit by the experience.

THE CANADIAN ENGINEER'S MONTHLY INDEX OF CIVIL ENGINEERING LITERATURE.

The purpose of this monthly index is: To inform engineers and contractors of the literature published on those subjects in which they are especially interested, the character of the article and the journal in which it appeared. **We do not index in this section articles that appear in The Canadian Engineer.**

Periodicals containing articles indexed, should be ordered direct from the publishers.

LIST OF PERIODICALS INDEXED.

Canadian Society of Civil Engineers Proceedings.—(Can. Soc. C. E. Proc.), Montreal, Can., m., 4 x 7 in., 50 cents.

Canadian Cement and Concrete Review.—(Can. Cem. and Con. Rev.), Toronto, Ont., m., 9 x 14, 15 cents.

Contractor.—(Contr.), Chicago, Ill., bi.-w.; 7 x 10 in., 20 cents.

Engineering—Contracting.—(Eng.-Cont.) Chicago, Ill., w.; 9 x 12 in., 10 cents.

Engineering News.—(Eng. News), New York, N.Y., w.; 10 x 14 in., 15 cents.

Engineering Magazine.—(Eng. Mag.), New York, N.Y., 7 x 10 in., 25 cents.

Machinery.—(Mach.), New York, N.Y., m., 7 x 11 in., 20 cents.

Municipal Journal and Engineer.—(Mun. Jl. and Eng.), w., New York, N.Y., 9 x 12, 10 cents.

Municipal Engineering Magazine.—(Mun. Eng. Mag.), Indianapolis, Ill., m., 7 x 10 in., 25 cents.

Power and Engineer.—(Pow. and Eng.), New York, N.Y., w.; 9 x 12 in, 5 cents.

Railway Age Gazette.—(R. R. Age Gaz.), New York, w.; 8 x 11 in., 15 cents.

Surveyor, The.—(Sur.), London, Eng., w.; 6 x 11, 10 cents.

Engineering.—(Engr.), London, Eng., w.; 12 x 15 in., 15 cents.

* Illustrated.

SEWERS, SEWAGE AND WATERWORKS.

Concrete Sewer Construction at Waukegan, Ill.*—1 p., contr., October 1, 1909.

Sewer Construction at Jackson, Mich.*—A reinforced lock-joint concrete pipe system, Mun. Jl. and Engr., Sept. 29, 1909., 3 pp.

The Sterilization of the New Jersey Water Supply.—Sur. Sept. 24, 1909, 1 p.

RAILWAYS.

The Makatote Viaduct,* on the North Island Main Trunk Railway in New Zealand. Length, 895 feet. Piers, 270 feet high. Engr., Sept. 3, 1909, 4 pp.

Increasing the Efficiency of the Electric Motor Drive.—A digest of a series of electric driving tests and methods for determining the fitness of any given installation. Engr. Mag., Oct.

MISCELLANEOUS.

Hammer Drills Applied to Rock Excavation in Sewer Construction.*—Eng. News, Sept. 9, 1909.

Comparative Cost and Stone Consumption in Diamond Drilling, Using Carbon and Borts.—Eng. Cont., Sep. 8, 1909.

Methods of Measuring the Flow of Water.*—Tank Measurements, etc., and Calibration of Flow through a valve. Pow. and Eng., Sep. 7, 1909.

Principle of Planimeter Operation.*—Explaining simplicity of construction, etc. Pow. and Eng., Sep. 7, 1909.

Steam Turbines in English Power Houses.*—Some reasons for the popularity of the steam turbine in electrical work. Pow. and Eng., Sep. 7, 1909.

The 180 feet Stone Arch Bridge at Wiesen, Switzerland.* Eng. News, Sept. 16, 1909, 3 pp.

CONCRETE AND REINFORCED CONCRETE.

Pressure of Concrete on Forms.*—Eng. News, Sep. 9, 1909.

The Economics of the Design and Construction of the Walnut Lane Concrete Arch.*—Eng. Cont., Sep. 8, 1909.

Tests of Plain and Reinforced Concrete Columns.*—Eng. News, Oct. 16, 1909., 3 pp.

Density and Draining Capacity of Artificial and Natural Mixtures of Sand and Gravel.*—Engr. News, Sep. 23, 1909, 1 pp.

Moments in Continuous Reinforced Concrete Beams Under Uniform Loading.*—Eng. News, Sept. 30, 1909, 2 pp.

The Design and Construction of Forms for Concrete Work.*—Eng. Cont., Sept. 22, 1909, 1 p.

ROADS AND PAVEMENTS.

Dust Abatement by Surface Applications.—Mun. Eng., Oct., 4 pp.

Cost of Road Construction in Missouri, Contr., Oct. 1, 1909.

The Bridges of New York City,* II.—Brooklyn Bridge and Brooklyn bridges. Eng. Mag., Oct.

BOOK REVIEWS.

Books reviewed in these columns may be secured from the Book Department, Canadian Engineer, 62 Church Street, Toronto.

Canadian Annual Review of Public Affairs, 1908; by J. Castell Hopkins, F.S.S. 660 pages, 6 × 9, cloth. Price, $3.50. Published by the Annual Review Publishing Company, Ltd., 2 College Street, Toronto.

Ample proof of Canada's growing importance—the endless march of progress—is offered by the eighth issue of the Canadian Annual Review of Public Affairs, a publication whose scope becomes wider and wider with each succeeding year and the remarkable expansion that is being witnessed on every hand. The Canadian Annual Review is a wonderful volume, and the gentleman mainly responsible for its preparation—Mr. J. Castell Hopkins—is to be congratulated upon the completion of a work which leaves little to be desired. It teems with information in which every man of affairs is vitally interested, and its admirable arrangement, in sixteen parts, containing nearly seven hundred pages, comprises a task to which few are equal. All the important affairs of the Dominion, and of each province, are chronicled and dealt with at length, in a masterful style—a style which all will appreciate.

Transportation is play ng an important role in our work of development; and this phase has not been lost sight of. Part IX. is devoted exclusively to transportation interests. In it is found able comment upon the problems and conditions with which the builders of our great highways of commerce have been brought face to face, while the progress of the steam railroads has been summed up in a manner worthy of special mention. Other questions of paramount importance—finance, insurance, empire relations, municipal affairs, literature, journalism, art—are dealt with quite as capably. Beautifully colored photographs of thirty or forty men in the public eye—nation builders—are also included; and it is safe to say that the Canadian Annual Review constitutes the most complete and useful history of the affairs of a country which is great and yet only at the beginning of things.—W. M.

Dictionary of Chemical and Metallurgical Material, 1909; 180 pp.; 5 × 8; price 50 cents. Published by Electrochemical and Metallurgical Industry, 239 West 39th St., New York, U.S.A.

With commendable enterprise and much care, the publishers of Electrochemical and Metallurgical Industry have compiled a dictionary of chemical and metallurgical material whose value and usefulness can be fully appreciated by only those directly interested. The publication, which represents a timely innovation, is divided into three parts, as follows:—

Part I: Machinery, appliances, and material for chemical and metallurgical industries.

Part II.: Measuring instruments and laboratory supplies.

Part III.: Professional Directory.

The object of the volume is to give purchasers a list of manufacturers of the apparatus they are looking for.

Building Foreman's Pocket Book and Ready Reference. By H. G. Richey. Published by Renouf Publishing Company, Montreal, and John Wiley & Company, New York. Pages, 1,110. Price, $5.

This is the first edition of a handbook by H. G. Richey, Superintendent of Construction, United States Public Buildings.

As the title of the book implies, it is intended to be a ready reference for building foremen, or those in charge of the various trades in building operations.

As a building foreman must have a knowledge of all the various trades employed on work in his charge, the author has brought together into one volume such information and knowledge of the different trades as is necessary for a foreman to know or have convenient for reference.

In addition to this matter pertaining to the different trades a large amount of information especially for the use of foremen is given, such as the care of plans, laying out and running work, organization of the working force, etc., which is especially useful and should be of value to any one in charge of work.

A large amount of matter has been given in tabular form so as to be of easy and quick access.

The work is divided into fourteen parts: Duties of foremen; excavating and stone work; brick and terra-cotta work; lime and cements; mortar and concrete; carpentery and wood-work; heating and plumbing; piles and foundations; drawing and laying out work; strength of materials; weight, sizes, etc., of materials; mensuration, and receipts.

Concrete in Highway Construction. A Text-book for Highway Engineers and Supervisors. Prepared and published by the Atlas Portland Cement Company, 30 Broad Street, New York City. For gratuitous distribution among engineers, architects, contractors, and road officials; to others, $1.

This work is an octave volume of 136 pages, well illustrated, and containing many working drawings and some valuable tables. As indicated by the title the book deals with the use of concrete in the construction of roads and of structures appurtenant thereto. The subject matter is divided into nine chapters which treat of the following matters: Concrete; sidewalks, surbs and gutters; street pavements; sewers, drain tiles, brook linings and conduits; culverts; beam bridges; arch bridges; retaining walls, and miscellaneous structures.

The illustrations show actual applications of the principles treated in the text, and cover a wide range of engineering practice. The matter of bridge and culvert construction has received especially thorough treatment, the examples shown being well known specimens of typical forms of construction.

Artificial Waterways and Commercial Development. By A. Barton Hepburn. Published by the Macmillan Company of Canada, Toronto. 111 pages. Price, $1 net.

As its name implies, this little volume is not an engineering treatise, and its aim, as explained in the author's preface is "to place before the public in concise form the salient facts as to artificial waterways and their relation to commercial development."

The author takes the Erie Canal as a typical case upon which to base his arguments, and the main body of the book is devoted to the political and financial history of this scheme from the time of its inception in 1724 up to the present time. This portion of the book is of general interest in that it shows the enormous benefit derived from this waterway, during the period of its greatest efficiency, by the port of New York, and the very serious shrinkage in its commerce coincident with the non-development of the canal to keep pace with railway transportation. Statistics are quoted to prove that the State of New York was forced to proceed with the present enlargement of the Erie Canal, at an estimated cost of $101,000,000, to maintain the commercial supremacy of its capital port.

The first chapter of the book is devoted to a general description of the world's artificial waterways, and it is interesting to note that Canada is credited with a greater expenditure per capita for canalization, over a shorter period of time, than any other country in the world.

Another section is devoted to a historical and critical review of the Panama Canal scheme, and the whole concludes with tabulated statistics covering canal operation, costs, dimensions, etc. One table gives the general dimensions and length of the Canadian canals and another shows the progress of work and expenditure on the Panama Canal to July 1908. The time is not far distant when the Canadian ratepayer will be called upon to cast a vote for or against the construction of the Georgian Bay, or the enlargement of the Welland Canal, and to such as desire to vote intelligently, this volume is full of interest.—H. G. A.

Concrete and Constructional Engineering.—The current issue of "Concrete and Constructional Engineering" marks an important development, not only of that journal, but of the subject it deals with.

Appearing for more than three years as the pioneer journal devoted to concrete and reinforced concrete as a bi-monthly, it has now been decided that the publication shall appear as a **monthly,** and this departure, in the main, is due to the extraordinary development of the subjects of concrete and reinforced concrete, and the uses of Portland cement generally.

The character of the journal remains as heretofore, and it contains as in previous issues, a number of special articles well illustrated, as also a summary of the principal lectures and papers delivered during the past two months.

Two articles in the September issue of "Concrete" may claim special attention; i.e., the one dealing with reinforced concrete as applied to the National Gallery, London, and the other dealing with reinforced concrete as applied to a torpedo station in the Mediterranean.

Special articles include one on "earthquake-proof" buildings of reinforced concrete, and considerable space has been devoted to the experimental work that has been carried on at home and abroad in connection with reinforced concrete.

Tungsten Ores in Canada.—A Report on the Tungsten Ores of Canada, by Prof. T. L. Walker, of Toronto University, has just been issued by the Mines Branch of the Department of Mines of Canada at Ottawa. The Report covers 56 pages and includes 15 illustrations.

Amongst the rare metals which have recently become of commercial value, tungsten is an important example. One of its most recent applications is as a filament in incandescent lamps, in which it gives a much more brilliant light with greater efficiency than carbon. Its most important use, however, is in the manufacture of tungsten steel, to which it imparts great elasticity and tensile strength. The metal has, therefore, become particularly valuable to the manufacturers of special steels. The known occurrences of tungsten ores throughout the world are comparatively few, which fact lends additional interest to some discoveries of scheelite (an ore of tungsten) which have been made within the past year or two in Nova Scotia. These, together with other occurrences of tungsten ores in Canada, have been made the subject of the present report, which is designed to present to those interested all the available information on these ores.

PUBLICATIONS RECEIVED.

Manual of the Engineer's Solar Transit.—A valuable, pocket-sized publication, just issued by the Keuffel & Esser Company of Hoboken, N.J., a firm known the world over for reliable surveying instruments. The contents include a description of the transit, its adjustments, and methods of use, table of mean refractions, rules for taking the sun at any latitude or longitude, tables regarding the correction of azimuth errors, directions for determining the meridian by direct observation on the sun and Polaris, and other useful data. Canadian readers interested in surveying may address inquiries to the publishers' Montreal office, where they will be cheerfully and promptly attended to.

Modern Methods of Street Cleaning, by George A. Soper, Ph.D., Mem. A.S.C.E.; 6 × 9; 200 pages; 100 illustrations; price, $3 net. Published by the Engineering News Book Department, 220 Broadway, New York, U.S.A.

The Elements of Mechanics of Materials, by C. E. Houghton, A.B., M.M.E., associate professor of Mech. Engr., New York University. 200 pp., 6 × 9; price $2. Published by the D. Van Nostrand Company, 23 Murray Street, New York City, U.S.A.

The Protection of Railroads from Overhead Transmission Line Crossings, by Frank S. Fowle, S.B., consulting electrical engineer; 70 pages, 6 × 9. Price, $1.50. Published by the D. Van Nostrand Company, 23 Murray Street, New York, U.S.A.

Electric Power Conductors, by William A. Del Mal, A.C.G.I., assistant engineer, Electrical Transmission Department, N.Y. Central Railway; 330 pages, 6 × 9; price $2. Published by the D. Van Nostrand Company, 23 Murray Street, New York, U.S.A.

CATALOGUES.

Electrical Supplies.—Section 2; second edition; issued by the Canadian General Electric Company, Toronto. This is a handsome, 100-page catalogue, devoted to cabinet panels, cut-outs and fuses. Illustrations and prices of all types of this apparatus are given in a volume which should be on the file of every purchasing agent.

Pumping Machinery for Waterworks is described in an elaborate volume which is being distributed by the Fred. M. Prescott Steam Pump Company of Milwaukee, Wis., in honor of the American Waterworks Association's twenty-ninth annual convention, held at Milwaukee, June 7-12. Profuse illustrations of many types of pumping engines are given in a piece of work which represents the printer's best.

Cements and their uses are described and illustrated in the 8th edition of the Smooth-on Manufacturing Company's instruction book, just issued. If you desire a copy, with the publishers' compliments, drop a postal to their head office, Jersey City, N.J.

Contractors' Equipment.—From the Montreal office of Mussens, Limited, come interesting bulletins devoted to contractors' equipment. Mine scoop cars and dump cars, rails, buckets, rock drill steel, etc., are listed in a useful manner. Mussens have branches at Toronto, Cobalt, Winnipeg and Vancouver.

RAILWAY EANRINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Sept. 28		STOCK QUOTATIONS TORONTO				MONTREAL			
				1909	1908	Price Oct. 1 '08	Price Sept. 23 '09	Price Sept. 30 '09	Sales Week End'd Sep. 30	Price Oct. 1 08	Price Sept. 23 09	Price Sept. 30 '09	Sale Week End'd Sep. 30
Canadian Pacific Railway	8,920.6	$150,000	$100	$2,763 000	2,104.000	177¼ 176¼	182¾ 182	186¾ 186⅝	735	177 176⅜	182¼ 182	186¼ 186	2450
Canadian Northern Railway	2,986.9	....	....	375.900	313,900	....	....	....	....	....	....	....	....
*Grand Trunk Railway	3,536	226,000	100	1,179.150	1,050.980	....	*1st. pref. 108½, 3rd pref. 58½, ordinary 24¾					....	....
T. & N. O.	334	(Gov. Road)	....	50,050	26,536	....	....	....	....	....	....	....	....
Montreal Street Railway	138.3	18,000	100	75,185	70,911	....	....	....	....	....	215 214½	214½ 214	238
Toronto Street Railway	114	8,000	100	73,875	67,655	102 100	124½ 124¼	126½ 12[illegible]	689	101½ 101	124¼ 124⅛	126½ 126	1611
Winnipeg Electric	70	6,000	100	....	....	161	187½	187½	135	162¼ 161½	167½	187½	10

* G.T.R. Stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

ONTARIO ELECTRIC RAILWAYS.

From week to week we propose to give, on our page devoted to transportation interests, particulars of the equipment, mileage, and other information regarding the railways of Canada, together with a list of the officials. This series of articles commenced in our issue of October 1st.

Previously Given:—

Brantford and Hamilton Railway.
Chatham, Wallaceburg and Erie Railway.
Cornwall Street Railway.

GUELPH RADIAL RAILWAY COMPANY, LIMITED.

President, Mr. J. W. Lyon.
General Manager and Purchasing Agent, Mr. J. J. Hackney.
Chief Engineer,

Kind of Road: Street Railway.

Length of Road, in miles:

Single track, 6.
Total in single miles, 6.

Character of Service:

Car equipment, No., 14.
Number of motors, 30
Power of motors, 25 h.p.
Method of braking, hand.
Gauge of track, standard.
Weight of rails, 60 lbs.

Power:

Direct current, D.C.
Voltage of transmission, 550 volts.
Trolley voltage, 550 volts.

GALT, PRESTON AND HESPELER RAILWAY.

President and General Manager, Mr. M. N. Todd, Galt.
Secretary-Treasurer and Purchasing Agent, Mr. W. H. Lutz, Galt.
Superintendent, Mr. M. W. Kirkwood, Preston.
General Freight and Passenger Agent, Mr. C. J. Whitney, Preston.

Kind of Road: Interurban and Street Railway.

Length of Road:

Single track, 6.
Double track, 2 miles.
Total in single miles, 21.

Equipment:

Closed cars, double truck, 6; four 65 h.p. motors.
Open cars, double truck, 1; four 45 h.p. motors.
Closed cars, single truck, 2; two 35 h.p. motors.
Open cars, single truck, 1; two 35 h.p. motors.
Freight locomotives, 2,; four 65 h.p. motors.
Steam locomotives, 1.
Method of controlling, unit switch control.
Method of braking, automatic air brakes.
Gauge of track, 4 ft. 8½ in.
Weight of rails, 65 lbs., and 70 lbs.

Power:

Direct current.
Alternating current transmission, 6,600 volts, 25 cycle, 3 phase.
Current collecting devices, over-head trolley.

EDMONTON STREET RAILWAY.

The earnings and other figures relating to the operation of the Edmonton Street Railway for the past three months are as follows:—

	Earnings.	Passengers Carried.
September	$8,816	209,920
August	8,002	194,704
July	8,721	204,584

In July two extra cars were placed in operation on the system, and in September two more were placed in commission, making 11 in all.

RAILWAY ACCIDENTS.

(Continued from page 393.)

Notes of Wrecks.

At Fernie, B.C., five coal cars on a G.N.R. train were ditched and completely ruined. Cause, broken rail.

The caboose of a C.N.R. freight train was derailed near Brandon, Man., and line was blocked for six hours.

Several derailed cars near Smith's Falls, Ont., delayed a C.P.R. passenger train two hours.

A C.N.R. passenger train was delayed eight hours by a wrecked freight train near Kamsack, Sask.

Several hours' delay resulted through the wreck of a freight train on the Grand Trunk, near Aylmer, Ont., caused by a broken axle.

A street car in Vancouver jumped the tracks and fell into a trench which was being excavated in connection with paving work. Considerable damage resulted but no one was hurt.

Three cars were demolished and much damage was caused to the engine of freight through a broken coupling. A passenger train ran into the freight before the latter was able to get clear.

Three hundred dollars damage was the result of a rear end collision between freight and passenger trains at Burketon Junction, Ont.

Twelve hours' delay was caused by a wreck on the C.N.R. near Port Arthur, in which three cars of grain were spilled.

Six cars were ditched at Georgetown on the G.T.R. through a collision at a cross-over diamond between two freights. Estimated damage, $3,000.

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.

Quebec.

MONTREAL.—Tenders will be received until noon of Wednesday, October 13th, for the construction of the Steel Work, Concrete and Masonry, and Reinforced Concrete Flooring and Paving of the St. Catherine St. bridge. L. O. David, City Clerk.

MONTREAL.—Tenders will be received for an electrically-driven waterworks pump, with a capacity of 1½million gallons per day, for the Saraguay Electric and Water Company, and for six 250 k.w., and three 500 k.w., 11,000 volts transformers. Mr. Charles Brandeis, consulting engineer, 4 Phillips Place, Montreal.

QUEBEC.—Tenders will be received until Friday, October 22nd, for the construction of an Ice Breaker at St. Liguori, Montcalm County, Que. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

QUEBEC.—Tenders will be received up to 4 p.m. on Monday, the 11th October for trenching and refilling in part of Champlain Street. J. Gallagher, Waterworks Engineer.

Ontario.

BARRIE.—Tenders will be received until Monday, October 11th, for the material and work of constructing 1,900 feet of sewers. E. Donnell, clerk; C. H. and P. H. Mitchell, consulting and supervising engineers, Traders Bank Building, Toronto. (Advertised in the Canadian Engineer.)

BERLIN.—Tenders will be received until Thursday, October 28th, for paving King Street. A. H. Millar, town clerk; Wm. Mahlon Davis, C. E., town engineer. (Advertisement in the Canadian Engineer.)

HAMILTON.—Tenders will be received for the several works required in the erection and completion of an office and warehouse building for the W. A. Freeman Co. A. W. Peene, architect.

NEW LISKEARD.—Tenders will be received until October 15th, for a sewerage system. H. Hartman, town clerk, C. H. Fullerton, town engineer. (Advertisement in the Canadian Engineer.)

TORONTO.—Tenders will be received until October 11, for supplying the material required in the reconstruction of the Ontario parliament buildings. Mr. J. O. Reaume, Minister of Public Works, Toronto. (Advertisement in the Canadian Engineer.)

TORONTO.—Tenders will shortly be invited for two new steam fire engines for the city of Toronto.

TORONTO.—Tenders will be received until Thursday, October 28, for turbine pumps. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Thursday, October 28, for electric motors. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Monday, October 11th, for the construction of sewers in the township of York. Barber & Young, York Township Engineers, Toronto. (Advertisement in the Canadian Engineer.)

LATCHFORD.—Tenders will be received until Thursday, October 28, for the construction of a Dam and Sluiceways across the Montreal River at Latchford. Plans and specifications can be seen at the office of J. G. Sing, district engineer, Confederation Life Building, Toronto, and on application to the Postmaster at Latchford. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

BRANTFORD.—Tenders will be received until October 12th for pavements. T. Harry Jones, city engineer. (Advertised in the Canadian Engineer.)

Manitoba.

WINNIPEG.—Tenders will be received up to Monday, 11th October, for erection of foundation of all concrete work for overhead crossing, with pile and timber approaches, at Sixth Avenue, Moose Jaw. Plans and specifications may be seen at office of C.P.R. assistant chief engineer, Winnipeg; division engineer, Calgary, or resident engineer, Moose Jaw.

Alberta

MEDICINE HAT. — Tenders will be received by the Chief Engineer of the Southern Alberta Land Co., until October 14th, for the construction of an Earth Dam across Snake Valley, containing about 110,000 cubic yards and for about 16 miles of canal, averaging about 50,000 cubic yards per mile. The work is situated close to Little Bow River in township 14 and 15, range 21, west of the 4th meridian. Bids will be received for all or any part of the work.

Saskatchewan.

ELBOW.—Tenders will be received up to October 11th, for the erection of a pump house and tank for the village of Elbow. B. Longmore, secretary.

MAPLE CREEK.—Tenders will be received until October 15th for sewage pumping equipment. H. A. Greeley, secretary-treasurer; C. M. Arnold, consulting engineer, Lethbridge. (Advertisement in the Canadian Engineer.)

British Columbia.

VICTORIA. — Tenders will be received up to 4 p.m., Monday, 15th November, for supplying 20 tons of best blue pig lead. W. W. Northcott, purchasing agent.

VANCOUVER.—Tenders will be received until October 25th for building a large bridge over False Creek, this city. sulting engineers, Kansas City, Mo. (Details advertised in the Canadian Engineer.)

CONTRACTS AWARDED.

New Brunswick.

FREDERICTON.—Hon. John Morrissy, Chief Commissioner, awarded the following bridge contracts, which were opened at the Public Works Department last week. Hatfield bridge, Simonds, Carleton Co., to W. R. Fawcett, Temperance Vale, $900; Dingey bridge, Simonds, Carleton Co., to Aaron Shaw, Peel, Carleton Co., price in the vicinity of $600; Ellis bridge, Brighton, Carleton Co., to W. R. Fawcett, contract price, $1,500; Maugren bridge in Brighton, Carleton Co., has been awarded to W. R. Fawcett; the figure is $1,800.

Nova Scotia.

NORTH SYDNEY.—Extensive orders for mining plant have been placed by the Colonial Coal Co., Ltd., of North Sydney. Engines have been purchased from E. Leonard & Sons, of London, Ont., and hoisting plant from Mussens, Limited, of Montreal.

Quebec.

QUEBEC.—Mr. E. G. M. Cape, of Montreal, was the lowest tenderer for the technical school which will be erected by the Quebec government and modelled after that now in course of construction in Montreal. Several days after the tenders were opened, a local firm offered to erect the building for $223,000. This is $12,000 less than the figure submitted by Mr. Cape. The situation has caused trouble among the members of the special school commission, some of whom are in favor of accepting the local firm's tender, while the others think the contract should be given to Mr. Cape.

MONTREAL.—The contract for a 500 k.w. steam turbo-generator for the Saraguay Electric & Water Co., has been placed with the Canadian General Electric Co., of Toronto. Delivery will be made in time for the coming winter service. Mr. Chas. Brandeis, of Montreal, was the consulting engineer.

MONTREAL.—A contract was signed here on September 30 by the Mexican Northern Light and Power Company with the big English contracting firm of Sir Whitman Pearson & Sons, for the construction of a dam, power plant and twenty miles of railway on the Conclas River for about $5,000,000, the work to be completed in three years.

MONTREAL.—Work will be begun at once on the C. P. R. bridge between St. Johns and Iberville, spanning the Richelieu River. The bridge will be 1,500 feet long. There will be a lift span in the centre. The Government intends widening the river at this point and already the dredging is well under way. Although a double track will not be installed at once, provision will be made for double tracking the bridge. The contract for the sub-structure has been awarded to Messrs. Quinlan and Robertson, of Montreal.

VERDUN.—Mr. I. Collins, of Montreal, has secured the contract for the new power house here, the work of erecting which is being supervised by Mr. Charles Brandeis, consulting engineer, Montreal.

HULL.—The tender of Messrs. Carriere & Wilson for the excavations of the waterworks extension, which is to cost $22,000, was accepted.

Ontario.

OTTAWA.—Messrs. Henry Smith and J. J. Heney of this city have been awarded a contract from the public works department to build a large dock at Mission river, near Fort William. The contract is in the neighborhood of $350,000. The docks are to be erected in connection with the construction of the Grand Trunk Pacific railway and, as can be judged from the estimated cost, will be of very large size.

TORONTO.—Among the contracts let recently by the Hydro-Electric Commission were those for the supply of cranes. Royce & Company, of Ancaster, England, got the contract for the electric cranes and Mussens Limited, of Montreal and Toronto, that for nine hand cranes. The amounts aggregated $16,575. In each case the lowest tenderer was awarded the contract. This completes all the contracts to be let for the mechanical work of the transmission lines.

British Columbia.

VICTORIA. — Messrs. Gore and McGregor have received a contract from the American Securities and Finance Co., who recently purchased from the C. P. R., large timber areas in the Cowichan district, to run boundary lines in connection with the delimitation of the land. The C. P. R. will probably build a branch line in this neighborhood as a result of the deal.

VANCOUVER.—A contract was awarded to Messrs. Cleveland & Dutcher, civil engineers, of Vancouver, for the engineering work in connection with the construction of a complete irrigation system at Richlands, Okanagan Valley, which involves an area of 3,750 acres.

RAILWAYS—STEAM AND ELECTRIC.

Quebec.

CHICOUTIMI.—The Chicoutimi Pulp Company recently gave out contracts for the construction of an electric railway from their mills into the limits in the River du Moulin district. These limits are only of use with such a railway as the rivers flowing through them are not large enough to "drive" any considerable number of logs and it is in order to get the wood from them that this line will be constructed. It is thought that at some future date this line may be continued into the River a Mars limits, thus joining the village of St. Alphonse with Chicoutimi and the Quebec & Lake St. John Railway.

Ontario.

LONDON.—Extensions to the roundhouse and yards of the C.P.R. at this point have been decided upon.

LONDON.—The C.P.R. have just completed the relaying of the entire line between London and Windsor with new 85-lb. rails.

OTTAWA.—Construction work has been commenced by the G.T.R. on a bridge over Preston Street. It will be a girder structure with concrete piers. Estimated cost, $18,000.

OTTAWA.—The Department of Railways have approved the route map of the new line of the Canadian Northern Railway from Toronto to Ottawa via Smith's Falls. The Canadian Northern has agreed to build a branch line to Lanark.

OTTAWA.—The Chatham, Wallaceburg, & Lake Erie Railway Company have been refused by the Board of Railway Commissioners permission to construct a branch line to a point opposite Grand Ligne.

OTTAWA.—Railway charters will be asked at the next session for the following projects: To incorporate the Pine Pass Railway Company; to build from Edmonton through the Pine River Pass to Fort George, B.C. The Manitoba and North-Western Railway Company; to build from Birtle to Hamiota, Man., and from Russel, Man., 150 miles northerly or north-easterly. The Calgary and Edmonton Railway Company; to extend its Lacombe branch 200 miles to join the C.P.R. Moose Jaw branch at Outlook. Extensions of time will be asked as follows: By the Columbia and Western Railway Company, in regard to its second, fifth and sixth sections; The Manitoba and North-Western Railway Company; The Kamloops and Yellowhead Pass Railway Company; The Esquimault and Nanaimo Railway Company, for its Comox extension and branches; The Nicola, Kamloops and Similkameen Coal and Railway Company; The Edmonton, Dunvegan and British Columbia Railway Company.

ORILLIA.—Mr. Johnson, Parry Sound, and Mr. Gordon Conyers Kirby, of Ottawa, have arrived at Atherley, where they will remain all winter in order to carry out the engineering work of the Udney-Orillia line of the C.N.O., which is being commenced this week. It is also believed that the C.P.R. will build their swing bridge at the Narrows during the coming winter.

Manitoba.

VIRDEN.—Track laying has been commenced on a 15-mile extension of the C.P.R. which runs north-west from here.

WINNIPEG.—It was announced this week that the Government will commence the construction of the Hudson's Bay Railway this fall. Surveys of the first section are already completed.

BRANDON.—A number of men previously employed by the C.N.R. on construction work in the Goose Lake district are being transferred to Maryfield, near Brandon, where the railway company have 125 miles of steel to lay. A long train bearing the gear and men passed through the C.N.R. depot this week, and the work will commence immediately upon their arrival at the destination.

WINNIPEG.—Work is being pushed forward rapidly on the G.T.P. branch lines. About twenty miles of steel have already been laid on the Melville-Regina extension, and the balance of the steel to Balcarres will be completed in about a week's time. This is as far as the grade will be completed this fall. On the Melville-Yorkton branch the steel has been laid for six miles, and the line will be completed in a month. Grade work on the Tofield-Calgary line is progressing favorably, and should the weather continue fine it will be constructed as far as Camrose this fall, a distance of 50 miles.

Alberta.

CALGARY.—In a recent interview, Mr. Cecil Goddard, engineer of the Canadian Western Railway said that the company had decided upon a line into Calgary. The railway will cross the High River a distance from the town of High River, and the company expect to have the line completed in two years.

Saskatchewan.

VONDA.—The C.N.R. have over one hundred men here, raising the main track eighteen inches and putting in an additional siding Extensive repairs will also be made to the station. The object of thus grading the road is to prevent snow drifts similar to those of former winters.

British Columbia.

NEW WESTMINSTER.—Reports received from Chilliwack are to the effect that work is being pushed along at an exceptionally rapid rate on the last section of the Westminster-Chilliwack tram line extending from Abbsotford to the Valley City. The contractors are all working under time limits, and in addition to large gangs of men they have extensive machinery plants in operation. It is expected that gradings will be completed within sixty days, while the line will probably be opened early next year.. The rails have already been laid from this city almost to Cloverdale—15 miles.

VANCOUVER.—The Canadian Northern Railway has filed plans of survey for the first 54 miles north of Kamloops. A grade of less than one-fifth per cent. from the Yellowhead Pass to Kamloops has been secured.

NEW WESTMINSTER.—The British Columbia Electric Company are planning to erect a building which, when completed, will be the finest structure in this city. They will also extend their car shops.

VANCOUVER.—The contract for building the extension of the branch of the E. & N. railroad from the end of the present line to Alberni, 27 miles, has been awarded to the Calgary firm, Janse, McDonnell & Timothy. The successful firm were the lowest tenderers, the next lowest being Macdonell, Gzowski & Company, of Vancouver. Work on the extension will be started within a few days.

LIGHT, HEAT, AND POWER

Quebec.

MONTREAL.—The Saraguay Electric and Water Company are duplicating their line from Cartierville to Notre Dame de Grace.

VERDUN.—On Monday, October 4th, tenders closed for electric light plant, the installation of which is in charge of Mr. Charles Brandeis, consulting engineer, Montreal.

Ontario.

TORONTO. — Last Thursday, the concluding meeting of the engineers representing the general municipalities that have subscribed for Niagara power held their concluding meeting, with Mr. R. A. Ross, of Ross & Holgate, consulting engineers, of Montreal, in the chair. With a view to fixing rates which they are to be charged by the Hydro-Electric Commission, the engineers decided to furnish the power commission with full particulars regarding the present conditions in their cities. It is expected that the Hydro-Electric Commission will deliver power in Toronto and several other cities with which they connect by next March.

COBALT. — The contract for sixty transformers and switchboards in sizes of 160 K.V.A. and less, for the Cobalt Power Company, has been awarded to the General Electric Manufacturing Company of Sweden, through their representatives, Messrs. Kilmer, Pullen & Burnham, Toronto.

Foreign.

RJUKAN (NORWAY).—The contract for what is believed to be the largest generators in the world was recently awarded to the General Electric Manufacturing Company of Sweden. The five generators are to be supplied for the Rjukan Saltpeter Plant in Norway, and are each of 23,000 electrical horse-power, 11,000 volt, 50-cycles, 250 R.P.M., of the horizontal water-wheel type, totally enclosed and ventilated by the revolving field which acts as a fan. Canadian representatives: Kilmer, Pullen & Burnham.

SEWERAGE AND WATERWORKS.

British Columbia.

VICTORIA.—Mr. Arthur L. Adams, the city's water expert, and Mr. Ashcroft, assistant engineer, recently reported on the cost of bringing water from Sooke Lake. Two schemes were submitted. To bring the water by a tunnel, the distance would be 17.4 miles, while if a pipe line were decided on, the distance would be 2.72 miles. The estimated cost of the tunnel route, as given in Mr. Adam's report is $1,098,900, and the alternative route $1,064,000. It would take four or five years to install the plant and build the tunnel, which would be designed to carry 7½ million gallons daily. The cost of acquiring the lands and right-of-way would be $100,000. Mr. Ashcroft thinks that estimate too low. His estimate of the cost of a tunnel route is $2,236,500, and the alternative route $1,663,000. These figures include $150,000 for the lands.

VANCOUVER.—Details of the plan to provide South Vancouver, Point Grey and Richmond municipalities with water from Seymour Creek at an initial cost of $500,000 were placed before the municipal council of Burnaby last week in a report by Messrs. Cleveland & Dutcher, civil engineers, of Vancouver. A special committee was appointed to go carefully through the report.

SOUTH VANCOUVER.—A by-law has been submitted to the ratepayers of the municipality with a view to bringing water from Seymour Creek at an estimated cost of $225,000. It would take two years to install the system proposed, which would be capable of supplying nine million gallons a day.

PRINCE RUPERT.—The plans for the proposed municipal waterworks system have been approved and returned from Victoria, and the work is now under way. The work will be rushed by the engineer in charge, Mr. A. W. Agnew. Over one and a half miles of feed pipe from the source of supply to the reservoir have been laid. There will be eighty miles of mains. A flat rate of $5 a yard for rock and 55 cents for earth has been secured, which will make the job less expensive than any work yet done.

CEMENT—CONCRETE.

Ontario.

OTTAWA.—Concrete piers will form part of a new $18,000 bridge which the Grand Trunk will shortly erect over Preston Street here.

PETERBOROUGH.—The work of erecting the new power house, which is being done by the Bishop Construction Company is progressing favorably, and it is expected that the building will be completed in five weeks. Work on a concrete dam will commence shortly.

Quebec.

MONTREAL.—Until Wednesday, the 13th October, Mr. L. O. David, city clerk will receive tenders for concrete and masonry work and reinforced concrete flooring in connection with a bridge to be erected at St. Catherine Street.

TELEPHONY.

British Columbia.

CRESTON.—The Creston Power, Light & Telephone Company is now putting the finishing touches to its new telephone system. Altogether there are about fifteen miles of line hung. The electicians have installed the new switchboard and distributor in the company's new head office. This company has also run private lines through the town and many suburban lines are now in operation.

CURRENT NEWS.

Manitoba.

BRANDON.—City Engineer Speakman is preparing plans for a subway which the city proposes to build under the C.P.R. and G.N.R. tracks. The cost is roughly estimated at $100,000.

Yukon.

DAWSON.—The Yukon Gold Coy.'s. great ditch, extending to Goldhill, has been completed, and on September 23rd water was turned into it. The water is conveyed from Twelve Mile River, 70 miles from the place of its use. A volume of 5,000 inches is sent over the hills at a cost of $10,000,000, making the successful consummation of what is probably the greatest engineering undertaking in the history of the far north.

PERSONAL NOTES.

MR GEORGE C. GERTH., formerly of Port Pelly, Sask., is now located at Canora, Sask.

MR. G. C. McKAY'S appointment as engineer was confirmed at a recent meeting of the City Council of Nelson, B.C.

MR. J. W. PORTER, formerly assistant engineer on the Toronto-Sudbury branch of the C.P.R. has been transferred to the National Transcontinental Railway at Quebec.

MR. GEORGE A. BROWNE, of the National Transcontinental Railway, has changed his address to Residence 15 of the N.T.R. at Cochrane, Ont. He was formerly at North Bay.

MR. CHARLEIS BRANDEIS, who has a large consulting practice in Montreal, where he has offices at 4 Phillips Place, was recently appointed consulting engineer to the Colonial Coal Company, Ltd., of North Sydney, N.S.

MR. P. H. MITCHELL, consulting engineer, of Toronto, has returned from a business trip to New York. Mr. Mitchell says the American manufacturers are watching Canada's development with great interest.

MR. H. SHEARER, of Detroit, has been appointed division superintendent of the Canadian lines of the Michigan Central Railway, with headquarters at St. Thomas, to succeed Mr. Adams, who takes the general superintendency of the Toronto, Hamilton, and Buffalo Railway at Hamilton.

MR. H. K. DUTCHER, M.Sc., A.M. Can. Soc. C.E., who was until recently a member of the firm of Cleveland & Dutcher, has opened offices in the Winch Building, Vancouver, B.C., where his large consulting practice will be carried on. Mr. Dutcher was formerly located in the Flack Block.

MR. A. N. ADAMS, division superintendent of M.C.R. at St. Thomas for the past seven years, has been appointed general superintendent of Toronto, Hamilton and Buffalo, with headquarters at Hamilton, succeeding Mr. E. Fisher, who is leaving on account of ill-health. Mr. Adams is a native of Detroit, 35 years of age, a graduate of Johns Hopkins University and Massachusetts Institute. He was draughtsman on M.C.R. in 1899, assistant engineer in 1901, assistant chief engineer in 1902, and later assistant superintendent at Detroit.

OBITUARY.

MR. N. A. RHODES, vice-president of the Rhodes-Curry Company, Ltd., Amherst, N.S., died on September 30th. Mr. Rhodes was 64 years of age, and had been in business in Amherst for nearly forty years.

MR. JAMES H. SUTHERLAND, roadmaster of the Brandon-Regina division C.N.R., died at his home Brandon, Man., September 26, 1909. Mr. Sutherland was forty-three years of age and a native of Fredericton, N.B.

MARKET CONDITIONS.

Montreal, October 7th, 1909.

Latest reports from the United States, on pig iron, are to the effect that the strength commented upon in the Canadian Engineer for some time past has more than been realized. It would seem that all records for the output of iron were smashed in the month of September. This certainly was the case with steel-making iron, and probably with foundry. Stocks of pig iron, to-day, in the various producing centres, slightly exceed 1,000,000 tons, the significant feature being that at these figures they have decreased not far from 500,000 tons. This is one of the most encouraging features of the market, inasmuch as it indicates an enormous consumption. Contracts during the month of September are said to have reached 1,000,000 tons. Consumers outside the steel companies contracted for 600,000, this being the largest tonnage of foundry iron ever placed under contract during a single month. It was a little significant, however, that during the latter part of the month, the buying movement showed a falling off as compared with the earlier portion.

In finished steel products, transactions were less heavy during September than during the previous few months, but in steel rails the aggregate was heavy, being 700,000 tons, which was the heaviest month in two years. The tendency of prices is still upwards, and 50c. per ton has been added during the past week, all round.

There is not a very great deal happening in the English and Scotch markets, but the tendency of prices is entirely in an upward direction. Apparently, considerably more metal is being sold for prompt delivery and is going into immediate consumption. Warrant prices have advanced about 9d. during the week, with an indication of higher prices being asked, as the result of increasing cost of ore and fuel, and also in view of the possibility of exports from the United States. The Scotch makers are well situated and are holding their output for prices which are fully 8s. above the low figures for last June. Hematite, the steel-making iron, which has been in poor demand for many months past, has taken a turn very much for the better. Consumption is rapidly increasing and prices have gone up about 6s. in the past three weeks. These advances on raw material will undoubtedly have the effect of increasing the cost of finished material in proportion thereto. As a rule, however, the advance in finished products does not come for some little time after raw material has started to move up.

In the local market, the situation continues very strong. Supplies are practically exhausted. Canadian furnaces are well sold ahead, and as a consequence are not anxious to do new business. Consumers requiring material do not seem to hesitate to pay the prices demanded, it being apparently their opinion that delay will only make the situation worse for them. Furnace people do not hesitate to declare that the next six months will see prices $1.50 to $2 per ton higher than they now are, for delivery in 1910. Offers to purchase at a fraction below the market are receiving little consideration from holders.

There has been a general advance in local pig iron prices, as will be seen from the following list. Notwithstanding the strength of the pig-iron situation, however, merchants handling finished and semi-finished iron and steel products fail to find the strength uniform throughout their markets. Steel plates, for instance, are almost easy in tone and it is quite possible that the prices quoted for some time past would even be shaded. In bar iron and steel, however, the situation is otherwise, and the mills report that advances are not far away. Following is the list of prices:

Antimony.—The market is steady at 8 to 8¼c.

Bar Iron and Steel.—The market promises to advance shortly. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.85 for 1 x ⅜-base; tire steel, $1.00 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; imported, $2.20.

Boiler Tubes.—The market is steady, quotations being as follows:—1½ and 2-inch tubes, 8¼c.; 2½-inch, 10c.; 3-inch, 11¼c.; 3½-inch, 14 1-2c.; 4-inch, 18 1-2c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—Prices are as follows:—¼-inch, $5.10; 5-16-inch, $3.95; ⅜-inch, $3.55; 7-16-inch, $3.35; ½-inch, $3.20; 9-16-inch, $3.05; ⅝-inch, $2.95; ¾-inch, $2.90; ⅞-inch, $2.85; 1-inch, $2.85.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal.

Copper.—Prices are strong at 14½ to 14¾c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 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; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5. Double strength fuses, 4-ft., $3.75; 6-ft., $4.29; 8-ft., $4.83; 10-ft., $5.37. Fuses, time, double-tape, $6 per 1,000 feet; explohmeters, fuse and circuit, $7.50 each.

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.—The outlook is strong. The following prices are for carload quantities and over, free on dock, Montreal, prompt delivery; No. 1 Summerlee, $20.50 to $21; selected Summerlee, $20 to $20.50; soft Summerlee, $19 to $19.50; Clarence, $18.25 to $18.50; Midland, or Hamilton pig is quoted at $20 per ton for No. 1 f.o.b., cars at point of production, No. 2 being $19.50, and No. 3 $19, for delivery during the next six months. It is said Dominion and Scotia companies are not quoting prompt delivery. Carron No. 1, $20.50 to $21; Carron special, $20. to $21.50.

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.50 to $3.60.

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carring $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 better, but prices are steady at $2.30 per keg for cut, and $2.25 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—$1.20 per gallon, in barrels; liquid red lead in gallon cans, $1.75 per gallon.

Pipe.—Cast Iron.—The market is unsettled and uncertain, as dealers are compelled to meet competition from all sources. Prices are easy and approximately as follows:—$31 for 6 and 8-inch pipe and larger; $32 for 5-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

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

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

Spikes.—Railway spikes are steady at $2.35 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pounds. (See building paper; also roofing).

Tin.—Prices are unchanged, at 33½ to 34c.

Zinc.—The tone is steady, at 5¾ to 6c.

* * * *

Toronto, October 7th, 1909.

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

Antimony.—Demand active and price higher at $9.25 per 100 lbs.

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

Bar Iron.—$1.95 to $2, base, per 100 lbs., from stock to wholesale dealer. Market well supplied.

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

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $18.50 to $19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. Demand is fairly active.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick move also freely. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 60c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. The supply is excessive; hence the lowered price. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—Manufacturers' prices for Portland cement are $1.35 without bags, or $1.65 including cotton bags for car lots on board car, Fort William or Port Arthur. This has been the case since September 16th. There is a good deal moving and the likelihood felt that the merger is unlikely to boost prices beyond a living point, will probably cause the free movement to continue. Smaller dealers get $1.50 per barrel without bags, in load lots, delivered in town.

Coal.—Retail price for Pennsylvania hard, $6.75 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.75. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is laregly used here, quotes at from $5.25 to $5.50; Reynoldsville, $4.50 to $4.75; Connellsville, 72-hour coke, $5.25 to $5.50.

Copper Ingot.—The market continues as before stated, price being $13.85 to $14.05, and the demand normal.

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.—An improvement in demand of late, no change in price, which is $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. The demand is steady.

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

Galvanized Sheets.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, 3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—gauge, $4.50; 20-gauge, $4.25; per 100 lbs. Demand very active and prices advanced 10c.

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

Iron Pipe.—Black, ¼-inch, $2.03; ⅜-inch, $2.26; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.90; 2½-inch, $15.81; 3-inch, $20.76; 3½-inch, $26.13; 4-inch, $29.70; 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, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.50, per 100 feet. Talk is still heard of an advance, but nothing definite.

Lead.—Prices steady outside. This market is steadier, and demand quiet, at $3.75 to $3.85 per 100 lbs.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car. Demand is good.

Lumber.—Although prices are stiffening generally, there is no freedom in buying shown by country dealers in Ontario, who continue to order "from hand to mouth." It is the city trade building being still active, which still absorbs the attention of producers or large merchants. Some sizes of native pine, for example, 2-inch good and 10 x 12 inch stock, are becoming scarce. British Columbia shingles are easier; everything else on the list appears to be on the upward trend according to outside advices. The almost wonderful demand from builders in the city, however, continues, and the keen competition to fill it makes the market almost a buyers' one. We quote dressing pine $32 to $35 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to 45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $20; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.60, and very few to be had.

Nails.—Wire, $2.25 base; cut, $2.70; spikes, $3 per keg of 100 lbs.

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar fairly active at $3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20 per ton. Producing plants are everywhere busy, and there is considerable business in prospect for 1910.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $2; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—An improved request is noted lately, at catalogue prices before quoted.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Pennsylvania slate 10x16 may be quoted at $7.25 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. The demand continues active; competent roofers are scarce.

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

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
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	.....

Business steady; price, 73 per cent. off list at factory for car-load lots; 65 per cent. of list retail. Small lots subject to advance.

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

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 30-lb. $43.

Sheet Steel.—Market steady at the former prices; 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. Quite a quantity of light sheets moving.

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

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

Tin.—The feeling in tin is firm, and the price 32 to 33c. per lb.

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

Zinc Spelter.—A very active movement continues, and a large business is being done. Price very firm at $5.75 to $6 per 100 lbs.

CAMP SUPPLIES.

Beans.—Hand picked, $2.60 to $2.70; prime, $2.40 to $2.50; Rangoon, hand-picked, $1.90 to $2.

Butter.—Dairy prints, 20 to 21c.; creamery rolls, 24 to 25c.

Canned Goods.—Peas, 77½ to $1.12½; tomatoes, 2s, 85 to 90c.; tomatoes, 3s, 95c. to $1; pumpkins, 3s, 80 to 85c.; corn, 85 to 95c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.90 to $1.95; raspberries, 2s, $1.90 to $1.95.

Cheese.—No old cheese on hand; new cheese, large, 12¾c.; twins, 13c.

Coffee.—Rio, green, 10 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, Valencia, 6 to 6¼c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7¼c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 12 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 8c.

Eggs.—New laid, 24 to 25c. per dozen, in case lots.

Lard.—Scarce and higher. Tierces, 15¼c.; tub, 15½c.; pails, 15¾c. per lb.

Molasses.—Barbadoes, barrels, 37 to 45c.; Porto Rico, 45 to 60c.; New Orleans, 30 to 33c. for medium.

Onions.—$1.25 a bag.

Potatoes.—Best, 75c. a bag.

Pork.—Still advancing. Short cut, $27.50 per barrel; mess, $26.

Rice.—B grade, 3½c. per lb.; Patna, 5½ to 5¾c.; Japan, 5¼ to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75.

Smoked and Dry Salt Meats.—Long clear bacon, 15c.; firm, tons and cases; hams, large, 14 to 14½c.; small, 15½ to 16c.; rolls, 13¾ to 14c.; breakfast bacon, 17c.; backs (plain), 17½c. to 18c.; backs (peameal), 18c. to 18½c.; shoulder hams, 12c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 16 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c

Sugar.—Granulated, $4.85 per 100 lbs. in barrels; Acadia, $4.75; yellow, $4.45; bags, 5c. lower; bright coffee, $4.65; bags, 5c. less.

Syrup.—Corn syrup, special bright, 3½c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

* * * *

Winnipeg, October 6th, 1909.

Quotations are as follows:—

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

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch.

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 2 White Pine, 6 in., $55; cull red or white pine or spruce, $24; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6 in., $55; No. 3, $45.

Bricks.—$10, $11, $12 per M, three grades.

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

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

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

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

Cement.—$2.25 to $2.50 per barrel, in cotton bags.

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

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 80 to 90c. per bale.

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

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

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 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.

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, $26.00; 2 x 20 up to 32 feet, $36.50.

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

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

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Rope.—Cotton, ¼ to ½-in. and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c.; sisal, 10½c.

Spikes.—Basis as follows:—1¼ 5 and 6, $4.75; 5-16 x 5 and 6, $4.40; ⅜ x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sizes.

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

Staples.—Fence, $3.40 per 190 lbs.

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.

Tool Steel.—8¼ to 15c. per pound.

Wire.—Oiled and annealed, 8 and 9 gauge, $3 per cwt.; 10 gauge, $3.06; 11 gauge, $3.12; 12 and 13 aguge, $3.20; 14 to 16 gauge, $3.25 to $3.70; 10c. extra for oiling.

TENDERS CALLED FOR

TURBINE PUMPS.

EXTENSION OF TIME.

Tenders will be received by the City of Toronto, Canada, up till noon of Thursday, October 28th (changed from October 14th), for the following Turbine Pumps:—

4—13½	million	gallon	pumps.	100	pounds	pressure.
2— 5	"	"	"	300	"	"
2—10	"	"	"	65	"	"
2—10	"	"	"	110	"	"
2— 6½	"	"	"	90	"	"
2— 6½	"	"	"	160	"	"
2— 1½	"	"	"	65	"	"
2— 1½	"	"	"	110	"	"

With valves, piping, bed plates, couplings, etc.

The lowest or any tender not necessarily accepted.

For specifications and form of tender apply to the City Engineer.

ELECTRIC MOTORS.

EXTENSION OF TIME.

Tenders will be received by the City of Toronto, Canada, up till noon of Thursday, October 28th (changed from October 14th), for the following Electric Motors:—

4—1500 H.P. Synchronous Motors.
2—1500 H.P. Induction Motors.
4— 500 H.P. Synchronous Motors.
4— 500 H.P. Induction Motors.
2— 225 H.P. Synchronous Motors.

With exciters, switchboards, connecting material, etc.

The lowest or any tender not necessarily accepted.

For specifications and form of tender apply to the City Engineer.

The city of Toronto, Canada, will shortly call for tenders for pole line supplies, including poles, cross-arms, pins, braces, etc., etc.

For information apply Electrical Department, City Hall.

SUPPLY OF PIPE.

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, November 16th, 1909,** for the supply of three thousand feet of rivetted steel pipe 60 inches in diameter, and five hundred feet of rivetted tapered steel pipe, also one thousand seven hundred and eighty-two lineal feet of 60-inch reinforced concrete pipe for the outfall sewer.

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

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

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

The lowest or any tender not necessarily accepted.

JOSEPH OLIVER (Mayor),
Chairman, Board of Control.

City Hall, Toronto, Oct. 1, 1909.

CITY OF MOOSE JAW, SASK.

Tenders for Water Meters.

Sealed tenders addressed to Alderman Matthews, Chairman Water and Sewer Committee, will be received in the Council Chamber, up to 8.30 p.m., Monday October 11th, 1909, for 50 ⅝" Water Meters and connections complete, delivered F.O.B., Moose Jaw, Saskatchewan.

J. DARLINGTON WHITMORE, City Engineer.

TOWN OF MAPLE CREEK

Tenders will be received by the secretary-treasurer of the town of Maple Creek, Saskatchewan, until October 15th, 1909, for the delivery and erection of Sewage Pumping equipment, approximate capacity 350 gals. per minute.

Plans and specifications may be seen at the office of the secretary-treasurer, Maple Creek, or at the office of C. M. Arnold, Consulting Engineer, Lethbridge. Alta.

A certified check for 10% of the amount of tender, payable to the secretary-treasurer of the town of Maple Creek, must accompany each tender as a guarantee that the successful tenderer will enter into a contract.

No tender necessarily accepted.

H. A. GREELEY,
Secretary-treasurer.

Maple Creek, Sask., September 21st, 1909.

TO QUARRYMEN, BRICK MANUFACTURERS, SUPPLY MEN ETC.

Tenders will be received by the Minister of Public Works, until 3 p.m. on Monday, October 11th, for the supplying of the under-mentioned materials in connection with the erection and reconstruction of the portion of the Ontario Parliament Buildings, Toronto, recently destroyed by fire.

Tenderers will be requested to estimate for the supplying of the material in quantities as may be required from time to time, viz.:

(1) For Hard Building Brick, per thousand.

(2) For Red Credit Valley Stone, per superficial yard, suitable for random masonry work, similar to what has been formerly used in connection with the erection of the Buildings. Stone to bed from about 9 to 14 inches.

(3) For Red Credit Valley Stone in promiscuous sized blocks, per cubic foot.

(4) For Red Credit Valley Stone, in dimension blocks, per cubic foot.

(5) For Building Sand, per cubic yard.

(6) For Grey Lime, per hundred pounds.

The whole of the above materials must be of first-class quality, subject to the approval of the Architect. The prices submitted, must include all charges, such as freight, cartage, handling etc., necessary to deliver material upon the works.

Plans of the present buildings and all other information can be had at the offices of the Architect, E. J. Lennox, 164 Bay Street, Toronto.

J. O. REAUME,
Minister of Public Works, Ontario.

Department of Public Works,
Toronto, October 2nd, 1909.