THIS ISSUE CONTAINS { Reinforced Concrete Bridge
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Canadian Engineer

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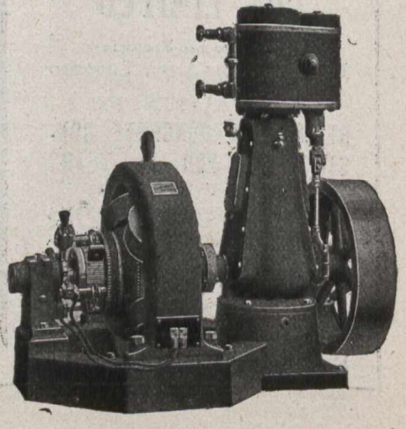

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The Canadian Engineer

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Editor—E. A. JAMES, B.A. Sc.
Business Manager—JAMES J. SALMOND

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NOTICE TO ADVERTISERS

Changes of advertisement copy should reach the Head Office by 10 a. m. Monday preceding the date of publication, except the first issue of the month for which changes of copy should be received at least two weeks prior to publication date.

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TORONTO, CANADA, JUNE 25, 1909.

CONTENTS OF THIS ISSUE.

Copy and cuts for changes of advertisements must be in our hands by the Monday preceding date of issue. If proofs are to be submitted, changes should be in our hands at least ten days before date of issue. When advertisers fail to comply with these conditions, the publishers cannot guarantee that the changes will be made.

THE DOLLARS VALUE OF A DEGREE.

June is the graduation month, and incidentally the month in which a thousand or so college graduates are seeking a job. For the first time they are seriously debating the question as to whether a college education helps in the world's work.

They are offered (lucky if they get an offer at all) from eight to ten dollars per week, while their high school classmates, who went to work when they went to college, are drawing two or three times as much.

In their high school days, ten dollars a week was a munificent income, but four years at college—four years of social evenings, pink teas, hops and theatre nights and three years lording it over freshmen—have given them a different view of things. To commence as messengers and assistants under former classmates seems hard—is hard. But they have the experience, they know business methods, they are familiar with the routine; and, after all, this knowledge does count. What will our college graduate do? Wear the white collar and refuse to submit to conditions as he finds them? Some do and continue at twelve per. Others drop in line, and submit to the painful (?) adjustment, and very shortly their training and knowledge and learning begins to count.

The university graduate will most certainly outstrip the high school graduate, but he will find, in the first few years, many places where his college-acquired dignity, and side, and bravado will be severely shocked—again the adjustment will be painful, but successful.

RAILWAY TAXATION.

The report of the Michigan State Tax Commissioners for 1908 gives statistics in reference to taxes paid by transportation companies within the State. The railway companies paid $3,650,132, the sleeping car companies $8,811, express companies $18,193, car loaning companies $13,065, making a total of $3,690,202.

In the same year Ontario, which has about the same mileage of railways and about the same density of population, collected taxes from companies within the Province as follows:—

Railways $400,902, sleeping cars $2,040, express companies $6,375, car loaning companies, nothing; total, $409,317. The railways paid also about $240,000 in municipal taxes, making the total in Ontario for these four kinds of companies $649,317, or $3,040,885 less than similar companies paid in Michigan.

The three great railway companies doing business in both Michigan and Ontario paid taxes as follows:—

	Michigan.	Ontario.
Grand Trunk	$535,173	$168,638
Michigan Central	895,142	27,791
Pere Marquette	496,951	13,348
Total	$1,927,266	$209,777

The St. Clair Tunnel Co. paid in Michigan $22,909, and in Ontario nothing except about $700 municipal taxes.

BRITISH STEEL OUTPUT DURING 1908.

The output of steel ingots in Great Britain was less by a million tons during 1908 than it was in 1907.

There was produced in 1908 by the Bessemer process, acid and basic, 1,478,539 tons. The following statement gives the output since 1905:—

	Acid.	Basic.	Total.
1908	906,466	472,073	1,478,539
1907	1,280,315	578,944	1,859,259
1906	1,307,149	600,189	1,907,338

The output of Bessemer and steel rails in 1908 was 715,407 tons, being 117,169 tons less than in 1907.

The decline in open-hearth steel was not so great. For the last three years the output has been a follows:—

	1908.	1907.	1906.
Basic steel ingots.....	1,238,263	1,278,709	1,176,245
Acid steel ingots.....	2,578,840	3,384,780	3,378,691
Totals	3,817,103	4,663,489	4,554,936

These figures indicate a falling off in acid open-hearth output of some twenty-five per cent., but of basic steel not quite three per cent.

The output of open-hearth blooms and billets and rails during the same period was:—

	1908. Tons.	1907. Tons.	1906. Tons.
Blooms and billets.....	999,636	498,656	580,961
Rails	192,525	79,532	94,926

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The twenty-sixth annual convention of the American Institute of Electrical Engineers will be held June 28th to July 1st, 1909, at Frontenac, New York. It is expected the convenience of this point will make it possible for a large number of Canadians to attend.

The programme is a particularly good one, and the Thousand Islands an ideal place for an outing. The attendance will surely be large.

EDITORIAL NOTES.

A special Board of Engineers appointed by Congress, and the regular United States Government Board having examined the scheme of building a 14-foot waterway from the Lakes down the Mississippi to the Gulf of Mexico, declares that it will not be worth the $128,000,000 it will cost. But Mr. Kavanaugh, of St. Louis, president of a local body committed to that enterprise, says: "We must have the waterway, whether it pays or not; this section has got to be developed." Whereupon the New York Journal of Commerce reminds Mr. Kavanaugh that the United Sates would have to pay the 128 millions, and they demand more assurances and less assurance than "Three Tailors of Tooley Street" show.

The Forestry Branch of the Department of the Interior has recently issued the first sheets of a new "forest atlas," which will include plans of the Dominion Forest Reserves, of which the surveys are now being carried on. The "legend" is now being sent out. This designates the marks used to denote natural features, the different species of trees, and the amounts of timber that can be obtained per acre from timbered areas, entries of various kinds (such as homesteads, mineral lands, etc.), burns or brules, cuttings and sales, roads, trails, railways, canals, flumes, telegraph and telephone lines, buildings, etc. One of the smaller forest reserves —that known as "The Pines," situated near Prince Albert, Sask.—has already been mapped, and the map of the Riding Mountain Forest Reserve, in Northwestern Manitoba, is now in preparation. As surveys of the forest reserves and other forested districts are completed, maps of these will be prepared and added to the atlas. It is hoped that the general scheme of indicating information, such as the different colors for stands of timber of various densities and the other special signs adopted by the Forest Service of the Dominion, may be put into general use throughout Canada, so that forest maps may be uniform in plan and may be easily compared.

* * * *

The American National Red Cross Association have prepared posters containing seven warnings to careless persons around railway tracks. The posters are sent free to railways, and read as follows:—

Rules for the Prevention of Railroad Accidents.

NEVER cross a railway at a grade crossing before making sure that no trains are approaching.

NEVER jump on or off cars in motion.

NEVER stand on platforms of cars in motion.

NEVER put head or other part of person out of car window.

NEVER cross in front or rear of standing or moving train without first making sure that there is no danger from some other train or cause.

NEVER disobey the cautionary rules for safety posted at stations, crossings, etc.

NEVER forget that carelessness on your part in regard to these precautions not only endangers your life, but the happiness and welfare of those most dear to you.

"Prevention of accidents and injuries by all legitimate means is a personal duty which everyone owes not to himself alone, but also to his family."

Issued January 1, 1909, by the American Red Cross.

This association realizes that the prevention of accidents is a matter of education, and they wish to enable the public to do subconsciously that which they would do if warned.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of June 14		STOCK QUOTATIONS TORONTO				STOCK QUOTATIONS MONTREAL				
				1909	1908	Price June 18 '08	Price June 10 '09	Price June 16 '09	Sales Week End'd Jun. 17	Price June 18 '08	Price June 10 '09	Price June 17 '09	Sales Week End'd Jun 17	
Canadian Pacific Railway	8,920.6	$150,000	$100	1,478,000	1,172,000	161½ 160	183¾	.....	25	160¾ 160½	185 184	181	282	
Canadian Northern Railway	2,986.9	.....	.....	184,500	151,200	.....	.....	.....	.....	.....	.....	.....	.....	
*Grand Trunk Railway	3,536	226,000	100	795,519	774,522	.....	*1st. pref. 106, 3rd pref. 56½, ordinary 23¾			.....	.....	.....	.....	
T. & N. O.	334	(Gov. Road)	.....	28,000	14,000	.....	.....	.....	.....	.....	.....	.....	.....	
Montreal Street Railway	138.3	18,000	100	75,508	73,600	.....	.....	.....	.....	179¼ 179	218½ 218	218 217¾	1239	
Toronto Street Railway	114	8,000	100	78,930	69,023	100½ 99½	126	.....	290	99½ 98½	126⅝ 126	124⅝ 124½	782	
Winnipeg Electric	70	6,000	100	.....	.....	160	189¾	189	180	159 158	190	.....	.....	

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

THE PENNSYLVANIA STEEL COMPANY'S REPORT ON THE BLACKWELL'S ISLAND BRIDGE.

By C. R. Young, A.M. Can. Soc. C.E.

Since the publication of the expert reports of Professor William H. Burr and Messrs. Boller and Hodge, on the condition of the Blackwell's Island (now the Queensboro) Bridge, over the East River at New York City, a few months ago, much comment of a disturbing character has appeared in the technical and daily press concerning this structure. To the end, that the confidence of the public in this bridge and in the professional capacity of American engineers may be restored, the Pennsylvania Steel Company, of Steelton, Pa., contractor for the steel superstructure, has recently issued a report of a reassuring character on the design of the bridge by its chief engineer, Mr. F. C. Kunz. Prefacing this report is another by a Commission named by the Pennsylvania Steel Company, and consisting of Messrs. Charles Macdonald, C. C. Schneider, H. R. Leonard and J. E. Greiner. This Commission was asked to examine the report of Mr. Kunz and express an opinion concerning it. The report submitted by the Commission is commendatory of that of Mr. Kunz and attempts to answer "the unjust and disturbing criticisms that have appeared in the public prints" by "an appeal to common sense rather than to technicalities," with what success remains to be seen. The Pennsylvania Steel Company's efforts to establish public confidence in engineering works of great magnitude and in the ability and integrity of the men who execute them is laudable, but it is a question if more efficient service in this respect might not have been rendered by choosing as text the best work of Fowler and Baker, John A. Roebling, James B. Eads or L. L. Buck, rather than attempting to whitewash the Blackwell's Island Bridge. The latter course is a natural one for the Steel Company, however, for, although no question has been raised as to the quality of its work or its adherence to approved plans in the construction of the bridge, it is vitally interested in maintaining a favorable impression of American engineering practice abroad. American bridge companies have in recent years secured extensive foreign contracts, for example, the great Gokteik viaduct in Burma, built by the Pennsylvania Steel Company itself, and no doubt the continuance and enlarging of this business is desired.

The Blackwell's Island Bridge is a double-deck cantilever structure without the usual suspended span between the extremities of the cantilever arms, as illustrated in Fig 1. In the original design there were to have been, on the lower deck, four lines of trolley cars and a 35½ feet driveway, and on the upper deck two lines of elevated railway and two 11-feet sidewalks. In 1904 the capacity of the bridge was increased by adding two more elevated railway tracks to the upper deck and moving the sidewalks outside of the trusses. Figures 2 and 3 respectively show cross sections of these two designs. The live load for the main members of the trusses and towers was fixed in the final design as 8,000 pounds per lineal foot of bridge for "regular" traffic and 16,000 pounds per lineal foot for "congested" traffic. The permissible unit stresses for structural steel specified for main members of trusses, towers and bracing were for tension, 20,000 pounds per square inch for dead load and "regular" live load and 24,000 pounds per square inch for dead load and "congested" live load. For compression the corresponding stresses were $20{,}000 - 90\frac{l}{r}$ and $24{,}000 - 100\frac{l}{r}$, l and r being in inches. The permissible stresses for nickel steel, which was used in eye-bars and pins were proportionately high.

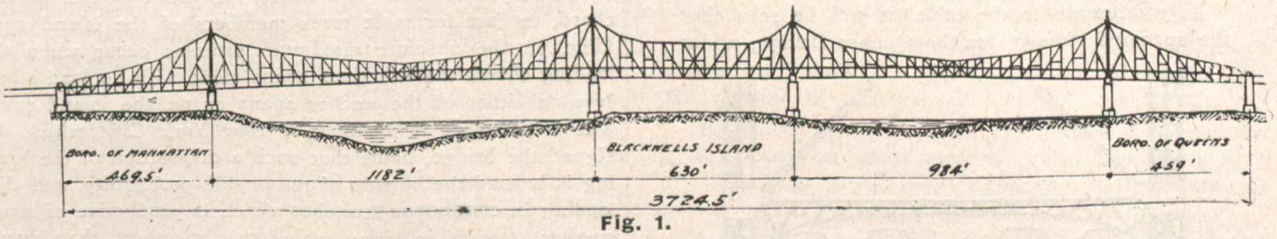


Fig. 1.

In the spring of 1908 articles appeared in the New York papers, particularly "The Tribune," criticizing the design of the bridge and drawing analogies between it and the ill-fated Quebec bridge, which had collapsed on August 29th, 1907, So insistent was the demand for an investigation that the two independent reports of Professor Burr and Boller and Hodge, mentioned above, were secured. The conclusions were not reassuring, to say the least. Professor Burr found that by reducing the dead load by at least 1,172 pounds per lineal feet of each truss of the cantilever arms traffic on the four trolley lines of the lower deck with clear intervals of two car lengths between cars and on two of the four elevated lines of the upper deck together with a vehicular traffic on the roadway and two loaded sidewalks might be permitted. The arrangement of the upper deck would then be as now existing (Fig. 4), the sidewalks being moved inside the trusses. Boller and Hodge were unable to sanction any elevated railway traffic at all, but concluded that if the dead load were decreased by 1,000 pounds per lineal foot of each truss the four trolley lines with clear intervals of one car length between cars might be operated in conjunction with the roadway and sidewalk traffic.

These findings naturally gave rise to considerable alarm, and in the opinion of the Pennsylvania Steel Company's Commission the experts who reported them failed in their duty, if one is to judge by the following statement:

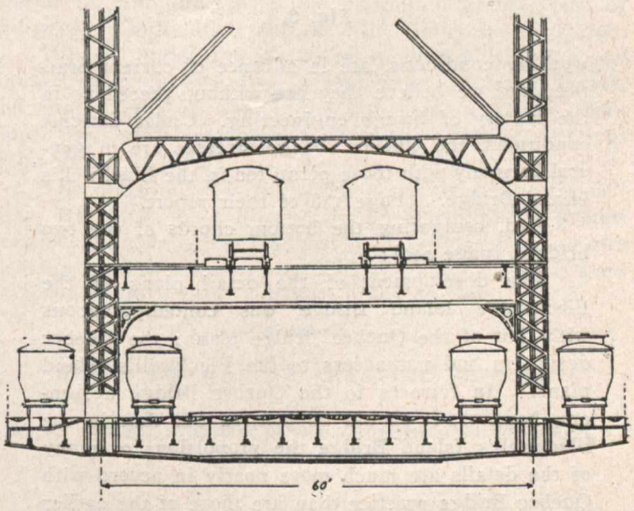


Fig. 2.

> The public confidence, which was disturbed by the Quebec failure and by the unwarranted comparison of that bridge with the Blackwall's Island Bridge structure, **has certainly not been restored by the reports of the city's experts on the latter bridge.**

The question whether the experts were retained for the purpose of restoring the lost confidence of the New York public or to pass unbiased judgment as to the actual state

of the structure does not seem to have suggested itself to the reviewing Commission in this connection. Mr. Kunz partially exonerates the experts by the remark:

> It would seem that the experts were not in possession of all data concerning the design, which would not be surprising, considering the fact that the construction of this bridge was directed by three different administrations of the Department of Bridges.

Just what these data were, and in what manner the lack of them led Professor Burr and Boller and Hodge astray does not appear in Mr. Kunz's report.

Much of the responsibility for the present and past uneasiness concerning this structure is placed farther back than the reports of Professor Burr and Boller and Hodge. Mr. Kunz is

> not aware that the failure of the Quebec Bridge caused any "suspicion" of the safety of the Blackwell's Island Bridge until the Royal Canadian Commission, which was appointed to enquire into the cause of the collapse of the Quebec Bridge made the following published statements:
>
> By reference to the table, it will be seen that the specified stresses for the Quebec Bridge, under

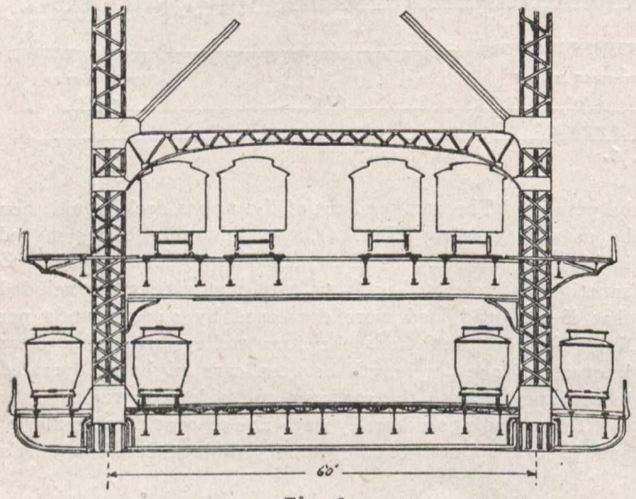


Fig. 3.

> working conditions, are in advance of current practice, and we believe they are without precedent in the history of bridge engineering. Under extreme conditions, the Quebec Bridge stresses are in general harmony with those permitted in the Blackwell's Island Bridge. (Page 148 of their report.)
>
> And, comparing the bottom chords of the two bridges (page 140):
>
> The development of the detail plans of the Blackwell's Island Bridge was contemporaneous with that of the Quebec Bridge plans; the Quebec designers had not access to the Blackwell's Island plans. In fairness to the Quebec Bridge designers, however, it should be pointed out that in the Blackwell's Island Bridge the proportions of many of the details are much more nearly in accord with Quebec Bridge practice than are those of the earlier bridges, although the principles of the designs are very different.

If Mr. Kunz was unaware of any suspicion of the safety of the Blackwell's Island Bridge until the Quebec Bridge Commission had the temerity to arouse it, the same does not seem to have been the case with the Commission which reviews Mr. Kunz's report. Its report opens thus:

> Since the failure of the Quebec Bridge, public confidence has been somewhat disturbed as regards the safety of bridges of unusual magnitude. This feeling of distrust has been **aggravated** by the opinion expressed in the report of the Royal Com-

(Continued on Page 820.)

> mission, appointed to inquire into and report on the cause of the failure of the Quebec Bridge.

Acknowledgment is here made of a feeling of distrust prior to the report of the Quebec Bridge Commission and the worst misdemeanor laid at the door of that Commission is **aggravating** an existing sense of insecurity.

The principal exception taken by Mr. Kunz and his reviewers with the reports of Professor Burr and Boller and Hodge is on the manner of **estimating** the maximum live load stresses in the main truss members. The word **estimating** is used advisedly, for in a cantilever structure with a loading of such complex character as was specified, great differences in stresses may be obtained by making different assumptions as to the worst **probable distribution** of the loading. Professor Burr and Boller and Hodge interpreted literally the clause in the specification which stipulated that loads should be "placed so as to give the greatest strain in each part of the structure." This, from the peculiar properties of the cantilever, required **discontinuous** loading, or that two or three isolated sections of the bridge should be covered with load while all other sections should be entirely free from it. Thus, for the top and bottom chord, in fact for most truss members of the island span (Fig. 1) the absolute maximum stresses occur when the loading covers the two river spans alone with no load whatever on either of the anchor spans or on the island span. The Department of Bridges of New York City, which designed the bridge, holds that such a disposition of the loading is beyond the bounds of reasonable probability, and that loading in **continuous** stretches which is productive of much smaller stresses in many main truss members than would arise from the **discontinuous** loading is the most unfavorable arrangement that need be provided for. Thus, in the instance cited above, the Department of Bridges assumed **continuous** loading over both river spans and the island span with no load on either anchor span as the most serious condition likely to occur in the lifetime of the bridge. In this respect departure was made from the strict letter of its specifications. As a result of these different ways of dealing with the live load, Professor Burr and Boller and Hodge obtained in many members much higher live load stresses than were obtained by the Department of Bridges, in some instances running as high as 57 per cent. greater.

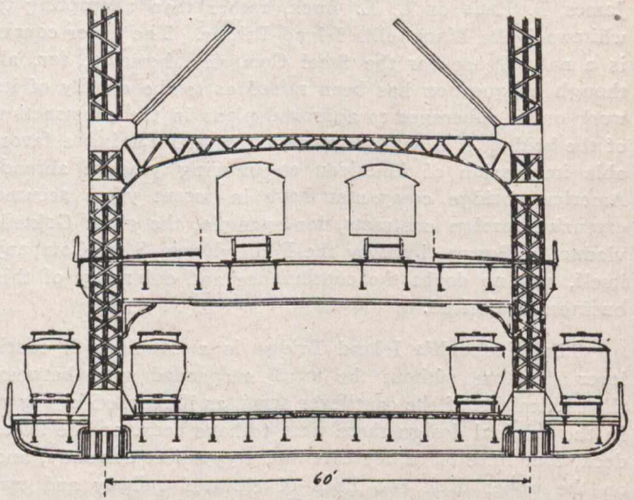


Fig. 4.

Both Mr. Kunz and the reviewing Commission approve of the disposition of the live load adopted by the Department of Bridges. Mr. Kunz estimates the probability of the live load representing fourteen lines of traffic of four different kinds on two independent floors covering two or three isolated stretches of certain definite lengths separated by unloaded spaces of certain other definite lengths as exceedingly small. The Commission regards the calculation of the maximum live load stresses due to the "congested" loading of 16,000 pounds per lineal foot on the basis of

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

IS SEWERAGE A PAYING PROPOSITION?

Generally speaking, "a sewerage system" is understood to be a non-profit-bearing proposition. Hence, the reluctance of many citizens to contemplate taxes for something only considered in the light of a luxury.

Water supply, lighting and power plants all may be productive of direct municipal dividends. Water, light and power represent products which can be retailed, and a return shown which may more than cover the initial and maintenance cost. This is not the case with a sewerage proposition, and, in spite of the fairy tales as to the value of sewage products, it represents a continual expenditure with no apparent direct return.

That this conclusion is more apparent than true can be easily shown.

We find in the case of many small towns a tendency to adopt a system of water supply combined with a determination to allow the question of sewerage to take care of itself until some indefinite period in the future.

Water supply and sewerage should go hand in hand; the one is dependent on the other. It is, in fact, a pertinent question, whether it would be good policy to make it compulsory that any community adopting a method of providing and selling water, should also at the same time provide means by which this water can be further taken care of after it has been rendered into sewage.

Where water is supplied by a common system, and no method of common sewerage is in vogue, the onus of eventually getting rid of the water after it has been used for scouring, washing and general domestic purposes lies with the individual consumer.

Does the individual consumer ever stop to consider that this onus entails an extra cost, which should properly be debited to the water account.

We have in mind a town in Ontario which represents many others in the same category. Water is pumped from municipal wells to the amount of 100,000 gallons per day for a population of about 4,000. The town council sells this water to the people. This 100,000 gallons is each day converted into sewage in one form or another; in fact, as well as providing a supply for dietetic purposes, it forms the scouring medium of the town, removing with it all the dirt and filth which would otherwise accumulate.

The council virtually say: We provide this water; do what you like with it and get rid of it by the best means you can. Our responsibility is finished. No common sewerage system is provided to deal with this common water supply.

The necessity of dealing with this 100,000 gallons of water per day, converted into sewage, is forced upon the individual. There being no common pipe system into which he can readily and automatically discharge it, he digs a hole, probably in the rear of the premises, and runs the sewage water into this hole. This he calls a cesspool, or probably a septic tank if built solid and covered over.

If it is possible to find a site for this cesspool on porous ground, well and good. The liquid is allowed to soak into the ground, and thus much trouble obviated. If the ground is non-porous, then he may carry a few tile drainage pipes from the tank, and distribute the liquid through the top porous layer of soil. Whatever happens to the liquid, however, he finds that he has occasionally to pay, more or less cheerfully, a dollar or so to have the accumulated solids carted away from the tank.

Apart from the health question of the gradual polluting of a town's subsoil with sewage, and the eventual pollution of the drinking water, does the householder ever stop to consider that after all this individual method of dealing with the water supply after it is converted into sewage entails an annual cost which may far exceed the tax necessary to provide a common sewerage system?

Wherever a water supply exists, there must exist either an individual or a general method of taking care of the amount of water used.

The individual system simply bristles with hygienic objections, and on being carefully gone into it will generally be found to be more expensive to a community than a common sewerage system.

In many towns, and in the particular case referred to, certain regulations are laid down as to the construction of the cesspools. They must be watertight, etc. A properly-built cesspool costs anywhere from $100 to $150. The annual maintenance for cleansing is anything from $1 to $5 per annum. The interest on the capital outlay at 5 per cent., together with maintenance, represents an annual payment for the individual system of from $6 to $12.50 per house.

In taking into account any proposed expenditure for sewerage purposes, the amount of assessment in taxes necesary to pay off the capital and interest for the works should be compared with the estimated annual cost of the present individual method which may be in vogue.

Where, under the above cesspool conditions, 1,000 houses exist, representing a population of about 4,000, the annual cost of the individual system would more than pay for a sewerage system of from $100,000 to $150,000.

The question, "Is sewerage a paying proposition?" may, we think, be answered in the affirmative if proper consideration be given to the various economic points bearing on the question, as well as to the general gain to a community from a health point of view.

A NEW METHOD OF TREATING SEWAGE.*

By K. Imhoff, Engineer of the "Emschergenossenschaft," in Essen, Germany.

In urban sewage about one-half of the organic matter is, in general, undissolved. This undissolved matter can be removed by mechanical means. The simplest method of mechanical purification consists in sedimentation, the suspended impurities being deposited, by gravity, as sludge. Sedimentation is dependent on time. The longer the period of clarification the more sludge is deposited. The separation is, however, very unequal. In the first few minutes the rate of separation is highest; thereafter, the rate gradually decreases. This is shown by the curve in Fig. 1, which may be taken as representing the average for normal

* Reprint from The Surveyor and Municipal and County Engineer.

municipal sewage. It will be seen that after one-and-a-half to two hours, 75 per cent. of the suspended matter has been separated. In the course of the following hours there is practically no increase of this percentage. The slight effect produced by extending the period of purification is by no means proportional to the increased cost of construction of the larger subsidence tanks required. In addition to this, protracted retention of the water in the tanks involves risk of putrefaction. For this reason alone the period of sedimentation should not exceed two hours. In the Fifth Report of the Royal Commission on Sewage Disposal a considerably longer period is indeed mentioned. For example, it is recommended with regard to subsidence tanks for preliminary separation of fine granular matter, that they should take the inflow of from ten to fifteen hours. This may have its explanation therein that the space occupied by the sludge is included in the calculation, and that the reference is to sewage works in which the subsidence is disturbed by activity in decomposing sludge. It may be mentioned that the percentage of separation varies considerably in different sewages. In the case of dilute sewage, it is usually lower than in the case of concentrated sewage. The curve is consequently sometimes flatter than in Fig. 1, and sometimes less flat, but it is always of the same type.

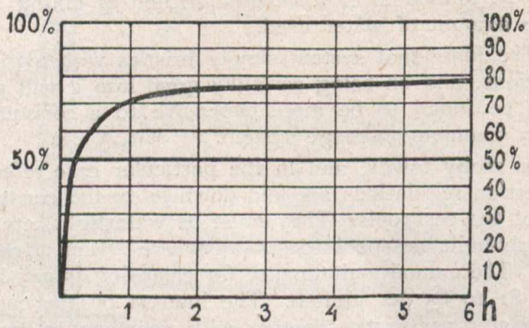


Fig. 1.—Rate of Sedimentation of Undissolved Matter.

Besides the length of the treatment, which is the main factor in sedimentation, a number of secondary factors have to be taken into consideration in the construction of subsidence works.

In tanks in which the sewage flows in a horizontal direction, the depth largely influences the result. Shallow tanks are better than deep ones. The velocity of the water in these tanks within the limits occurring in practice is without material effect, provided the necessary time is given. However, the velocity must not be so great as to cause agitation of the settled sludge.

It is important to construct the inlet and outlet in such a way that the water is uniformly distributed throughout the entire width. The whole construction must be so designed that changes of temperature do not give rise to currents which carry insufficiently cleared water to the outlet.

The separation of the minutest (colloidal) suspended particles is favoured by affording large surfaces on which these particles can settle. The best arrangement hitherto designed for this purpose is that indicated by Mr. Travis. This consists in placing vertical, thin walls in the longitudinal direction of the tank. These walls fulfil their purpose without obstructing the flow of the water.

Finally, it is, as already indicated, of extreme importance that the sedimentation is not disturbed by activity arising from decomposition of the sludge. The best way of preventing this is to provide for automatic removal of the sludge from the tank proper as soon as it is deposited.

Treatment of the Sludge.

The treatment of the sludge is equally as important as the purification of the sewage. Sewage works in which the question of the sludge treatment is not satisfactorily disposed of cannot in the long run fulfil their primary purpose—i.e., that of purifying the water. It is not sufficient to provide only for effective sedimentation of the sewage. It is equally essential to provide for efficient removal of the sludge, and for the further treatment thereof, even if provision for these matters involves some departure from the ideal process of sedimentation pure and simple.

The plant must, in fact, be the result of a compromise between the requirements of sedimentation on the one hand and of sludge treatment on the other hand.

The sludge pumped in a fresh state from the tank has very unfavorable qualities; it contains much water, and is consequently of large bulk; it dries with difficulty and passes while drying into a state of odoriferous putrefaction. Industrial utilization of the sludge (for example, for the production of fat) has not hitherto proved successful on a large scale. The best manner of dealing with the sludge is still the treatment in septic tanks, known of old. The sludge is by this treatment reduced in bulk; the drying thereof is facilitated, and it is rendered odourless.

If it is preferred to allow the sludge to decompose it is advisable to combine all residues with the sludge—that is to say, to retain only the coarsest obstruction at the gates, and to dispense with a sand collector provided that the sludge mixed with sand is capable of conveyance. It is important in this respect that the sand is mixed as uniformly as possible with the sludge at the time of the sedimentation.

Sewage Purification in the West of Germany.

Based on these principles a new process of sewage purification has been adopted on a large scale in the district of the West German coal and iron industry. The Emscher, a small affluent of the Rhine, drains the most important part of this district. The district of the Emscher presents extremely unfavorable conditions for sewage. An association was therefore formed in the year 1904. The powers of this association go far beyond those possessed, for example, by the English boards. The "Emschergenossenschaft" controls all the sewage works of the district referred to, as well as the large collecting sewers belonging thereto. It also exercises control over the river and its affluents. The association maintains and works the plant established. The cost of construction, amounting to about 50,000,000 marks, and the working expenses are provided by annual contributions.

For separating the sludge from the sewage, the association will establish about seventy sewage works, of which up to the present seven are working, the largest being at Bochum, a town of 130,000 inhabitants.

Outside the district of the association about ten works of the same kind have been established. The works are known in Germany as "Emscherbrunnen."

Tanks as Self-acting Sewage Works.

The sewage plant used by the "Emschergenossenschaft" consists essentially of deep tanks, which receive the sludge. In the upper part of these tanks the subsidence chambers through which the water flows are divided off by partitions. The floors of the subsidence chambers are inclined, and the sludge slides down them, in order to pass through slots into the sludge tanks. Without supervision or attendance the sludge is, therefore, continuously and promptly removed from the subsidence chamber. The sludge accumulates in the tanks, and the sludge tanks gradually develop into septic tanks. Only the sludge, however, is decomposed. The flowing water is kept free from putrefaction. If putrefaction has already occurred in the water, it is at least not furthered in the tank.

The tanks are used either singly or in series. Both methods are illustrated in the accompanying diagrams.

Fig. 2 shows sewage plant comprising two tanks, for a population of 10,000. A subsidence basin is arranged above the two tanks. It is important that each tank receives the same amount of sludge, so that decomposition occupies the same time in each tank. For this reason, the direction of flow is changed at intervals of a few weeks, so that each tank in turn is first in the series, and receives the greater influx of sludge. This also has the result that all the tanks receive sludge of the same kind; without the change, one tank—**the first** in the series—would receive a large proportion of

sandy, solid sludge, and the other tanks organic, liquid matter. To allow of admitting the water from both sides, an annular channel is formed at the edge of the tank.

Fig. 3 shows a single tank for a population of 5,000, designed for the treatment of sewage in which the proportion of water to sludge is higher than in the case of the sewage treated in the apparatus shown in Fig. 2. The water is in this case supplied at the centre, and flows radially outwards, to overflow at the edge. In the course of its outward flow the water must first descend, and then ascend, along the wall of a cylinder suspended in the tank. The sedimentation consequently takes place while the water is flowing vertically. It is essential that the velocity of the ascending water is not greater than the velocity of the sinking particles.

The sedimentation in tanks of this kind is at least equal to that in well-designed subsidence tanks of other type, size and time being equal. The decomposition taking place in the sludge chamber has practically no unfavorable effect on the condition of the water flowing through the subsidence chamber. The small amount of liquid expelled from the sludge chamber by the descending sludge has practically no effect.

The sludge in the sludge tank acquires the same favorable qualities as that treated in other septic tanks. Its bulk is reduced to about one-quarter of the original bulk, partly by evolution of gas and partly by reduction of the percentage of water. The sludge becomes odourless, dries easily, and may then be utilized for agricultural purposes, or for filling purposes, or it may be burnt.

The decomposition extends only to the sludge and to the shallow layer of stagnant water at the top of the sludge tank. Flow of water through the sludge tank is deliberately avoided. The floating layer is also retained; it is found that this layer does not interfere with the decomposition, but is useful in preventing admixture of contaminated water with the outflow from the subsidence tank. It is found that the gases evolved are nearly all odourless (methane, carbon dioxide); there is practically no sulphuretted hydrogen, contrary to experience with septic tanks through which water flows, and in which decomposition of water takes place.

The great depth of the chambers favors the process of decomposition, inasmuch as the temperature is more regular. The depth also has a favorable effect on the final condition of the sludge, particularly with regard to the percentage of water in the sludge.

From the septic tank the sludge is conveyed through pipes to the drying beds. The pipes are shown in Fig. 2. If the beds are at a lower level the sludge may flow to them by gravity, a gate at the orifice of the lateral pipe being opened for this purpose. If there is no "head" the sludge is pumped from the upper end of the pipe. The sludge generally flows out with great readiness, having lost its stringy nature. It is a black mass, and liquid, notwithstanding that the proportion of water is only 75 or 80 per cent. Water may be admitted from pipes at the bottom of the tanks, for the purpose of diluting the sludge, and starting its flow, but this is only necessary if the sludge contains an exceptionally large proportion of sand.

The size of the sludge tank is dependent on the length of time required for decomposition of the sludge. The time varies considerably in different places. The average may, perhaps, be stated as one-an-a-half to three months. More time may be required at first until the tank has become "seasoned." In designing the tank a margin is preferably allowed as regards size, so that sludge may be allowed to accumulate in case the drying or depositing beds should temporarily cease to be available.

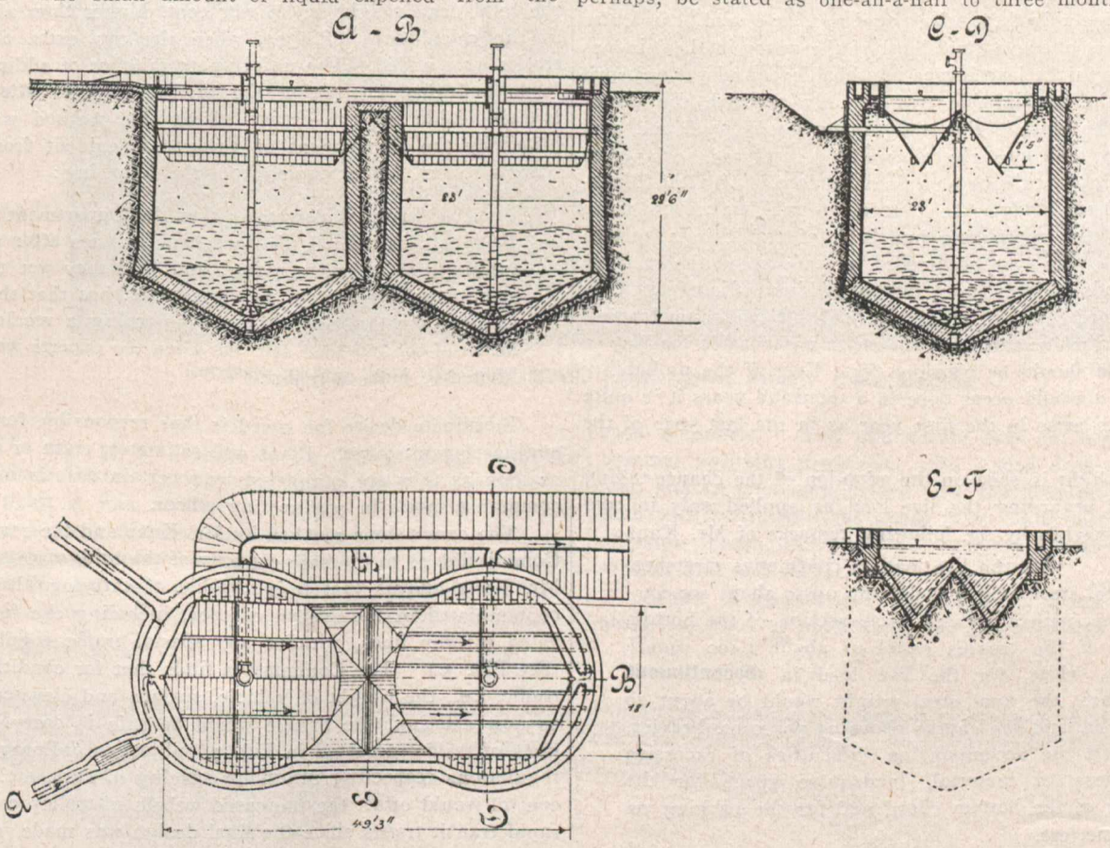


Fig. 2.—Clarifying Plant for Population of 10,000.

(To be continued.)

The Annual Convention of the Canadian Electrical Association, just held in Quebec, was one of the most successful yet held. The election of officers resulted as follows:—President, W. N. Ryerson, general manager, Great Northern Power Company, Duluth (re-elected); First Vice-President, P. S. Coates, Chatham, Ont.; Second Vice-President, E. A. Evans, Quebec; Secretary-Treasurer, T. S. Young, Toronto (re-elected). Managing Committee: R. S. Kelch, Montreal; R. G. Black, Toronto; A. A. Dion, Ottawa; J. J. Wright, Toronto; H. O. Fisk, Peterborough, Ont.; R. J. Smith, Perth, Ont.; W. L. Adams, Niagara Falls; W. M. McFarlane, Cornwall; F. A. Chisholm, St. Johns, Que., and A. L. Mudge, Toronto.

(Continued from Page 816.)

discontinuous disposition as " a method that might well be described as the placing of impossible loads in an impossible manner." This may be true, but once in every generation or so the unthinkable contingency arrives and disaster overtakes an engineering work hitherto considered as safeguarded against all possibility of failure. Mr. Kunz himself admits that the method of probability could not be employed here.

> As even the most elaborate assumptions as regards speed and time of the rapid trains on the four tracks will be often overthrown by delays, accidents, etc., and the traffic on the trolley tracks, roadway and promenades is beyond the reach of a mathematical expression of its probability.

If then, untoward condition, might result in traffic combinations unforeseen by the designer, is it idle to provide for that disposition of the loading which would give rise to the absolute maximum stresses in the main truss members? What engineer is there who would not have said that a rise of forty feet above normal level of the water in the Niagara Gorge was in the last degree improbable? And yet on April 9th last the unthinkable was actually realized, the power house of the Ontario Power Company was flooded and part of the Gorge Route electric railway destroyed with great resulting inconvenience and financial loss. With the Blackwell's Island Bridge the outcome would be much more serious if the improbable bunching of traffic in a certain unfavorable way even occurred. It would mean the sacrifice of thousands of lives in an instant of time. New York City cannot afford to take chances on **probable** maximum loading for this great structure but the most unfavorable loading at all **possible** should be provided for. Even if the probability were that it would occur once in a thousand years it is quite as likely to arise in the first year as in the last year of the cycle.

Some light is shed on the adoption of the chance-taking method of regarding the live load as applied only in continuous stretches by the following remarks of Mr. Kunz:

> . . . with the live load in continuous stretches, the total steel weight would run up to about 100,000,000 lbs., with a greatest cross-section of the bottom chord of the trusses equal to about 1,100 square inches, while, for the live load in **discontinuous** stretches, the total steel weight would be about 10 per cent. and the chords about 25 per cent. heavier, with all the accompanying difficulties of excessive thickness of material, inadequate space for the lacing of the bottom chord and for the packing on the pins, etc.
>
> **The question of continuity or discontinuity of the live load, therefore, involved a question of an increase of the steel weight of the structure of about 10,000,000 pounds, at a corresponding additional cost of approximately $700,000.**
>
> Even in designing these verticals (the two making the most unfavorable showing under " congested " **discontinuous** loading) for condition (2) (" congested " **continuous** loading) as this gave the greater stress, their packing was so difficult that their upper half had to be made flared at the top in order to minimize the great bending moment of the pin caused by the kink in the outline of top chord, which necessitated a pin joint in their centre; and their bottom, consisting of three ribs, each five inches thick, had to be made of nickel steel to provide for the necessary area through and back of the pin hole, in spite of the fact that the bottom chord in the island span is ten inches wider than in the rest of the bridge.

The **continuous** live load seems to have been adopted, therefore, largely to effect a saving of $700,000 and to secure easy details in the structure. Any layman and most engineers would first ensure that a bridge be designed to safely carry a certain possible load as economically as possible and would allow the weight and details to follow. Here is a bridge which apparently was designed primarily to be cheap and easy to construct, and the live load capacity was fixed to suit the resulting design. It would appear as if $700,000 and the devising of some unusual details were too much to pay to ensure absolute security under the full loading set down in the specifications and which everybody had supposed the bridge would be able to accommodate.

The under-estimation of the dead weight in the design is conceded in both reports. The action of the Department of Bridges in changing the plans as to roadway, increasing the weight of paving, inside trolley rails and hand-rails, making the uniform load (other than steel) 6,968 pounds per lineal foot, or an increase of 1,859 pounds for these items, is characterized by the reviewing Commission as an admitted error. Even by now reducing the weight of paving, etc., on the river spans to the extent of 1,168 pounds per lineal foot, no change being made on the anchor and island spans, the total dead weight is 6½ per cent. higher than assumed in the calculations of 1904, when the two extra elevated tracks were added. The unfortunate practice of adding new loads and then computing the revised stresses **afterwards** is responsible for the excess. That this method was followed by the Department of Bridges is evident from Mr. Kunz's report, for example, from the following:

> The writer understands that the Department of Bridges recalculated the dead load stresses **after** arranging for heavier paving, and that they got the same excessive figures as the experts, but that they had not come to any conclusion pending a recalculation of the live load stresses when the experts were invited to make a report.

Inordinate desire for speed is thus responsible for many engineering mistakes. Plans and estimates, right or wrong, as long as they are completed by a certain date is only too common a motto in engineering offices.

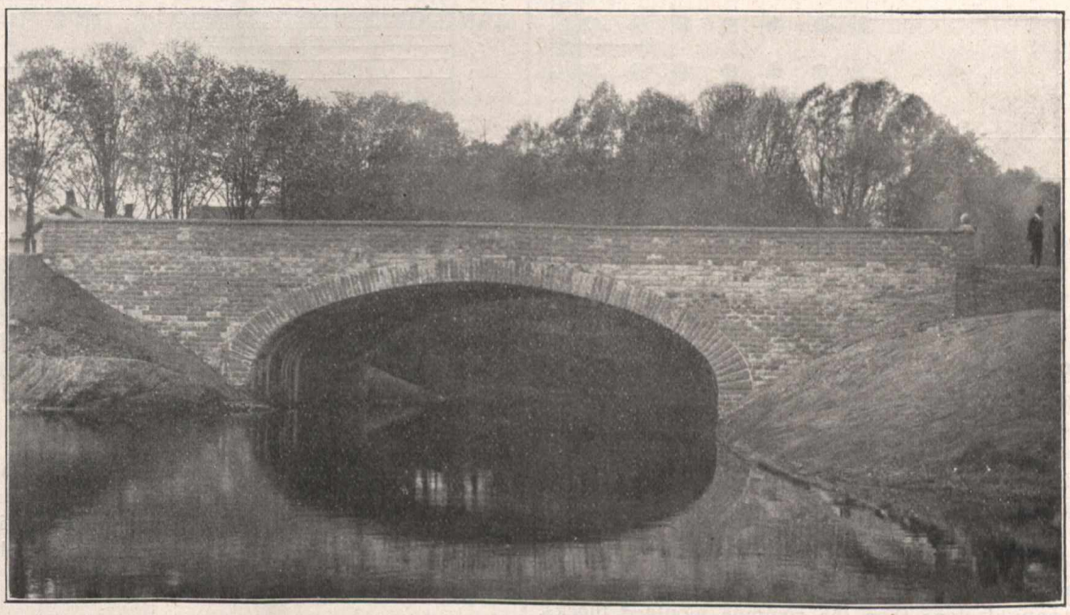
The conclusions reached by Mr. Kunz and the reviewing Commission as to the safe capacity of the bridge are similar. Mr. Kunz affirms that it is capable of carrying all traffic, contemplated in the design of 1904, including the four elevated railway lines, without any special traffic regulations. (See Fig. 3.) The Commission finds that for conditions of traffic, i.e., the weight of vehicle, surface and elevated cars, as now existing, the bridge would be safe to carry all the lines of traffic indicated in Fig. 3, subject to ordinary traffic regulations respecting minimum spacing of cars, etc. This control would offset the increased weight of trolley cars and rapid transit trains since the final design was made in 1904.

In spite of the arguments thus adduced and the conclusions arrived at, the city authorities have not the faith in the structure designed by its Department of Bridges which sustains the defenders of the latter. Since these reports were written, it has been decided to use only two of the four elevated railway tracks, sufficient dead load to be removed to make this permissible. On March 30th the driveway and footwalks were opened but not the trolley lines, since no trolley-car connections to the bridge existed. The elevated tracks will not be used for some time as there are no elevated lines near the crossing. In view of the character and weight of the expert testimony concerning the structure, there are few engineers who will not commend the action taken by the city. Nor will years of successful operation under the maximum authorized traffic warrant a material increase in that traffic. There were too many contingencies unprovided for in the designs to render such a course desirable; permissible unit stresses regarded as excessive by most engineers; no allowance for snow load which in the latitude of New York sometimes attains considerable magnitude; secondary stresses which under certain conditions are by no means negligible; and lastly, great compression members from which the cloud of grave uncertainty has never been lifted.

A REINFORCED CONCRETE ARCH CEMENT BLOCK FACE.

R. McDowall, C.E., Owen Sound, Ont.

Concrete as a bridge building material has been so long in use that anything unusual is seldom found, but in this article we feel that in the concrete block face type of arch and cost of construction, we have something that will be of interest to engineers.



Concrete Bridge with Concrete Block Face, Union Street, Owen Sound.

Site.

The site of the bridge is on Union Street over the Sydenham River. Owing to a sharp bend in the river at this point it was decided to remove the site of the new bridge a short distance easterly from that of the old one and thus in a great measure straighten the river. The arch was in this way built on dry ground and the new river channel excavated after its construction, the excavated material being used to fill up the old river channel and the street grade which was raised five feet higher than formerly. The false work of the arch was enabled to be placed, supported and removed all on dry ground.

Dimensions and Design.

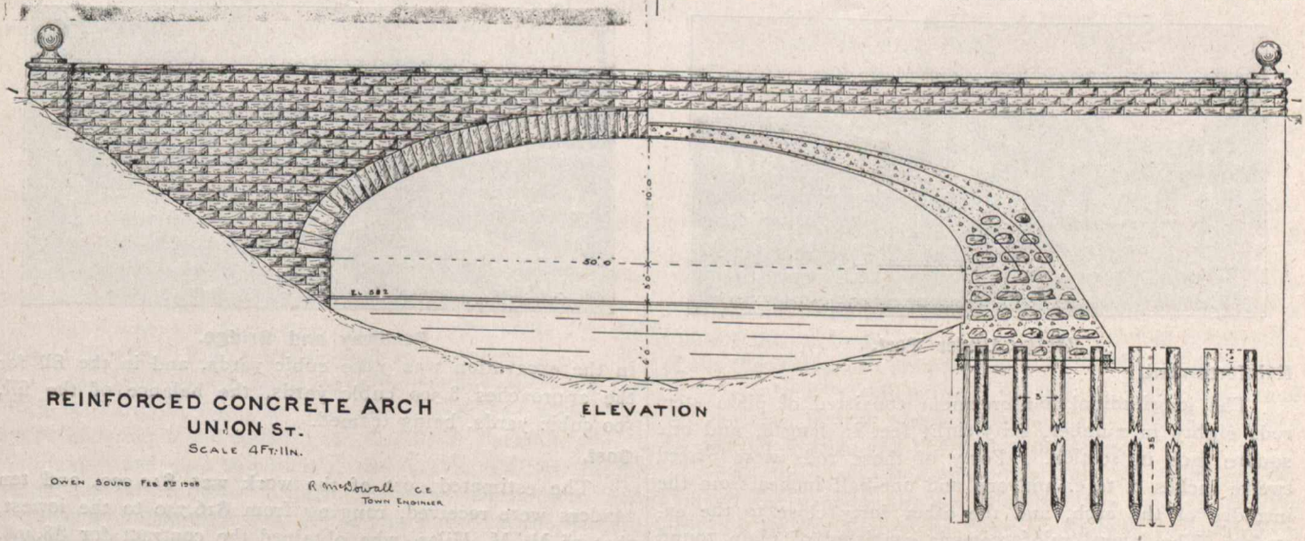
The arch is an ellipse having a span or horizontal axis of fifty feet and a vertical axis of ten feet, the spring of the arch is three and the soffit thirteen feet above the normal level of the river.

The abutments are "U" shaped with wings twenty-five ft. in length making the length of the bridge from end to end one hundred feet. The width of the whole roadway is thirty-eight feet, including two sidewalks six feet in width and a macadamized roadway twenty-six feet in width. The total width of arch is forty feet. The arch was designed to carry a live load of one hundred and fifty pounds per square foot and a moving load of a sixteen-ton road roller.

Foundations.

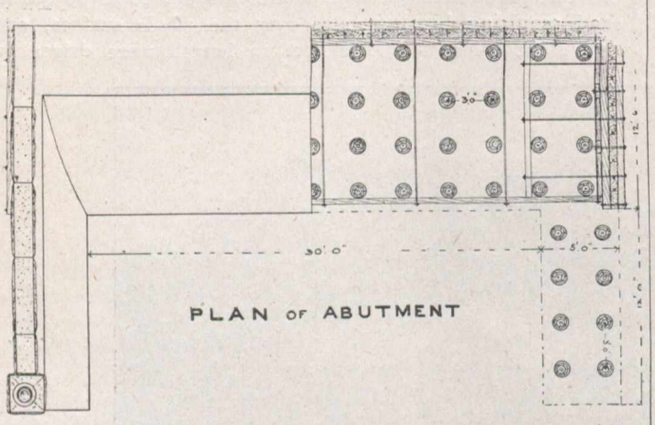
The foundations of both abutments proved to be quick-sand requiring bearing piles over the whole surface, and sixty-eight piles thirty-five feet in length were driven in each abutment. The pile driver used in driving had a hammer weighing 2,500 lbs., with a lead drop of thirty-six feet, and all piles were driven until the penetration was less than two inches with the above blow. The piles used were of maple, beech, birch and elm fourteen inches in diameter at their butt and six inches at their point.

A row of tongue and grooved sheet piling was driven along the face of each abutment and returned twelve feet back on the sides of the wings. This sheet piling was six inches in thickness, twelve feet in length, and was driven three feet below normal river level. Two runs of 12-inch by 6-inch waling was well bolted to the piling both inside and outside and also anchored by iron rods to the inside row of bearing piles. The bearing piles were cut off at a level three feet below normal and the excavation for foundation extended eighteen inches lower. All the water entering the coffer dam could easily be taken care of by two men on a hand pump.



Concrete.

The concrete used throughout the whole work, with the exception of the veneer blocks, was composed of one part Portland cement, three parts sand, and five parts of No. 2 broken stone, mixed by a Smith steam mixer. Hand rubble was bedded in the heavier walls of the abutment and wings but was not allowed in the arch.



PLAN OF ABUTMENT

Veneer Blocks.

The veneer blocks and arch stone were made of one part Portland cement and four parts sand, mixed wet and moulded on a gridiron made of planking. The gridiron was of sufficient size to mould four hundred blocks at one mix. The blocks were moulded eighteen inches in length, six inches in depth, and seven inches in width. After the blocks had set for two weeks the outside inch was rock faced by a pitching tool, this gave the blocks an appearance more like natural stone than the common moulded blocks. Two 6-inch spikes were bedded in each block and left head, and three inches protruding to form a bond with the concrete in mass on the body of the bridge.

The arch stones were moulded in a form representing a half section of the arch, each stone being separated by a board three-eights of an inch in thickness. The arch stones varied in length from two feet six inches at key to three feet six inches at spring, they were tapered uniformly and rock-face in same manner as the blocks.

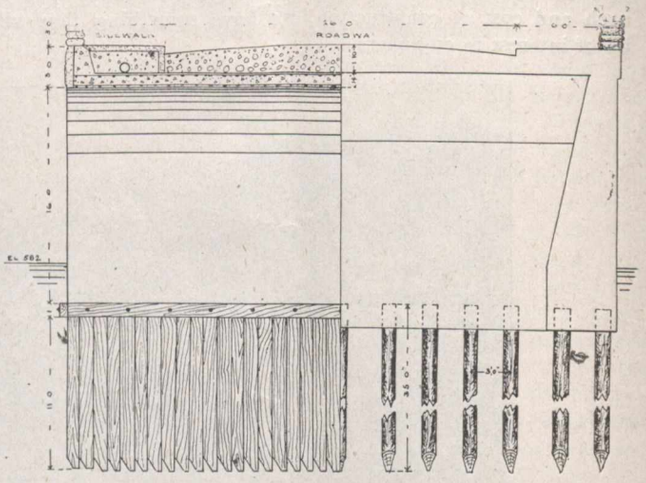
Bridge Under Test.

Reinforcement.

The longitudinal reinforcement consisted of plain steel rods eighty in number, sixty-eight feet in length, and one square inch in section. Forty of these rods were placed twelve inches c. to c. and one and one-half inches from the intrados of the arch, and the other forty close to the extrados. The lateral reinforcement consisted of plain round steel rods one half inch in diameter placed twelve inches c. to c. at right angles to longitudinal rods, and bound together at their intersection.

False Work.

The false work consisted of forty-one hemlock ribs ten inches in depth and four inches in thickness shaped so as to conform the ellipse of the arch at two inches distant from the soffit. Each rib was built up of two-inch plank breaking joint and spiked well together. The lagging was of pine two inches in thickness and four inches in width, sized and planed and spiked to ribs. The ribs were supported by seven lateral stringers of 8 × 8 inch timbers. Each stringer was supported by nine posts 8 × 8 inch resting on mud sills 10 × 10 inches. Hardwood wedges were driven between the mud sill and the ends of the posts. Diagonal braces of two-inch plank were spiked to the posts. All the false work was placed on dry ground.



SECTION

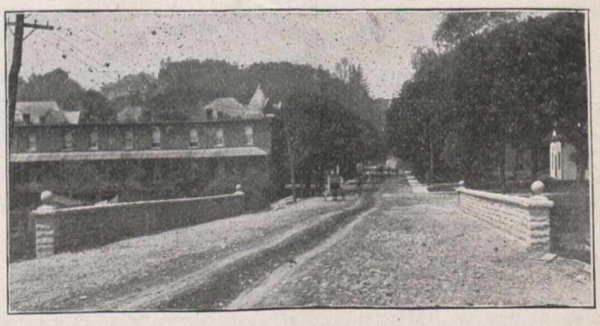
No planking whatever was used for the outside of the wings or spandrel walls, the veneer blocks being built up as an outside wall and the concreting placed inside. The false work was removed thirty days after completion of the arch; no noticeable deflection occurred.

Railing.

The railing is built up of two rows of concrete blocks laid back to back and capped with a concrete rail moulded eighteen inches in width.

Excavation.

After the false work was removed the channel beneath the arch was excavated by horse and scrapers and the material dumped in the approaches. The amount of material



Roadway and Bridge.

in the excavation was 3,800 cubic yards, and in the fill for the approaches 8,300 cubic yards, the balance of the fill, 500 cubic yards, being teamed.

Cost.

The estimated cost of the work was $10,000, and ten tenders were received, ranging from $16,740 to the lowest, that of M. M. Hiles, who obtained the contract for $8,498, for which it was done. Prices for material ranged as follows:—

Labor	$1.50 to $1.75 per day of 10 hours
Piles 35 feet in length	$1.75 each
Sheet piling, lumber, etc., from $16 to $18 per thousand B.M.	
Sand	73 cents per cubic yard
Broken stone	85 cents per cubic yard
Rubble	70 cents per cubic yard
Cement	$1.15 per barrel
Earth filling	17 to 33 cents per cubic yard

Test Load.

The arch was tested on May 26th by passing a steam roller weighing sixteen tons several times across it. No deflection whatever occurred, and although a slight vibration was perceptible on the filling for the approaches it ceased immediately when the roller passed from the approaches upon the arch.

ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

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

7221—June 11—Granting leave to the Q. M. & S. Railway to construct its railway, at rail level, across the highway at station No. 2140-32, parish of St. Gregoire, County of Nicolet, P.Q.

7222—June 11—Granting leave to the Q. M. & S. Railway to construct its railway, at rail level, across the highway at station No. 2076-71, parish of St. Gregoire, P.Q.

7223—June 11—Granting leave to the Q. M. & S. Railway to construct its railway, at rail level, across the highway at station No. 1920-47, in the parish of St. Gregoire, County Nicolet, P.Q.

7224—June 11—Granting leave to the Q. M. & S. Railway to construct its railway, at rail level, at station No. 2196-26, in the parish of St. Gregoire, County of Nicolet, P.Q.

7225—June 11—Granting leave to the Q. M. & S. Railway to construct its railway, across the highway at station No. 3499-88, in the parish of St. Philomene, County of Lotbiniere, P.Q.

7226—June 11—Granting leave to the Q. M. & S. Railway to divert its railway, at station No. 3413 to 3417, in the parish of St. Philomene, County of Lotbiniere, P.Q.

7227—June 10—Authorizing the C.P.R. to construct, maintain, and operate the industrial spur for the International Harvester Company at Saskatoon, Sask.

7228—June 11—Granting leave to the Vancouver & Lulu Island Railway to construct the Westminster & Eburne branch of its line of railway across the Kerr Road, at station 221, and the Cemetery Road at station 101, in the city of South Vancouver, B.C.

7229—June 11—Authorizing the C.P.R. to construct, maintain, and operate industrial spur line for D. Stamper, the Knechtel Furniture Co., and the city of Moose Jaw, near Moose Jaw, Sask.

7230—June 14—Approving location of the C.P.R. Co.'s station at Blairton, County of Peterboro', Ont.

7231—June 14—Approving location of the C.P.R. Co.'s station at Chapleau, Ont.

7232—June 14—Approving location of the C.P.R. Co.'s station at Erindale, Ont.

7233—June 11—Approving location and details of the station of the G.T.R. to be erected at Powassan, Ont.

7234—June 14—Granting leave to the corporation of the town of Parkhill, Ont., to lay pipe upon and across the lands underneath the track of the G.T.R. at Parkhill, Ont.

7235—June 14—Authorizing the G.T.R. Co. to reconstruct three overhead bridges between Darlington and Dunbar at mileages 303.74, 313.02 and 300.10 on the Eastern Division of its line.

7236—June 14—Authorizing the C.P.R. Co. to operate seven bridges on the Laggan section of its line of railway.

7237—June 14—Authorizing the town of St. Pierre, Que., to lay sewers under the tracks of the G.T.R. Co. and the Montreal Park and Island Railway.

7238—June 14—Granting leave to the Lobo Telephone Co. to erect, place, and maintain its wires across the track of the C.P.R., half mile west of Melrose Station, Ont.

7239—June 14—Granting leave to the B.T. Co. to erect, place, and maintain its underground wires under the tracks of the M.C.R. at Metcalfe Street, St. Thomas, Ont.

7240—June 14—Granting leave to the Walkerton and Lucknow Railway Co. to cross with its track the track of the Narrow Gauge Railway of the Hanover Portland Cement Co. at mileage 29.1, Lot 29, Con. 2, north of the Durham Road, Township of Brant, County of Bruce, Ont.

7241—June 15—Authorizing the C.P.R. to reconstruct bridge No. 66.5 on its Woodstock section, and bridges Nos. 27.34 and 27.71 on its Lake Superior Division.

7242—June 14—Authorizing the C.P.R. to construct bridge No. 53.1 on its Smith's Falls section, Eastern Division.

7243—June 15—Authorizing the C.P.R. to construct, maintain and operate spurs for the Knechtel Furniture Co. at Hanover, Ont.

7244—June 15—Authorizing the G.T.R. to construct, maintain, and operate branch line near Greenwood Avenue, Toronto, Ont.

7245—June 15—Granting leave to the Bell Telephone Co. to erect, place, and maintain its wires across the track of the G.T.R. at Sandwich Street on bridge, Walkerville, Ont.

7246—June 16—Ordering the British Yukon Railway Co., the British Columbia Yukon Railway Co., the Pacific and Arctic Railway and Navigation Co., and the White Pass and Yukon Railway to file within thirty days of the date of this Order tariffs of the companies' tolls covering all through traffic received at Skagway and destined to White Horse or to any intermediate point.

7247—June 15—Approving by-law of the O. and N.Y. Railway Co. authorizing H. K. Gays, G.P. agent, Ottawa; F. J. Balch, G.F. agent, Ottawa, and Frank E. Herriman, coal traffic manager, New York City, to prepare and issue tariffs of the tolls to be charged on its line of railway.

7248—June 15—Granting leave to Jas. Gordon Dunn, of St. Etienne, Beauharnois County, Que., to erect, place, and maintain electric light wires across the G.T.R. at Howick Station, Que.

7249—June 15—Granting leave to J. P. Ernst, of New Hamburg, to erect, place, and maintain its wires across the track of the G.T.R. Co. at Snider Street, about 600 feet east of Baden Station, Ont.

7250—June 15—Granting leave to the Canadian Machine Telephone Co. to erect, place, and maintain its wires across the track of the G.T.R. on the Brantford-Burford Road, Township of Brantford, County of Brant, Ont.

7251—June 16—Authorizing the C.P.R. to construct, maintain and operate branch line to and into the premises of the Constructing and Paving Co., North Toronto, Ont.

7252—June 14—Rescinding Order No. 6881, amending Order 6424, ordering the M.C.R.R. to protect the highways in the village of Dutton, Ont., by folding fence gates.

7253—June 14—Rescinding Order 6880, amending Order No. 6440, ordering the M.C.R.R. to protect the highways in the village of Rodney, Ont., by folding fence gates.

7254—June 15—Directing the Canada Southern Railway to construct a highway crossing over its line of railway to connect the highway laid out by the municipal corporation of the Township of Canboro, County of Haldimand, Ont.

7255—June 14—Reporting to the Governor-in-Council for sanction by-law adopted by the Q.M. and S. Railway re spitting in cars and on railway premises.

7256—June 14—Recommending to the Governor-in-Council for sanction by-law adopted at a meeting of the directors of the Napierville Junction Railway re spitting in cars and on railway premises.

7257—June 14—Rescinding Order No. 6882, amending Order No. 6423, dated February 25th, ordering the M.C.R.R. to protect with folding gates the highways in the village of West Lorne, Ont.

7258—June 16—Approving station grounds and location of depot of the C.P.R. at Kleinburg, Ont.

7259—June 17—Granting leave to the C.P.R. to construct its railway across the road allowance between Cons. 12 and 13, Lot 20, and to divert said road between Lots 20 and 21 in Con. 13, Township of Medonte, County Simcoe, Ont.

(Continued on Page 825.)

LEGAL NOTES.

J. E. Parsons, B. A., Barrister-at-Law.

[This department will appear in the third issue of every month. Should there be any particular case you wish reported we would be pleased to give it special attention, providing it is a case that will be of special interest to engineers or contractors.—Ed.]

PATENT FOR INVENTION.

Canada Patent Act (R.S.C., 1906, Chap. 69), provides that any person who has invented any new and useful art, machine or manufacture, or any new and useful improvement in the same which was not known or used by any other person before, may obtain a patent granting to such persons an exclsuive property in such invention.

Herbert L. Hildreth vs. the McCormick Manufacturing Co.—The plaintiff had obtained a patent for a certain candy-pulling machine, and brought action for infringement of his patent and to restrain the defendants from continuing the use of same. Various defences were set up, but the principal one was that the plaintiff's invention was not new, and that the public had been using the improvements before the patent was issued.

It appeared at trial that the plaintiff was a candy-maker, and had been in the business for some twenty-five years. As early as 1894 he had engaged machinists to get up such machines, and it appears by 1897 he had spent as much as $12,000 upon machines, which in the end turned out useless. He continued, however, to make efforts, and in February, 1900, he purchased a machine made in the United States, but which he returned in a few months later to the makers, reporting that he had tried it and given it up for a failure. Strange to say, during these months he received inspiration sufficient to enable him to complete his own, and on the 12th of August, 1902, he made application at Ottawa for the patent, which he later obtained. The defendants contended that his sudden and unexpected success, following as it did years of unsuccessful efforts, was not, in fact, the result of his own work, and that the plaintiff's machine was never worth much, if anything. The defendants pointed out a pretty obvious resemblance between the two machines, and the court, after considering the evidence and the circumstances above referred to, concluded that the plaintiff had never, in fact, invented the machine he claimed, and was, therefore, not entitled to the relief he asked. The plaintiff described his alleged invention as a "pendulum" machine, but it appeared that in his factory he continued the use of hand labor up to the time of receiving the machine made by the defendants. This later was a "rotary" machine, and after it was purchased and installed both the "pendulum" machine and hand labor disappeared together.

The plaintiff's case failed, and his patent (No. 79392) was declared void for want of invention, having been anticipated by earlier inventions in the United States. 41 S.C.R., 246.

The term limited for the duration of every patent used in Canada is eighteen years. It is, however, optional for the patentee to secure a term of only six years or twelve years; in the latter cases he can extend his time at expiration of such shorter period, but not exceeding in the whole eighteen years.

EXPROPRIATION BY RAILWAY—DAMAGES TO PERSONS INTERESTED.

Can Pac. Ry. Co. vs. Alexander Brown Milling and Elevator Co.—The Railway Act (R.S.C., 1906, Chap. 37), gives railways the right to expropriate lands, but in cases of exercising such right "The company.....shall make full compensation.....to all parties interested for all damages by them sustained by reason of such expropriation."

On October 1st, 1881, the city of Toronto leased to a certain company for twenty-one years a property lying on the Esplanade in Toronto, the lease to be renewable at the expiration of that term, but the city reserved the right to refuse a renewal, in which case they were to pay the company for its improvements.

The term expired on September 30th, 1902, at which date the defendant company was in possession of the lands. The city did not grant the milling company a renewal, but allowed them to stay in possession without any lease. Such was the state of facts when the railway commenced expropriation proceedings.

The C.P.R. proffered the defendants $1,000, which was refused, whereupon arbitration was commenced to ascertain what compensation, if any, the defendants were entitled to receive. It was argued that the mere possession by the defendants made them "interested" persons within the meaning of the Railway Act, and that they had at the time of expropriation a reasonable expectation of securing a new lease; and contended, on the other hand, that no such lease was ever given, nor was there any certainty of obtaining same; and further, that the defendants, being liable to ejectment by the city at any time, had no interest other than such as the railway might acquire without consulting the defendants, and even in spite of them.

The Ontario Court of Appeal has recently given judgment to the effect that the defendants were merely "tenants at will," and that this is not sufficient to entitle them to damages, as persons "interested" means persons having some definite interest in the land itself; the defendants had no estate or interest in the land itself—nothing, in fact, but mere possession—and have no right to share in the compensation provided for by the statute. Judgment for the plaintiffs. 18 O.L.R., 85.

DANGEROUS CROSSING—COST OF PROTECTING.

County of Carleton vs. City of Ottawa et al.—There was in the city of Ottawa a level crossing over four railway tracks on Wellington Street, and only a few feet from the city limits. When the city took objection to this crossing first and attempted to have it improved the adjoining county of Carleton joined with the city in applying to the Board of Railway Commissioners in applying for an order for the construction of a viaduct or overhead roadway. Subsequently the village of Hintonburgh in which the proposed viaduct would be situated, was incorporated with the city of Ottawa, and the works, which had been a few feet from the county boundary, were then distant from it nearly a mile. The county, therefore, withdrew from the joint application, and it was proceeded with by the city alone. The Board, however, held that the county was still a "party interested," and in granting the application ordered the county to pay part of the cost. Against this order the county appealed.

The Supreme Court points out that it is not merely a question of where the works are situated. The work might be situated within the limits of the county and still very few county residents use the bridge, or, on the other hand, it might be beyond the county boundary and a great many county people use it, as seems to be the case with the bridge in question. The real question is as to whether the bridge is a work for the "protection, safety and convenience of the public," and if so, the Board could order the construction

of the viaduct, or whatever else appeared best adapted to remove or diminish the danger. The Supreme Court upholds the order of the Railway Commissioners, and the county must bear part of the cost, notwithstanding the viaduct is no longer close to its boundaries. 41 S.C.R., 552.

RAILWAYS—CATTLE AT LARGE.

Sexton vs. C.T.R.—According to the Railway Act (R.S.C., 1906, Chap. 37), no cattle shall be permitted to be at large upon any highway within half a mile of any level railway crossing unless in charge of some competent person. Further, "If any cattle are at large contrary.....to this section and are killed.....by any train at such crossing.....the owner shall not have **any** right of action in respect of the same being killed."

The plaintiff was a farmer in the township of Scarborough, Ont., and on July 25th, 1908, sent his son, a boy ten years of age, to drive some fourteen head of cattle along the roadway and across the railway to a field lying further south. The morning train struck the cattle, killing four, and the farmer brought action for damages.

The company urged that he could have no right of action, because the cattle were not in charge of any competent person as required by the Railway Act. The jury found that the boy was a "competent person" to drive cattle, and, therefore, the plaintiff was not estopped from bringing this action. They found furthermore that the defendants were guilty of negligence in not blowing the whistle, and expressed the opinion that thetrain could have been stopped in time to avoid the accident. Judgment for the plaintiff. 18 O.L.R., 202.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from Page 833.)

7260—June 17—Authorizing the C.P.R. to construct, maintain, and operate branch line near Toronto Street in the city of Regina, Sask.

7261—May 31—Ordering that all railway companies weigh all coal carried by them received from foreign countries at the port of entry; also empty cars on demand of consignee at destination.

7262—June 16—Approving location and detail plan of the C.P.R. Co.'s standard No. 8 station at Espanola, District of Algoma, Ont.

7263—June 11—Authorizing the C.P.R. to construct, maintain, and operate branch line and seven sub-spurs in the city of Moose Jaw, Sask.

7264—June 16—Granting leave to the Bell Telephone Co. to erect, place, and maintain its wires across the track of the C.P.R. at public crossing 100 yards west of Dumfries, Ont.

7265—June 16—Granting leave to the Bell Telephone Co. to erect, place, and maintain its wires across the track of the G.T.R. at King Street, Berlin, Ont.

7266 and 7267—June 16—Granting leave to the Farmers' Telephone Co. to erect, place, and maintain its wires across the track of the C.P.R. at eastern side of highway, parish of Brighton, N.B., and at Deep Creek Crossing, so called, parish of Brighton, N.B.

7268—June 16—Granting leave to the Township Municipality of Laird, Ont., to erect, place, and maintain its wires across the track of the C.P.R., Algoma branch township line, between Townships of Laird and McDonald, Ont.

7269 and 7270—June 16—Granting leave to the Farmers' Telephone Co. to erect, place, and maintain its wires across the track of the C.P.R. at Pembroke Crossing, parish of Northampton, County of Carleton, N.B., and at King Street Crossing in the town of Woodstock, N.B.

7271 and 7272—June 16—Granting leave to the Township of the Municipality of Laird, Ont., to erect, place, and maintain its wires across the track of the C.P.R., Sections 18 and 19, Township of McDonald, District of Algoma, Ont., and at Sections 20 and 29, Township of McDonald, District of Algoma, Ont.

7273—June 16—Granting leave to the Norfolk County Telephone Co. to erect, place, and maintain its wires across the track of the M.C.R.R. at the highway crossing east of the village of Waterford, Ont.

7274 and 7275—June 16—Granting leave to the Farmers' Telephone Co. to erect, place, and maintain its wires across the track of the C.P.R. at the north side of the Geo. Sharpe Farm Crossing, near Newburg Junction, N.B., and at Never's Crossing, near Hartland Station, N.B.

(Continued on Page 834.)

DETERMINING THE VALUE OF AN UNDEVELOPED WATER POWER.

Charles T. Main,
Mill Engineer and Architect, of Boston, Mass.

The value of an undeveloped water power depends:—

First—Upon its location, the amount and uniformity of flow, head, conditions affecting the cost of construction and transmission, use of exhaust steam and need of water for other purposes than power.

Second—Upon what the power is to be used for, whether for electric lighting and railway work, through most of the hours in the day with a variable load, for some use requiring a fairly steady load for twenty-four hours a day, or for running a textile mill or similar plant with a fairly steady load for about ten hours a day.

Third—Upon the market which can be served, whether it is secure and steady, or must be built up and is somewhat unreliable.

The value of a privilege should be determined by comparison with the cost of producing power in such quantities and with such regularity as is required for the particular purpose for which it is to be used in a fairly economical manner at any place or places equally convenient for the transaction of the business under consideration. Sometimes the location is fixed, but oftentimes there can be a choice of locations.

In estimating the value of an undeveloped privilege the steps followed are as follows:—

1. Determining the flow, including the effect of storage and pondage.
2. Determine the net head.
3. Determine the horse-power which can be economically developed and used each month in an average year.
4. Determine the minimum flow and power, and from this the size of supplementary steam plant required if the power is to be developed above the minimum flow.
5. Determine the shortage of water power during such months as there is a deficiency.
6. Estimate the probable cost of development of the water power.
7. Estimate the probable cost of the supplementary plant, using steam, gas, oil, or anything which is best for the location under consideration.
8. Estimate the yearly cost of running the water power and supplementary plants, including the fixed charges on both, to produce a combined power suitable for the purpose for which the power is to be used.
9. Estimate the cost of a steam or other kind of plant necessary to produce the power required.
10. Estimate the yearly cost of running this plant, including fixed charges, to produce the power required.
11. Subtract the cost of producing the power by water power and the supplementary plant from the cost of producing it by steam power, or some other method, alone. The difference, if positive, gives the apparent yearly saving by the use of water power. The apparent saving should be modified if necessary for location or any other thing affecting the value.
12. Capitalize this difference at a rate which seems proper, and the result is the value of the privilege.

RETAINING WALLS AND ABUTMENTS.*

The committee collected information bearing on the practice of railroad companies in retaining-wall design from several companies. Diagrams giving dimensions of a number of representative retaining walls are included in the report, together with some description and comment. The answers to the letter of inquiry showed that the practice of using arbitrary ratios of width of base to height of walls is general. These ratios are very variable and generally no attempt is made to calculate the earth pressure back of the wall in order to determine the direction and position of the resultant pressure on the foundation. The term, "width of base," is used by some to designate the extreme width of the lowest footing of the wall and by others the "neat work" above the footing, a difference in usage which has been the cause of much confusion.

The use of a fixed ratio of width to height, which seems to be common practice, leads to a neglect of the study of the distribution of the pressure on the foundation. This is a question of great importance, since it is well established that movements from the original alinment, due to unequal settlement, form a defect more common than any other. The introduction of reinforced concrete retaining walls adds another reason for requiring an analysis of the forces and pressures. The committee calls attention to the importance of making a study of each case, and particularly of the amount and distribution of the pressure on the bed or foundation.

Notwithstanding the importance of an analytical treatment, the committee deems it proper to add a word of caution on the acceptance of existing formulae, with the constants usually quoted, without further investigation. There is a feeling in some quarters that the direction and amount of the resultant pressures and the distribution of the pressure over the bed are not well represented by some of these formulae. If these doubts have a sound basis, some of the present tendencies in retaining-wall design are open to criticism. The committee hopes to present a fuller discussion in a later report and possibly to obtain information on the pressures developed.

The committee submitted the following method, which is widely published and frequently used for determining the pressures on the back and on the foundation of retaining wells. It is based on the well-known Rankine formulae, which consider that the earth is a granular mass with some assumed or determined angle of repose. In applying this method it is immaterial whether the force representing the earth pressure is considered as acting directly on the back of the wall or if it is considered as acting upon a vertical plane passing through the extreme back of the footing. In the latter case the force representing the lateral earth pressure must be combined with (1) the vertical force representing the weight of the earth prism between the back of the wall and the vertical plane considered, and (2) combined with the vertical force representing the weight of the wall itself.

If the angle of repose of the earth is assumed as 1½ to 1, the force per linear foot of wall, representing the resultant of the earth pressure back of the wall acting on the vertical plane referred to, will be as shown on the diagram, Fig. 1 for the case of the top of the fill level with the top of the wall; and diagram Fig. 2 for the case of the fill sloping up from the top of the wall at an angle of 1½ to 1 indefinitely. In all cases y = the weight of a cubic foot of earth, H being taken in feet.

If in addition to the weight of earth, the wall is to support a track load, then the earth pressure by this same method will be that indicated by the diagram Fig. 3.

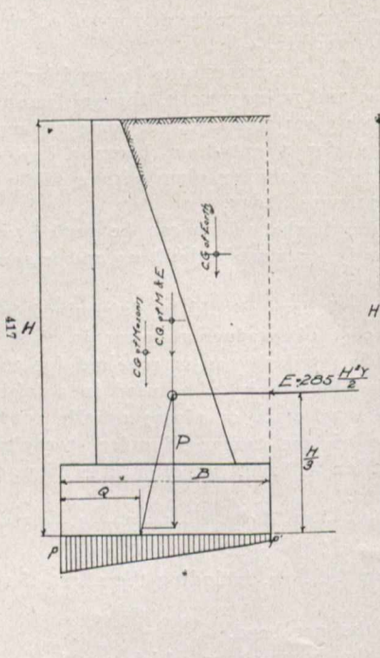


Fig. 1

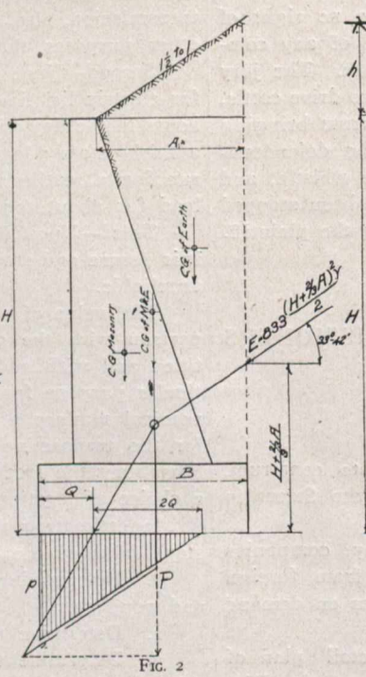


Fig. 2

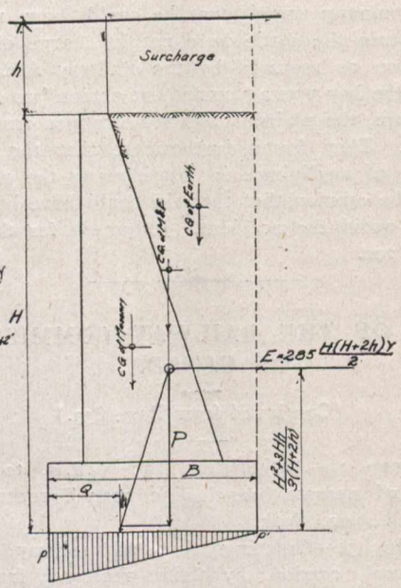


Fig. 3.

In all cases the pressure on the foundation by this method will be determined by the following formulae:—

$$\text{When Q is equal to or greater than } \frac{B}{3}.$$

$$\text{Pressure at the toe} = (4B-6Q)\frac{P}{B^2}.$$

$$\text{Pressure at the heel} = (6Q-2B)\frac{P}{B^2}.$$

$$\text{When Q is less than } \frac{B}{3}.$$

$$\text{Pressure at the toe} = \frac{2P}{3Q}.$$

Where P = the vertical component of the resultant pressure on the base.

B = the full width of the base in feet.

Q = the distance from the toe to where the force P cuts the base.

The above method seems to be as rational as any that the committee can present at this time. The constants given

(Continued on Page 833.)

*Abbreviated from the report of the Committee on Masonry of the American Railway Engineering and Maintenance of Way Association.

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Index to Volume 16

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The volume of editorial matter has increased to such an extent that it has been found necessary to issue indexes every six months. Henceforth a new index will appear in June and December.

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INDEX TO VOLUME XVI.

January to June 1909.

Note.—This index is subdivided into **Authors, Personal** (including obituaries, portraits, autobiographies, etc.), **Societies, Legal Notes, Cost Articles,** and **General** (including editorials and technical articles).

* Indicates illustrated articles.

AUTHORS.

PERSONAL.

LEGAL.

SOCIETIES.

COSTS.

GENERAL.

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ENGINEERS' CLUB OF TORONTO.—96 King Street West. Prtsident, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION.—Homer R. Linn, President; Walter A. Sittig, Secretary, 61 Ward Street, Chicago, Ill.

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

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

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

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, Louis Bolton; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. Andrew Allen, President; J. H. Warder, Secretary.

COMING MEETINGS.

Nova Scotia Society of Engineers: September 9 and 10. Third annual meeting at New Glasgow, N.S. S. Fenn, Halifax, N.S., secretary.

American Society of Civil Engineers.—Annual convention, Mount, Washington Hotel, Bretton Woods, N.H., July 6 to 9. Secretary, Chas. W. Hunt, 220 West 57th Street, New York.

American Railway Bridge and Building Association.—October 19-21. Nineteenth annual convention at Jacksonville, Florida. Secretary, S. F. Patterson, Boston & Maine Railway, Concord, N.H.

National Irrigation Congress.—Seventeenth meeting, August 9-14, at Spokane, Washington; Arthur Hooker, Secretary, Board of Control, Spokane, Wash.

American Institute of Electrical Engineers.—June 28th. Annual convention, at Frontenac, N.Y. Ralph W. Pope, Secretary, 33 West 39th Street, New York City.

American Society for Testing Materials:—June 29th, July 3rd. Annual meeting at Atlantic City, N.J. Edgar Marburg, Secretary, University of Pennsylvania, Philadelphia, Pa.

League of American Municipalities.—August 25-27. Thirteenth annual convention at Montreal, Que. John MacVicar, Secretary, Des Moines, Iowa.

American Society of Municipal Improvements.—November 9-11. Annual convention at Little Rock, Ark., U.S.A. A. Prescott Folwell, Secretary, 241 W. 39th St., New York City.

(Continued from Page 826.)

apply only to earth that will stand on a 1½ to 1 slope, and it must be borne in mind that the pressure on the foundation should never exceed the safe bearing pressure on the material considered.

Means should always be provided for draining the earth back of a wall, otherwise the wall will be subjected to hydrostatic pressure, which will greatly increase the lateral thrust.

The foundation for a wall should always be placed below frost. Usually a wall designed to resist overturning will be secure against sliding on its foundation, but this feature should receive careful attention. The frictional resistance on the base, combined with the abutting resistance of the earth in front of the wall, must be greater than the horizontal thrust of the earth back of the wall, in order to prevent sliding of the wall on its foundation.

SYSTEMATIC PATCHING OF MACADAMIZED ROADS WITH A SPECIALLY DESIGNED STEAM ROLLER AND WATER TANK.*

By J. S. Pickering,† M. Inst. C.E.

While so much attention is at the present time being devoted to new methods of road surfacing in order to meet modern requirements, it is remarkable that little or no consideration is given to the simple but important operation of repair and maintenance by systematic patching. The practice now prevailing, both in towns and country districts, is to allow the roads to get into a general state of disrepair, and then to resurface them, or, where patching is attempted, the depressions are, as a rule, filled in with loose stone, which is left to be ground to dust or to be scattered by the fast-moving traffic, a system—or, rather, want of system—which cannot be too strongly condemned. However carefully a macadamized road is made, depressions will appear in the surface long before the road actually requires recoating, and if these defects are neglected the life of the road must necessarily be shortened. If a newly-macadamized road is kept under observation during wet weather it will be seen that inequalities of the surface, which at first appear to be small and unimportant, gradually develop with the action of the traffic and the rain water, until depressions occur which allow the water to be retained and the structure of the road to be weakened. Instead of allowing these depressions to remain and to become worse year after year, they should be systematically repaired as they appear.

When the roads are dry and hard the depressions should be neatly cut out and filled in with suitable patching metal, the smaller material removed being applied with any additional material necessary for binding purposes. After periods of rainfall the surface may not require to be loosened, and in this case the depressions should be filled with metal of a suitable gauge and covered with new binding material. Rolling and watering should then be proceeded with until the surface is uniform with the adjoining portion of the road. A patch applied in this manner may not require a shovelful of metal, but it necessitates the application of water and the use of a steam roller. In practice it is found inconvenient and costly to use an ordinary steam roller and a water cart for patching purposes, the result being that the work is seldom systematically carried out.

The author has overcome these difficulties by the use of a specially-designed steam roller and water tank combined.

The length of the roller over all is 12 ft. and the width 5 ft. The rolling wheel, which is placed at the rear, and on which the bulk of the load is concentrated, is 3 ft. 6 in wide and 3 ft. 6 in. in diameter. A water tank of 200 gallons capacity is placed over the rolling wheel, the water being distributed behind through a perforated pipe 3 ft. wide. The distributor is divided at the centre so that a spread of either 18 in. or 3 ft. may be given. The top of the water tank is formed into an iron box in which cast-iron blocks are placed to enable the weight on the rolling wheel to be adjusted to the work it is required to do. The following are the weights of the machine under different conditions:—

	Tons.	Cwt.	Qrs.
Weight on rolling wheel without added weights and with water tank empty...	4	7	1
Weight on rolling wheel with tank full of water but without added weights...	5	6	1
Weight on rolling wheel with water tank empty	5	18	3
Weight on rolling wheel with tank full of water and added weights.....	6	17	3
Total weight of machine without added weights and with water tank empty...	6	19	2
Total weight of machine with added weights and tank full of water.....	9	10	0

This roller has now been in daily use for the past nine months, and is found in every way satisfactory. It does its work quicker and better than an ordinary steam roller, and its cost has already been more than saved in economy over the old system of carrying out repairs. The staff engaged in patching consists of the roller driven and two men. The metal used for patching is drawn by the roller in a dobbin cart, which holds about two tons. The roller travels at the rate of six miles an hour, and when rolling the speed is reduced to about two miles per hour. The water tank is filled from the fire hydrants, or when working outside the water-main area the supply is taken from the nearest watercourse, a steam water-lifter, with suction hose, being provided for this purpose.

The process of patching is a very simple operation, and, as the same men are employed for the work, they become so expert that it would be impossible a day or two after the patching is carried out to detect the position of the depressions in the road which had been made good. In order to show the sensitive and easy reversing action of the engine, it may be mentioned that the roller can be made to pass over a patch 18 in. long no less than thirty times in a minute. It is surprising to find what a small quantity of water is required when it is properly applied. The two taps governing the supply to the spreader at the rear are under the control of the attendant and not of the roller driver, so that the supply to the area being rolled can be regulated without waste.

When not required for road repairs the engine may be used as a tractor or for street watering purposes, a tipping body to carry four tons and a water tank to hold 1,000 gallons being made interchangeable. Springs are fitted on the main axle for use when hauling or street watering. A suitable chocking arrangement is provided to make the springs inoperative when rolling. This, however, has not been found necessary in practice, and the springs have a decided advantage in rendering the machine much less noisy in use than an ordinary roller.

The machine is most suitable for rolling tar-macadam roads, and it has been found specially serviceable in backing up street crossings and in maintaining at a proper level the narrow strip of carriageway which is always a source of trouble where it adjoins a tramway margin. It has also been used with success in finishing off a newly resurfaced road after the heavier rollers have partially consolidated the material, the advantage being that a true and compact surface is obtained without crushing the road metal. The roller could be made still more useful if it had attached to it a single-tined scarifier. The author believes that if suitable patching rollers were employed by county authorities there would be considerable improvement in the condition of the

* Paper read at the recent Road Conference convened by the County Councils Association of Great Britain at the Institution of Civil Engineers, April 30th to May 2nd, 1909.

† Borough Engineer, Cheltenham, England

roads throughout the country, and the cost of maintenance would be appreciably reduced. The number of rollers usually provided by county authorities does not permit of the patching work being carried out systematically, and even if the rollers could be spared for this purpose from their usual work of resurfacing, they would be found too cumbersome and unweildy to properly perform the work, and the use of horse-drawn water carts would be found too costly and impracticable. There can be no doubt about the economy of mending roads under the system advocated, to say nothing of the convenience to vehicular traffic. The author believes that the proverbial "stitch in time" is as true in its application to the repair of roads as in any other connection, but, simple and elementary as the process of patching macadamized roads may appear, the fact that, although its importance is generally recognized, it is seldom carried out in a systematic and scientific manner is a sufficient reason for bringing the matter before the conference.

It should, perhaps, be mentioned that the roller described is not protected in any way by patents.

MULTIPLE STARTERS FOR LARGE DIRECT-CURRENT MOTORS.

Starting devices are required for all direct-current motors, except in the smallest sizes, in order to limit the current which would flow through the motor when first connected to the circuit. With small motors, face-plate rheostats are used extensively, and give a high degree of satisfaction, but for large motors it is impractical to build a satisfactory face-plate rheostat which will be free from sparking under the large current handled. Furthermore, large motors are capable of producing far more damage when handled by a careless operator than small motors are, and it is, therefore, particularly advisable to have starting devices which are proof against careless and ignorant operators.

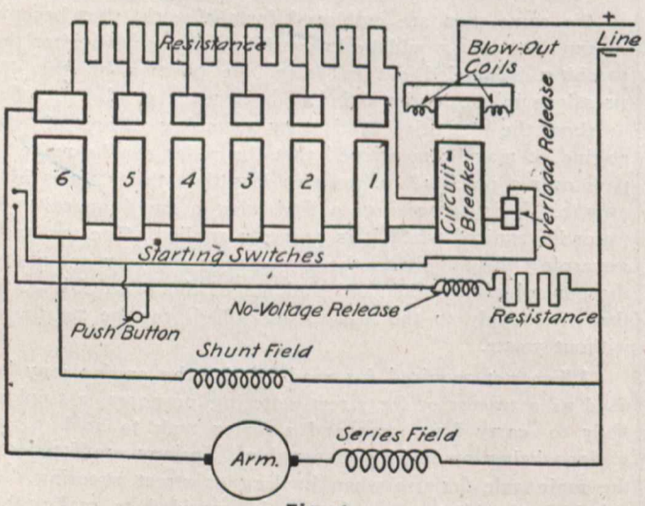


Fig. 1.

For such reasons as suggested above the Westinghouse Electric and Manufacturing Co. has constructed a line of multiple switch starters for motors from 50 to 600 horsepower, which are made up of a number of single-pole, butt-joint switches, mounted on a slate panel, with a separate resistance. The general appearance of a double-pole starter for low voltage circuits is given in Fig. 1. The motor is started by closing the switches, one at a time, in regular consecutive order from right to left. In the double-pole type as shown in Fig. 1, the closing of the first switch connects one side of the motor circuit to the line; closing the second establishes the shunt field circuit and the armature circuit, the latter through the entire field starting resistance. Each succeeding switch short-circuits a section of resistance; the last one also provides a permanent circuit for no voltage and overload release coils.

It is impossible to close the switches except in the proper order, as they are interlocking. The switch on the extreme right, facing the board, must be closed first, and each switch when closed permits the closing of only the one next on the left, and is itself locked until the first switch is opened. Thus the motor cannot be started and thrown across the line in a shorter time than is required to close all of the switches, one by one. To limit the current to full-load value one minute should be allowed for starting; if started in half this time the current will be 50 per cent. greater.

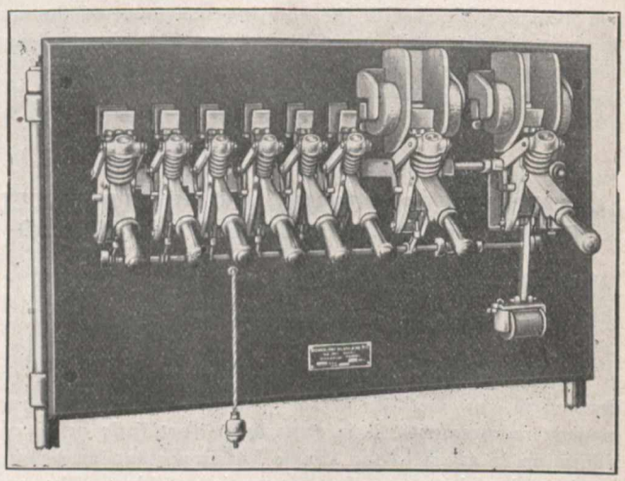


Fig. 2.

As an additional protection in starting, the low-voltage release device which operates the first switch is not connected permanently to the line until the last switch is closed, and the first switch will remain closed only while the no-voltage release magnet is excited. If current is cut off from this coil for any reason the switch will open and release all the others. Therefore, in order to be able to keep the switches closed while starting, an auxiliary circuit for the no-voltage release magnet is closed by pressing a push-button until the entire starting resistance is short-circuited. This insures against an operator inadvertently leaving part of the switches open.

On the double-pole starters the first two switches are single-pole circuit-breakers, but on the single-pole starters the first switch only is a circuit-breaker. Powerful blow-out coils are provided on these breakers to prevent injurious arcing when the circuit is opened.

The overload release opens the circuit of the low-voltage release magnet, and, since this magnet must be excited while starting as well as while running, the motor is protected from overloads at all times.

Fig. 2 shows a diagram of connections for a single-pole starter with six sections of resistance.

RAILROAD ORDERS.

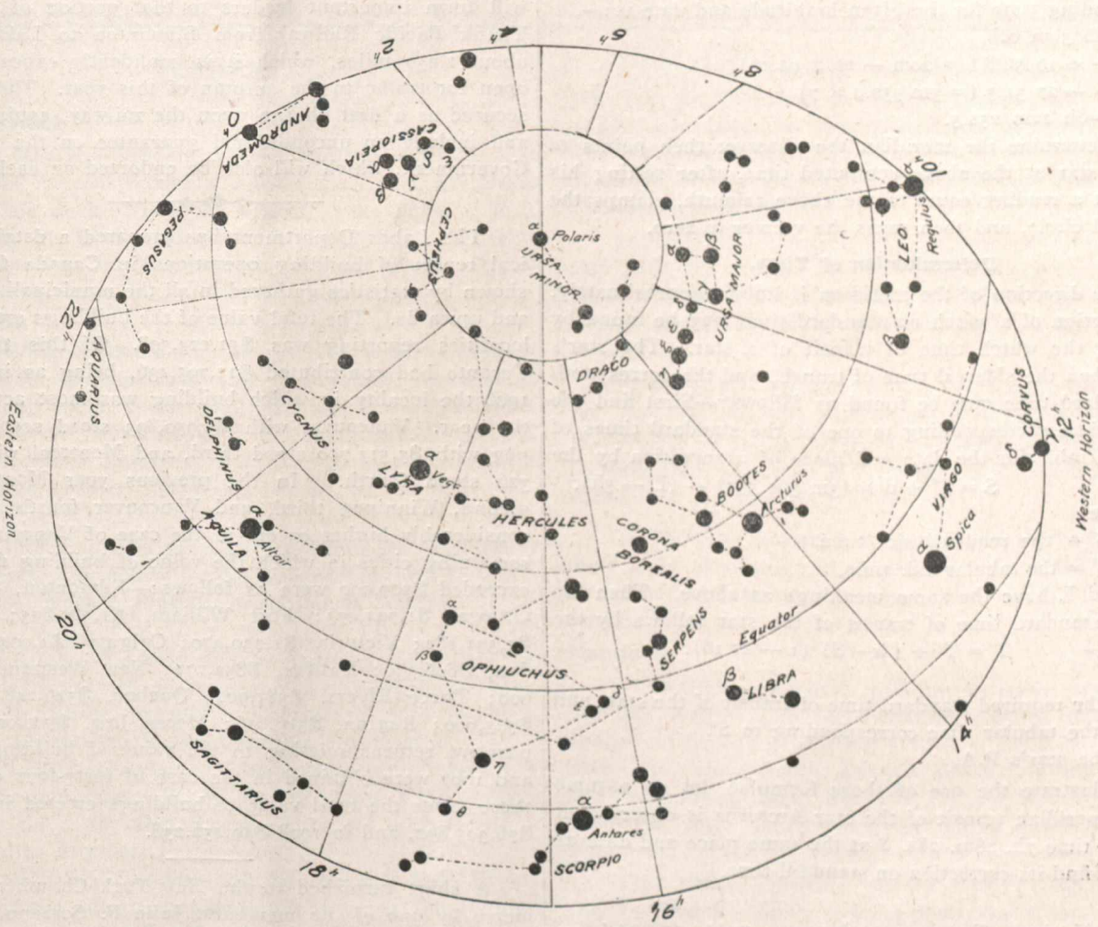
(Continued from Page 825.)

7276—June 16—Authorizing the Welland County Lime Works to lay and maintain a ¾-inch gas pipe under the G.T.R. where the same crosses the highway between Lots 27 and 28, Con. 1, Township of Wainfleet, County of Welland, Ont.

7277—June 16—Ordering the G.N.R. Co. (operating the V.W. and Y.R.) shall forthwith file and make public rates on lumber, shingles, and articles taking the same rates in the special tariffs of the C.P.R., via New Westminster or Vancouver, B.C.

7278—June 8—Dismissing application of the municipal corporation of the village of Coteau, Que., for Order directing the G.T.R. Co. to open Omaha Street and Rue de l'Eglise in the village of Coteau, Que.

ASTRONOMICAL PAGE



Star Map for July 1st, 1909, 10 p.m.

STAR MAP, SHOWING THE PRINCIPAL STARS, VISIBLE AT 10 P.M., JULY 1st, IN LATITUDE 45° N.

L. B. Stewart, D.T.S.

The table below gives the apparent places of the brightest of these stars for July 15th at transit across the meridian of 5h W. of Greenwich.

Star	Mag.	R. A. h. m. s.	Decl. ° ′ ″
β Cassiop.	2.4	0 04 20.4	+ 58 38 42
α Cassiop.	2.5	0 35 21.3	+ 56 02 08
γ Cassiop.	2.3	0 51 13.5	+ 60 13 16
α Ursæ Min. (Polaris)	2.1	1 26 28.5	+ 88 49 00
β Ursæ Maj.	2.4	10 56 21.0	+ 56 52 25
α Ursæ Maj.	2.0	10 58 06.7	+ 62 14 45
β Leonis	2.2	11 44 25.3	+ 15 04 54
γ Ursæ Maj.	2.5	11 49 03.0	+ 54 12 16
δ Ursæ Maj.	3.4	12 10 55.8	+ 57 32 31
ε Ursæ Maj.	1.8	12 50 02.2	+ 56 27 27
ζ Ursæ Maj.	2.1	13 20 16.6	+ 55 24 15
α Virginis (Spica)	1.2	13 20 24.4	− 10 41 17
η Ursæ Maj.	1.9	13 43 58.3	+ 49 46 14
α Bootis (Arcturus)	0.3	14 11 31.5	+ 19 38 25
α Librœ	2.9	14 45 51 7	− 15 39 57
β Librœ	2.8	15 12 07.8	− 9 02 56
α Ophiuchi	2.1	17 30 44.4	+ 12 37 35
α Lyræ (Vega)	0.1	18 33 53.6	+ 38 41 59
α Aquilœ (Altair)	0.9	19 46 22.6	+ 8 37 42

Determination of Azimuth by the Pole Star.

The following table gives the azimuth of Polaris on July 1st, 1909, for places in longitude 5th (= 75°) W., and at certain standard times T:

T	Sid. Time	Lat. = 44°		Lat. = 48°		Lat. = 52°	
P.M. h. m.	h. m. s.	A ° ′ ″	a ″	A ° ′ ″	a ″	A ° ′ ″	a ″
8 00	14 37 43.5	0 29 38	+25	0 31 46	+26	0 34 25	+29
8 30	15 07 48.4	41 29	+23	44 29	+25	48 12	+27
9 00	15 37 53.4	52 40	+22	56 29	+23	1 01 12	+25
9 30	16 07 58.3	1 02 59	+20	1 07 34	+21	13 14	+23
10 00	16 38 03.2	12 16	+17	17 32	+19	24 04	+20
10 30	17 08 08.2	20 21	+15	26 14	+16	33 32	+17
11 00	17 38 13.1	27 06	+12	33 31	+13	41 28	+14
11 30	18 08 18.0	32 24	+ 9	39 14	+ 9	47 43	+10
12 00	18 38 22 9	36 08	+ 5	43 17	+ 6	52 10	+ 6

In this table azimuths are reckoned from the N. in the direction E.S.W. The quantity a is the error in the azimuth resulting from an error of 1m. in the time. It will serve to show the best time to observe if the watch correction is not well determined. The azimuth for any other latitude may readily be found by interpolation.

The standard time corresponding to any azimuth given in the table for a place whose longtitude differs from 5h, and for some other date, may be found by the formula:—

$$T' = T + (L - 5h)\ (1 - 0s.16) - d \times (3m\ 55s.9).$$

Where

T' = the required time.

T = the time for July 1st.

L = the longitude.

d = number of days elapsed since July 1st.

CUT OUT FOR REFERENCE.

The difference L—5h must be algebraic, and in multiplying by os.16 it must be expressed in minutes of time.

To illustrate this, take the following example:—At a place in latitude 49° 20′ N., longitude 80° (= 5h 20m) W, an observer wishes to take an observation for azimuth between 8 and 9 p.m. on July 8th.

Here the interpolated value of the azimuth for 8h 30m is 0° 45′ 38″, interpolating by second differences, and the corresponding time for the given longitude and date is:—

8h 30m 00s
+ 19 56.8 (= 20m — 20 × os.16)
—27 31.3 (= 3m 55s.9 × 7)
=8h 22m 25s.5.

To determine the meridian the observer then points to the pole star at the above computed time, after setting his vernier at a reading equal to the above azimuth, clamps the horizontal circle, and then turns the vernier to zero.

Determination of Time.

If the direction of the meridian is known approximately, the correction of a watch on standard time may be found by observing the watch time of transit of a star. The star's R.A. is then the sidereal time of transit, and the corresponding standard time may be found as follows:—First find the sidereal time corresponding to one of the standard times of the above table for the date and place of observation by the formula: $S = S' + d \times (3m\ 56s.555) - (L - 5h)$.

Where

S = the required sid. time.
S′ = the tabular sid. time,

and d and L have the same meanings as above. Then the required standard time of transit of the star follows by the formula:— $T = T' + (\alpha - S)\ (1 - os.16)$.

Where

T = the required standard time of transit of the star, and
T′ = the tabular time corresponding to S′.
α = the star's R.A.

To illustrate the use of these formulae, let us assume that the meridian transit of the star Arcturus is observed at the watch time 7h. 26m. 28s. 8 at the same place and date as above; to find its correction on standard time.

		h.	m.	s.
Sidereal time, 8h. oom. (table....	=	14	37	43.5
7 × (3m 56s. 555)	=		27	35.9
		10	05	19.4
Difference of longitude	=		20	00
S	=	14	45	19.4
R.A. of star	=	14	11	31.5
α—S	=	—	33	47.9
33.8 × os.16	=			5.4
Equivalent mean time interval	=	—	33	42.5
T′	=	8	00	00
T	=	7	26	17.5
Watch	=	7	26	28.8
Watch fast	=			11.2

The methods described above do not take account of changes in the star places, but with ordinary field instruments and for short periods of time these are negligible.

GRAND TRUNK PACIFIC BRANCH LINES COMPANY.

The Grand Trunk Railway Company of Canada has received subscriptions for $5,000,000 4 per cent. first mortgage bonds of the Grand Trunk Pacific Branch Lines Company. The issue price is 97 per cent.

As indicated in the title, the proceeds of the bonds are to be applied in the construction of branch lines in the Provinces of Saskatchewan and Alberta. Of the amount offered half is unconditionally guaranteed both as regards principal and interest by the Government of the Province of Saskatchewan and the other half in a similar manner by the Province of Alberta. The amount is part of a total authorized of $9,174,500, of which $2,608,000 is in connection with lines to be constructed in the Province of Saskatchewan, the balance of $6,566,500 is in respect of branches in the Province of Alberta. These branch lines will be worked under agreement by the Grand Trunk Pacific Company, and will form important feeders to that portion of the Grand Trunk Pacific Railway from Edmonton to Lake Superior, about 1,250 miles, which it is confidently expected will be open for traffic in the autumn of this year. The bonds are secured as a first charge upon the railway, equipment, etc., and include an unconditional guarantee on the part of the Government, which will also be endorsed on each bond.

The Labor Department has prepared a detailed statistical report of building operations in Canada for 1908 as shown by statistics gathered in all the municipalities of 5,000 and upwards. The total value of the buildings erected in the localities reporting was $51,223,398. Of this the City of Toronto had contributed $11,795,436, being as in 1907 and 1906 the locality in which building was most active during the year. Vancouver with $5,950,893 stood second, Winnipeg with $5,513,700 stood third, and Montreal with $5,062,326 stood fourth. In the previous year Montreal stood second, Winnipeg third, and Vancouver fourth with totals considerably higher except in the case of Vancouver. The remaining cities in which the value of building during 1908 exceeded $500,000 were as follows:—Edmonton, $2,549,847; Ottawa, $1,794,073; Fort William, $1,560,835; Hamilton, $1,331,182; Victoria, $1,230,470; Calgary, $1,004,250; London, $806,330; Halifax, $852,271; New Wesminster, $600,000; Three Rivers, $581,900; Quebec, $546,248; Welland, $525,000; Regina, $516,656; Moose Jaw, $500,000. Comparative returns relating to the value of buildings in 1908 and 1907 were obtained in the case of forty-four cities. In these cities the total value of buildings erected in 1907 was $56,305,892, and in 1908 $49,452,238.

A chart furnished to the New York Chamber of Commerce by one of its members, Julio F. Sorzano, A.S.C.E., S.I.C.F., I.C.E., etc., and published by that body, shows in an interesting way the expansion of ocean steamers in periods of ten years since 1840. In that year the "Great Western" was the marvel of the Atlantic. She was 60 metres, or less than 200 feet, in length, while the "Britannia" and "Hibernia" had by 1850 carried the record to 70 and 80 metres, respectively. Then came the "Asia," 250 feet in length, and the larger and more celebrated "Persia," Captain Judkins, which floated at the time of the great exhibition of 1851. These were all side-wheelers, and so was the giant of 1858, the "Great Eastern," though she had a screw as well. Among the first ocean single-screw steamers of the next ten years was the "Washington," 310 feet, and after her, at intervals between 1870 and 1880, the larger "Oceanic" and "Britannic," followed about 1885 by the "Umbria" of 460 feet, which was called a flyer. Ten years later came the double-screw "Campania," 540 feet, and in rapid succession since then have been seen the "Deutschland" and "Lusitania," also the "Olympic," of 860 feet. All these were screw boats.

The Dominion Iron and Steel Co.'s output for the month of May has just been compiled, and is considered a very satisfactory one. The figures are as follows:—

	Gross tons.
Pig iron produced	22,402
Steel, produced	25,050
Total shipment	19,000

The annual general meeting is to be held on the 17th, when the directors' report on the operations of the past year will be submitted. It is expected that this will show a greater volume of business than in the previous year, with somewhat less earnings, which was due to the fall in steel prices.

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.

New Brunswick

PINK ROCK.—Tenders will be received until Monday, July 5th, for the construction of a Wharf Extension and Breakwater at Pink Rock. Plans can be seen at the offices of E. T. P. Shewen, St. John, N.B., and Geoffrey Stead, Chatham, N.B. Napoleon Tessier, Secretary Public Works Department, Ottawa, Ont.

Nova Scotia.

HALIFAX.—Tenders will be received until Wednesday, June 30th, for the construction of vault lining, vestibule lining and vault doors, specie vault, Halifax, N.S., Post Office. Plans can be seen and forms of tender obtained from C. E. W. Dodwell, Resident Engineer, Halifax, and at Department of Public Works, Ottawa. Napoleon Tessier, Secretary.

Quebec.

MONTREAL.—The town of Ste. Anne de Bellevue is ready to grant a franchise for the construction of a system of waterworks. Write J. Boileau, 26 St. James, Montreal.

Ontario.

ARNPRIOR.—Tenders will be received until July 3rd for a steel bridge with concrete piers and abutments. Macallum & McAllister, engineers, Continental Life Building, Toronto. (Advertised in the Canadian Engineer.)

CHAPLEAU.—Tenders will be received until July 5th for waterworks equipment. W. H. Farrell, Town Clerk. Willis Chipman, C.E., 103 Bay Street, Toronto. (Advertised in The Canadian Engineer.)

METAPEDIA.—Tenders will be received until Friday, July 9, for the construction of approaches to the highway bridge across the Restigouche River at Metapedia, Province of Quebec. Plans can be seen at the offices of E. T. P. Shewen, Resident Engineer, St. John, N.B.; C. E. W. Dodwell, Resident Engineer, Halifax, N.S.; J. L. Michaud, Resident Engineer, Merchants Bank Building, Montreal, Que., and at the office of the Chief Engineer of the Intercolonial Railway, Moncton, N.B. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

PETERBOROUGH.—Tenders for grading, sodding, drives, concrete and stone work, and interior fittings for the drill hall will be received until June 28th. William Blackwell, architect, Peterborough. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

FORT WILLIAM.—Tenders will be received until July 5th for electric wiring and fittings in Post Office building. Address, W. T. Rankin, Fort William, or Napoleon Tessier, Secretary, Public Works Department, Ottawa, Ont.

TORONTO.—Tenders will be received until June 28th for excavation work in connection with new St. Paul's Church, Bloor Street East. E. J. Lennox, 164 Bay Street.

TORONTO.—Tenders will be received until June 30th for a reinforced concrete arch over the Humber River. Frank Barber, C.E., engineer for the municipalities. (Advertised in The Canadian Engineer).

TORONTO.—The Board of Education accepted the following tenders: Soft coal, P. Burns & Company, $5.48 a ton; hard coal, Connell & Company, $5.15 to $5.30 a ton; hardwood at $7.50 per cord and pine at $4.47 per cord to P. Burns & Company.

TORONTO.—Tenders will be received by the city of Toronto up till noon of June 30th, 1909, for laying between 350,000 and 450,000 duct feet of underground conduit. For specifications, form of tender, etc., apply Electrical Department, City Hall. (Advertised in The Canadian Engineer.)

TORONTO.—Tenders will be received up to Friday, July 2nd, for chopping, clearing, stumping, and grubbing a wagon road from the Montreal River at Smythe to Gow Ganda. The length of the road will be about 27 miles. F. Cochrane, Acting-Minister of Public Works. (Advertised in The Canadian Engineer.)

TORONTO.—Tenders will be received until Tuesday, 29th June, for asphalt, bitulithic and brick pavements, grading, curbs, concrete sidewalks, and sewers, on some forty streets. Address, Joseph Oliver (Mayor), Chairman Board of Control.

TORONTO.—Tenders will be received until Monday, 5th July, for concrete foundation work in connection with the extensions to the Ontario Government Buildings. H. F. McNaughton, secretary, Department of Public Works. (Advertised in the Canadian Engineer.)

OTTAWA.—Tenders will be received until July 15th for the supply of coal for the Public Buildings throughout the Dominion. Napoleon Tessier, Secretary, Department of Public Works.

Manitoba.

WINNIPEG.—Tenders will be received until August 2nd and August 16th for hydraulic, electric, and auxiliary equipment for the generating station at Point du Bois. For plans, etc., apply Smith, Kerry & Chase, engineers, Toronto and Winnipeg; Wm. Kennedy, jr., Y.M.C.A. Building, Montreal, and M. Peterson, secretary, Board of Control, Winnipeg.

WINNIPEG.—Tenders will be received up to Friday, July 2nd, for the supply of fence posts, cedar, tamarac or iron for approximately twenty miles of fencing. M. Peterson, Secretary Board of Control.

WINNIPEG.—Tenders will be received up to Friday, July 2nd, for the supply, free on board cars at Winnipeg of approximately twenty miles of wire fencing. M. Peterson, Secretary Board of Control.

YORKTON.—Tenders for electric light wiring and fittings for the Post Office, Land Office and Customs Building will be received until Friday, July 2nd. Mr. J. W. Christie, Yorkton; Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

Alberta.

CLARESHOLM.—Tenders will be received until June 28th for the construction of about six miles of pipe line in connection with waterworks. P. Turner Bone, engineer, 340 4th Ave. W., Calgary.

CONTRACTS AWARDED.

New Brunswick.

MONCTON.—The following figures were submitted to the City Council in connection with new plant at the electric light station:—

	Copper Wire.	Waterproof Wire.
Canadian General Electric Co....	$93.93	* $80.75
Sumner Company	*94.35	85.00

*Accepted, and orders doubled in each case.

The Packard Electric Company, of St. Catharines, were given a contract for four transformers at $221. Tenders were open-

ed for generator, engine and boiler for electric light works as follows:—

Babcock and Wilcox, Montreal—	
Water tube boiler	$2,330
Robb Engineering Company, Amherst, N.S.—	
Return tubular boiler, 125 horse-power	1,040
Robb Mumford boiler, 150 horse-power	2,100
Robb Engineering Company, Amherst, N.S.—	
Robb-Armstrong Corliss engine	5,448
Compound engine, 450 horse-power	6,522
Canada Foundry Company, Toronto—	
Return tubular boiler	1,495
Standard boiler	1,185
Water tube boiler	2,015
John McDougall Caledonian Iron Works Co., Limited, Montreal—	
165 horse-power return tubular boiler	1,190
Water tube boiler	1,817
Generator	6,000
E. Leonard & Sons, London, Ont.—	
Simple Corliss engine	3,375
Compound Corliss engine, f.o.b., cars, Moncton	5,950
Return tubular boiler	1,063
Canadian General Electric Co., Toronto—	
Generator	6,745
Engine and generator	13,110
Engine, boiler and generator	16,120
Robb engine	13,272
Cross compound engine	14,325
Canadian Westinghouse Co., Hamilton—	
Generator	7,395
I. Matheson & Co., New Glasgow, N.S.—	
Return tubular boiler, with dome	1,100
Without dome	1,050
Laurie & Lamb, Montreal—	
Compound engine and generator	10,500
Goldie & McCulloch, Galt, Ont—	
Corliss simple engine	5,289
Corliss compound engine	8,352
Boilers, return tubular	1,055
Water tube	3,218

The tenders were referred to Engineer Edington to consider in detail and report at a later meeting.

Quebec.

MONTREAL.—The Westmount Council have awarded the following contracts:—Babcock & Wilcox, 200 horse-power boiler, $4,590; Bishop Construction Company, incinerator boiler house extension, $9,313.

Ontario.

OTTAWA.—The civic coal contract was given to J. G. Butterworth at $7.15 a ton.

OTTAWA.—A contract has been awarded for the construction of an experimental plant at Ottawa to be used by the Mines Branch for ascertaining the value of peat in making producer gas. The station will cost about $13,000. The contract has been given to Doran & Devlin, of Ottawa, the lowest tenderers.

TORONTO.—Tenders were awarded recently by the Department of Public Works for a number of the bridges on the new trunk wagon road which is being built from Sudbury to Sault Ste. Marie. The successful tenderers were as follows: Bridge over Vermillion River at Whitefish, to Dickson Bridge Company, Campbellford, $15,000; bridge over the Spanish River at Nairn, steel and concrete, to Dickson Bridge Company, Campbellford, substructure to Green, Sinclair & Campbell, Toronto, $12,000; bridge over Murdoch River in Nipissing, to M. A. Piggott & Son, Hamilton, $3,500; bridge at Courchasse Bay, to William Doust, Township Cosby, $3,500; bridge over Wabigoon River at Dryden, to Morrom & Beatty, Peterborough, $6,300. The contracts call for the work to be completed by October 1st, and tenders for the remaining bridges are now being called.

ST. THOMAS.—For special steel track in connection with Ross Street subway, the following tenders were received:

Montreal Steel Works (f.o.b. Montreal)	$1,477
Nova Scotia Steel Corporation	1,485
Dawson & Company, Montreal	1,559

PETERBOROUGH.—The Water Commissioners recently awarded the contract for the new concrete dam, pumping station and pumps. The contract for building the dam was awarded to the Bishop Construction Company, of Montreal, and for the water wheels and pumps it was divided between the Wm. Hamilton Company, of Peterborough, and the John McDougall Caledonian Iron Works, of Montreal. Cost of dam, $120,000.

GUELPH.—The City Council will pay $1.85 a yard for concrete pavements and $2.40 for vitrified brick, with curb.

WEST TORONTO.—The C.P.R. have let a contract for the extension of their erecting and machine shop to Bishop & Buchanan, of Owen Sound and Peterborough, at $30,000, and for remoulding the engine house to Green, Sinclair and McDermott, Owen Sound, at $16,000.

GUELPH.—A. McConnell has been given a contract for sand and gravel, for the aerial beds, at 15c. a yard.

GUELPH.—For permanent road work, to be done this summer, the Council has let the following contracts:—Quebec Street East (Penn vitrified brick), Blight & Fielder, Chatham, $4,594.97; $2.29 per square yard. Quebec Street West (Penn vitrified brick), Blight & Fielder, $6,797.40; $2.18 per square yard. Paisley Street (macadam), Conn & Company, $2,730.15; $1.25 per square yard. Macdonnel Street East (concrete macadam), Blight & Fielder, $12,568.80. Woolwich Street (cement macadam), Conn & Company, $32,155.75; $1.84 per square yard.

Manitoba.

WINNIPEG.—Davidson Bros., contractors, Winnipeg, have received the contract for the erection of 34 stations along the N.T.R. lines. The work covers all the stations between Winnipeg and Fort William. The contract was originally awarded to J. J. Vopni, but has been sub-let by him to Davidson Bros.

WINNIPEG.—The contract for the construction of the addition to the elevator of the Ogilvie Flour Mills Company at Fort William has been let to the Barnett & McQueen Co.

WINNIPEG.—Brown & Barker have secured a contract for the new Aberdeen school, which is to cost $62,800.

WINNIPEG.—The Robert Mitchell Company, of Winnipeg, have been awarded the contract for installing the electrical fixtures in the new Grand Trunk Pacific Depot, to cost approximately thirty thousand dollars.

British Columbia.

VICTORIA.—The Hassam Pavement Company have offered to lay a 6-inch pavement on Douglas Street for $2.25 a yard.

VANCOUVER.—The tenders received by the Works Board for block-paving Westminster Avenue from the bridge to Seventh Avenue are as follows:—Palmer Bros, fir, $43,000; cedar, $32,500; Christian & Hartney, fir, $47,848; cedar, $44,787. Ironsides, Rannie & Campbell, fir, $50,204.75; cedar, $40,004.75. M. P. Cotton, fir, $45,154; cedar, $37,359. T. R. Nickson, fir, $46,300; cedar, $39,000. The board favoured the use of cedar blocks in preference to fir.

VANCOUVER.—The Coquitlam Council has awarded contracts as follows:—Gravel on Prairie Road, Pringle & Leavell, 65c .per yard; grading on Prairie Road, E. Simpson, $105; gravel on road north of C.P.R., E. Simpson, 65c. per yard; gravel on Back Ditch Road, J. R. Veale, at 85c. per yard; ditching on Cole Road, A. Jackson, $8 per chain.

Foreign.

CLEVELAND, OHIO.—The contract for placing the concrete piles in the foundations of the Denison-Harvard viaduct at Cleveland, Ohio, has been awarded to the Raymond Concrete Pile Company, of New York and Chicago. The viaduct will span a stretch of low land situated on the outskirts of Cleveland. A. M. Felgate, county bridge engi-

neer; Concrete Steel Construction Company, general contractors.

RAILWAYS—STEAM AND ELECTRIC.

New Brunswick.

ST. JOHN.—That section of the G.T.P. between Moncton and Chipman will be completed this fall.

FREDERICTON.—Wheaton Bros., Folly, N.S., have been awarded a contract for the construction of a railway from the Drummond Iron Mines in Gloucester County to Bathurst, where smelters and shipping facilities will be constructed. This road will be sixteen miles in length.

Ontario.

OTTAWA.—Several route maps for new railways in the West were approved by the Minister of Railways on June 18th. The projected line from Prince Albert to Fort Churchill, was approved from Prince Albert to the Pas, a distance of 350 miles. Other routes approved were the G.T.P. branch line from Biggar to Battleford; the C.N.R. from Prince Albert to Battleford; the G.T.P. Regina and Yorkton branches, and the C.P.R. Manitou and Moose Jaw branches.

TORONTO.—The G.T.R. recently had prepared an estimate of the cost of putting the old belt line in proper condition for operation. The figure is $60,000.

Manitoba.

WINNIPEG.—The Canadian Northern Railway line is now 15 miles from the Pas mission.

WINNIPEG.—Davidson Bros. have received the contract for the erection of 34 stations along the N.T.R. lines. The work covers all the stations between Winnipeg and Fort William. The contract was originally awarded to J. J. Vopni but has been sub-let by him to Davidson Bros.

WINNIPEG.—Grand Trunk Pacific officials announce that the following contracts for branch lines have been let: Eighteen miles of the Yorkton-Melville branch to Messrs. Rigley and Hyland, Winnipeg; thirty-five miles of the Yorkton Regina branch to Messrs. McMilan Brothers, and Kenny Limited, of Winnipeg.

WINNIPEG.—W. J. Clifford and his party, who have been making a survey in connection with the proposed railway to Hudson's Bay, have returned to Winnipeg. They were away nine months.

Saskatchewan.

REGINA.—Work on construction of the Regina-Bulyea branch will probably be started at once. Construction trains will run over a portion of the line between Regina and Craven within three months, and trestle work requiring twelve million feet of timber will be erected in the Qu'Appelle valley. Contractor Neil Bradley is at present enroute to Regina with gangs.

NORTH BATTLEFORD.—A party of 15 C.N.R. engineers arrived a few days ago to locate a line from here to Athabasca.

Alberta.

CALGARY.—To get the plant on the ground for the Canadian Pacific's irrigation development along the Bow River the contractor has to build forty miles of a temporary railroad for supplies, etc. In the progress of the work over two million cubic yards of earth will be removed from the ditches.

CHIPMAN.—The G.T.P. steel gang reached Bruce last Wednesday. They are laying two and one-half miles a day, and will be in Edmonton by July 20th, with fair weather conditions.

British Columbia.

VANCOUVER.—Proposed extensions to the B. C. Electric Railway were approved at a meeting of the Works Board, held on June 15th.

VANCOUVER.—A bridge will be erected on Ninth Ave. East by the B. C. Electric Railway.

VANCOUVER.—An electric crane capable of handling heavy machinery direct from railway cars to boats is being installed by the C.P.R. on the wharf here.

SEWERAGE AND WATERWORKS.

Quebec.

MONTREAL.—On June 23 the town of Outremont opened tenders for sewer construction.

Ontario.

ST. CATHARINES.—Plans for new sewers to cost $8,000 have been approved. D. Benzie, city engineer.

NIAGARA FALLS.—The Council are calling for tenders for supplying and laying 2,500 feet of ten-inch sewers. J. C. Gardiner, city engineer.

FORT WILLIAM.—The formal opening of the waterworks took place on June 23.

Saskatchewan.

MOOSE JAW.—Work has been commenced on the water and sewer extensions. The city will spend about $70,000 this year on extensions and connections.

The work of building the new dam at Snowdy Springs is progressing rapidly. When completed this will give the city a water supply of about 25,000,000 gallons.

British Columbia.

VANCOUVER.—The city engineer's plans calling for an expenditure of $490,000, for sewers, have been approved.

VICTORIA.—The Esquimalt Waterworks Company will soon commence the construction of a pipe line from Goldstream that will deliver fifteen million gallons a day.

VANCOUVER.—The City Council has instructed its waterworks superintendent to report on a number of water-power propositions which have been submitted to the city for sale. The best will be selected, and an engineer will be engaged to make a report.

LIGHT, HEAT, AND POWER.

Ontario.

CAMPBELLFORD.—The Seymour Power and Electric Company are installing a pair of direct connected motor-driven centrifugal pumps, built by the Smart-Turner Machine Company, Ltd., of Hamilton, Ont.

Saskatchewan.

MOOSE JAW.—W. E. Skinner, Ltd., Electrical and Mechanical Engineers, Somerset Block, Winnipeg, has been appointed Consulting Engineer for the Moose Jaw electrical plant, with the object in view of putting this plant, which heretofore has never paid, on a paying basis. Moose Jaw is the first town in the West to take this matter up and it would undoubtedly pay other cities and municipalities to look into the matter of how their plants are run, and if they are paying propositions. The results of Mr. Skinner's tests and experiments will be looked for with interest.

Foreign.

PAWTUCKET, R.I.—The Royal Weaving Company, Pawtucket, R.I., is about to build a power plant. The plans and specifications, prepared by Charles T. Main, mill engineer and architect of Boston, Mass., call for a power house 98 by 64 feet with basement, and boiler house 93 by 47 feet. The generator equipment is to consist of three 500 K.W. Allis-Chalmers turbine units. In the boiler house will be installed four 350 horse-power B. & W. boilers. The building is to be of brick with reinforced concrete roof over the boiler house. The stack will be of red brick 175 feet high with 8 foot flue.

FINANCING PUBLIC WORKS.

Nova Scotia.

STELLARTON.—This municipality invites tenders until July 5th for water debentures, $12,000.

Ontario.

BARRIE.—The by-laws for sewers ($30,000), cement walks ($10,000), and storm sewer ($3,000) were carried.

BERLIN.—A by-law to provide $60,000 for local improvements here has been recommended.

CAMPBELLFORD.—A by-law to give the Northumberland Pulp Company a fixed assessment of $2,000 for ten years on a pulp mill to be erected near Ranny Falls, to cost $10,000, carried by a majority of six.

LONDON.—The Council is considering by-laws for waterworks system (Beck scheme) $123,700, and mains $95,000.

Alberta.

CALGARY.—Calgary ratepayers have passed by-laws to provide $26,000 for a trunk sewer and catch basins, $32,000 for sub-stations and a motor chemical engine and $16,000 for grading.

MEDICINE HAT. — Sidewalk and sewer debentures amounting to $71,000 are offered for sale by this municipality.

LETHBRIDGE.—The city has sold $200,500 debentures to J. A. Reid & Company, Ltd., of Regina. $153,000 is for the power plant.

British Columbia.

NEW WESTMINSTER.—A by-law to cover the cost of an incinerator plant, estimated at $15,000 will shortly be voted on.

CEMENT—CONCRETE.

Ontario.

BERLIN.—Davis & Johnston, consulting engineers, recently prepared plans for a concrete dam and abutments and piers for a bridge to be erected in Victoria Park. Tenders closed on June 25th.

British Columbia.

KAMLOOPS.—Johnstone & Company will probably be given a contract for concrete walks and crossings to cost $4,500.

TELEPHONY.

Quebec.

MONTREAL.—Many extensions, including exchanges, rural lines and long distance lines have been decided on by the Bell Telephone Company.

Ontario.

PORT ARTHUR.—The C.P.R. has a gang of men engaged in stringing a telephone line between Fort William and White River. This is the first stretch of a long distance line from coast to coast which they are installing.

PORT ARTHUR.—An agreement to purchase the central plant of the Bell Telephone Company, for $3,500, has been ratified by the City Council.

PORT ARTHUR.—The City Council has agreed to buy the local plant of the Bell Telephone Company for $3,500, subject to ratification by the ratepayers.

Manitoba.

WINNIPEG.—The Government Telephone Commission have been calling for tenders for the erection of an exchange building at Portage la Prairie.

CURRENT NEWS.

British Columbia.

PRINCE RUPERT.—Grant Brothers, of Vancouver, have thrown up their contract for building the sewers here, and the work has been taken over by the Provincial Government. The contractors found their estimate was too low.

MISCELLANEOUS.

Alberta.

MEDICINE HAT.—The Southern Alberta Land Company decided to spend $2,000,000 on irrigation, at a recent meeting held in London, England.

British Columbia.

VICTORIA.—The high pressure plant and extensions are nearing completion. The pumps will arrive in a few weeks.

PERSONAL.

MR. BALMER NEILLY, B.A.Sc., of Cobalt, has been appointed mining engineer for the John Black Company.

MR. CHARLES F. BRISTOL, B.Sc., formerly of the I.C.R. engineering staff at Moncton, N.B., recently left for Vancouver.

MR. REDMOND D. MACDONALD, C.E., of Goderich, Ont., has returned to Canada after spending two years on railway construction work in China.

MR. GUY C. DUNN has been appointed district engineer of the G.T.P. between Winnipeg, and Edmonton. Mr. Dunn was formerly district engineer at St. John.

MR. C. P. EDWARDS, of Montreal, has been selected by the Civil Service Commissioners for the position of superintendent of Government Wireless Telegraph stations.

MR. E. B. MERRILL, B.A.Sc., Consulting Engineer, Toronto, has been called in by Hamilton to report on the various light and power schemes before the City Council.

MR. T. URQUHART FAIRLIE, B.Sc., of Kingston, formerly of the C.P.R. construction department, has received an appointment from the Hydro-Electric Power Commission, Toronto.

MR. GEORGE H. FERGUSON, B.A.Sc., Toronto, Ont., has been appointed engineer in charge of a survey party making reconnaissance surveys for storage reservoirs along the Bow River, Alberta.

MR. A. A. INGRAM, son of A. B. Ingram, of the Provincial Railway and Municipal Board, Toronto, has been appointed Michigan Central Railway solicitor, to succeed W. B. Kingsmill at St. Thomas, who returns to Toronto.

MR. W. H. REYNOLDS, who has been connected with the Canadian General Electric Co. for several years, has resigned to take charge of the sales department of the Eugene F. Phillips Electrical Works, Ltd., Montreal.

MR. K. A. MACKENZIE, B.A.Sc., editor of "Applied Science," has been appointed business manager of four Toronto University publications, namely: The University Monthly, Forestry Journal, Faculty of Education Journal, and University Studies.

MR. KARL M. WAY, E.M., formerly assistant engineer, Fuel Testing Branch, U.S. Geological Survey, engaged in mine inspection, mine sampling, and studies of coal preparation in all important coal fields of the United States, has recently been appointed assistant mining engineer upon the staff of the Fuel Engineering Department of the Arthur D. Little Laboratory of Engineering Chemistry, Boston, Mass. Mr. Way is a graduate in Mining Engineering of the Ohio State University.

MR. L. B. MERRIAM, formerly division engineer on the Grand Trunk Pacific Railway, has opened an office as Consulting Civil Engineer, 609 Builders Exchange Building, corner of Portage and Hargrave, Winnipeg. Mr. Merriam is prepared to furnish expert advice, plans, specifications, estimates or surveys for railroads, waterworks, sewers, drainage and irrigation works; for roads, pavements, bridges, and electric lighting systems. He is a member of Canadian Society of Civil Engineers; Western Society of Engineers; also American Railway Engineering and Maintenance of Ways Association.

DR. CHARLES E. NORTH, of New York, and Professor Earle B. Phelps, of the Massacusetts Institute of Technology, announce that they are now associated as Consulting Sanitary Experts, with an office in the Hudson Terminal, New York City, and laboratories in an adjacent building. The chief branches to which their attention will be given are consultations, inspections, and laboratory researches in all matters of sanitation and preventive medicine; and especially those relating to the improvement of water supplies and milk supplies, methods of sewage disposal, the control of epidemics, and kindred lines of work.

OBITUARY.

MR. E. H. MILLINGTON, superintendent of telegraphs on the Michigan Central's entire system, and a pro-

minent railroad man, died here on June 22nd. Deceased was one of the most popular railroad men in the country, and was born in Guelph in 1860 and received his early education in St. Thomas. He learned telegraphy and was in the employ of the G.N.W. Telegraph Company in London, Montreal and Hamilton. He took up railroading here in Superintendent J. B. Morford's office and rapidly rose in railroad work. Seven years ago he was appointed to the present position, his headquarters being in Detroit, where he took an active part in the Transportation Club of Detroit.

DEFINITION OF HEAD OF WATER.

In a recent paper Mr. Chas. T. Main, mill engineer and architect, of Boston, gives the following definition of "head" as applied in water power development:

"There is the legal head, or the head to which the owner has a right to develop his power. This may or may not have been developed to its full extent. It may be that the expenses involved would be too great to warrant further development. In some cases it may be economy to make the expenditure necessary to get the benefit of some unused portion of the head.

"The gross head is the head actually used for producing power and getting the water to and away from the wheel.

"The net effective head is the gross head minus the loss in head required to get the water to and away from the wheel. This loss will vary with the length of the waterways leading to and away from the wheels, the velocity of the flowing water and the construction of such waterways.

"In several manufacturing cities where the water power is controlled by a company which is separate from the mill owners, there is an allowance of one foot made from the gross head before charging for the water as used on the wheels.

"The head should be measured with the wheels running. The only portion of the head which produces power is the difference in level directly above and below the wheel when the wheel is running."

The Cutler-Hammer Manufacturing Company, of Milwaukee, announce that it has purchased the plant, business and patents of the J. L. Schureman Company, of Chicago. The manufacture of the well-known types of Schureman controlling apparatus will be continued, and all agreements and contracts made by the J. L. Schureman Company will be faithfully carried out by its successor. The services of Mr. S. M. McFedries, General Manager of the Schureman Company, have been retained by the Cutler-Hammer Manufacturing Company, and he will remain in active charge of the manufacture and sale of Schureman apparatus. Mr. J. L. Schureman retires from the business. Until further notice customers of the Schureman Company should direct orders and inquiries to the old address, J. L. Schureman Company, 70 West Jackson Boulevard, Chicago.

MARKET CONDITIONS.

Montreal, June 23rd, 1909.

There is very little of an encouraging nature to report of the markets for pig-iron, in the United States. The situation is still of an undetermined nature, and there is very little doubt that the decision regarding matters concerned with the duties on iron and steel will have a good effect on trade. It is very much to be doubted, however, if it will occasion anything like the activity which was formerly expected. In fact, there does not seem to be any promise now that there will be a sudden spurt in the metal markets. The improvement will continue, according to many, if the crops turn out good; but, if not, a dull period is ahead. On the whole, however, the situation is slowly improving and the feeling is that it will continue to do so.

In England, there has been some very good selling for export, of late, according to reports brought over by some of the Canadian interests which have just returned. This is causing the producers in England to feel somewhat better, but it is by no means sufficient to cause a boom in the market. A moderate amount of iron is constantly going into consumption, and the feeling is that this is about all that can be expected for some time to come. That the situation is improving, there can be little doubt, but it is improving slowly.

In the local market, dealers seem to be more encouraged than their opponents from abroad. Orders are arriving constantly, and the volume of business transacted, while not marked by its greatness, compares very favorably indeed with that reported in other countries, population considered. In fact, dealers are of the opinion that matters are better in Canada than elsewhere.

Prices hold very steady. The market for finished and semi-finished products is moderately active, but featureless, and prices are practically the same as a week ago, as follows:—

Antimony.—The market is steady at 8¾ to 8¾c.

Bar Iron and Steel.—Prices are steady and trade is quiet. 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 ¾-base; tire steel, $1.90 for 1 x ¾-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; smooth finish, $2.70; imported, $2.20.

Boiler Tubes.—The market is steady, quotations being as follows:—1¼ and 2-inch tubes, 8½c.; 2½-inch, 10c.; 3-inch, 11½c.; 3 1-2-inch, 14¾c.; 4-inch, 19c.

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.

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).

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

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 14¾ 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 strentgh, 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., $4.20; 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 steady. The following prices are for carload quantities and over, on dock, Montreal: No. 1 Summerlee, $19.50; selected Summerlee, $19; Clarence, $17; Midland or Hamilton pig is quoted at $19 to $19.50, Montreal. It is said Dominion and Scotia companies are not quoting prompt delivery.

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.60 to $3.70.

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight rate of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $22 to $25. Spruce, 1-in. by 4-in. and up, $16 to $18 per 1,000 ft.; mill culls, $14 to $16. Hemlock, log run, culls out, $14 to $16. Railway Ties; Standard Railway ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X, $1.50; XX, $2.50; XXX, $3.

Nails.—Demand for nails is 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.—The market is 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-nch, $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 11c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $6; ⅝, $7.25; ¾, $8.50; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are steady at $2.30 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 pound. (See building paper; also roofing).

Tin.—Prices are unchanged, at 32½ to 33c.

Zinc.—The tone is steady, at 5½ to 5¾c.

* * * *

Toronto, June 24th, 1909.

There is a lull in pig-iron transactions in the United States, consequent on higher prices asked for better grades. As for the low grade, pipe makers would take a large quantity if it were available. The steel mills are in better shape than for some time; their capacity being so well sold

ahead for months that there is less competition and less pressure to sell. Prices of fabricated steel have advanced $5 within a month. Copper is lower in Europe, with less than the usual demand, and the steady production at Lake Superior keeps the American price down. Lead is quiet and steady. Tin has shown a decline since last week.

A general complaint from merchants is that trade is dull all over Ontario. People appear to be buying only from-hand-to-mouth. Wholesale orders can be obtained only for such goods as must be had. It looks as if the backward spring had not only deprived the farmers of a chance to do repairing or building, but also indisposed them to buy anything at the stores. Building in Toronto is active, some consider much too active, so far as dwellings are concerned. Prices of lumber, bricks, cement, and all building and roofing goods are fairly well maintained.

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

Antimony.—Demand inactive, market weak at $9 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. The spring rush is over and business steady.

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, delivered, $18; at works, $17 per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—The supply is far beyond the demand, and every maker seems to have his storage capacity occupied to the full. There is no reason, therefore, to look for any immediate change in the present quotation of $1.70 per barrel, including bags, or $1.30 without bags, car lots; for smaller quantities $1.40 to $1.50 per barrel in load lots delivered in town and bags extra. In paper packages, price would be, including paper bags, $1.40 to $1.50.

Coal.—Pennsylvania hard coal the retail price in Toronto is $6.50, with a strong likelihood of its continuing at this price for a month or two, the operators appearing to have agreed for a while. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.50. 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 largely 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 firmness continues at $13.85 to $14.05 per 100 lbs. The demand continues moderate.

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.—Unseasonably quiet, price maintained at $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000. The demand is steady and stocks light.

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, $3.05; 12-14-gauge, $3.15; 16, 18, 20, $3.35; 22-24, $3.50; 26, $3.75; 28, $4.20; 29, $4.50; 10¾, $4.50 per 100 lbs. Fleur de Lis—28-gauge, $4.30; 26-gauge, $4.05; 22-24-gauge, $3.50. Queen's Head—28-gauge, $4.50; 26-gauge, $4.25, per 100 lbs. Sheets continue in active request.

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch. $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, 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. Some talk of an advance in price.

Lead.—Prices steady outside. This market holds firm at $3.80 to $3.90, per 100 lbs., with an active movement.

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. In active demand.

Lumber.—Considerable demand for both Southern and Canadian dimension pine continues; hemlock dull. Prices are rather stiff all along the line. Dressing pine quotes $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, $3.20; 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 quotes $3.50 per barrel.

Pig Iron.—There is more 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.

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

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

Ready Roofing.—In moderate request at prices per catalogue. It is impracticable to quote figures, so great is the variety of this kind of goods, but prices are steady.

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 10 x 16 may be quoted at $7.25 per square of 100 square feet, f.o.b., cars, Toronto.

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	.....

Not much moving; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off 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, 1¾ 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.—Market firm and demand good. The price continues at 31c. to 31½c. The feeling rather steadier abroad.

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

Zinc Spelter.—A very active movement continues, and the market is higher at $5.50 to $5.75.

* * * *

Winnipeg, June 22nd, 1909.

The local market has been very active during the past week, lumber being probably the most active item in one section of the western part of the city. It is said there are over two hundred houses going up this summer, and lumber in all the different lines is the chief item of construction. Building and roofing paper also are very brisk, but the supply so far has been equal to the demand, and the local dealers had the precaution this year to lay in large stocks. Some people feel that Winnipeg is overbuilding this year along the line of houses and apartment blocks, and in the opinion of some there will be many vacant houses this coming winter, although a great number of the houses that are being built are for people who will occupy them themselves. The demand for brick for the better class of residence is strong, and prices remain steady for the three principal grades. Brick is largely used also in many of the large buildings, and the dealers are exceptionally busy. Cement continues active with the supply in every way equal to the demand.

Local quotations are as follows:—

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10½c.; anvil and vice combined, each, $5.50.

Bar Iron.—$2.50 to $2.60.

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

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

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

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, $8 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.

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; ¾-inch, $8.50; jack iron, single, per dozen yards 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Dynamite.—$11 to $13 per case.

Hair.—Plaster's, 80 to 90 cents per bale.

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

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

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

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

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—

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

Tool Steel.—8½ to 15c. per pound.

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

Boards.—Common pine, 8-inch to 12-inch wide, $38 to $45; siding, No. 2 white pine, 6-inch, $55; cull red or white pine or spruce, 6-inch, $24.50; No. 1 clear cedar, 6-inch, 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 6-inch, $55; No. 3, $45.

POSITIONS VACANT

Advertisements under this heading, two cents a word. Displayed $1.50 an inch.

UNIVERSITY OF MANITOBA, WINNIPEG.

The University of Manitoba invites applications for Lectureship in Civil Engineering. Salary $1,500. Duties to begin October 1st. Applicants must forward ten typewritten or printed copies of letter of application and of all testimonials not later than July 1st.

D. M. DUNCAN, Registrar.

POSITIONS WANTED

Advertisements under this heading, two cents a word. Displayed $1.00 an inch.

WANTED—By an experienced road foreman, situation under any municipality; well up in laying permanent pavements and sewers. excellent testimonials. M. Dobson, 122 Essex Street, Guelph, Ont.

TENDERS CALLED FOR

ROAD CONTRACTORS.

Sealed Tenders addressed to the undersigned will be received up to 12 o'clock noon on **Friday, July 2nd, 1909,** for chopping, cleaning, stumping, and grubbing a wagon road from the Montreal River at Smythe to Gow Ganda, following the line blazed by Mr. C. H. Fullerton, C.E., for the purpose of marking on the ground the location of said road. The length of the road will be about 27 miles.

The work of chopping, clearing, stumping and grubbing to include the cutting of all timber, brush, etc., on the roadway to a width of 60 feet, and removing all stumps, brush, timber, etc., from the central 30 feet, cutting, trimming and neatly piling all the logs, brush and stumps on the roadside, outside of the central 30 feet and burning same.

The work to be commenced immediately after the awarding of the contract, and to be continued to the satisfaction of the engineer in charge of the work, and completed by the 1st of October, 1909.

Tenders shall be submitted on the blank forms to be obtained from any of the undermentioned.

The tenders to be at a rate per lineal mile of road. A Guarantee Company's bond, approved by the department, will be required for the due fulfilment of the contract.

A marked cheque for five per cent. of the total amount of the contract must accompany each tender.

Plans and specifications of the work to be done may be seen at this department, or at the office of Mr. C. H. Fullerton, C.E., New Liskeard, at the office of Albert Skill, mining recorder at Smythe, or Harry Sheppard, mining recorder at Gow Ganda, or George T. Smith, mining recorder at Haileybury, or T. A. McArthur, mining recorder at Cobalt.

The lowest or any tender will not necessarily be accepted.

F. COCHRANE,
Acting Minister of Public Works.

Department of Public Works, Toronto,
June 17th, 1909.

Newspapers publishing this advertisement without authority will not be paid for it.

TOWN OF BATTLEFORD, SASKATCHEWAN

TENDERS WANTED.

Sealed Tenders, addressed to the undersigned Secretary-Treasurer, and marked "Tenders," will be received until 8 p.m. on Friday, July 2nd, 1909, for

(A)—Excavating and pipe-laying.
(B)—Erection of Pump House and Power House.
(C)—(1) Furnishing and erecting steel stand pipe; (2) Concrete foundation for stand pipe; (3) Housing for stand pipe.
(D)—Furnishing cast iron water pipes and special castings.
(E)—Furnishing fire hydrants, gate valves and valve boxes.
(G)—Furnishing and erecting pumping machinery.
(H)—Furnishing and erecting boilers
(J)—Furnishing and erecting steam engines.
(K)—Furnishing and erecting electrical equipment.

Plans and specifications will not be sent out but may be seen at the offices of the Chief Engineer, 103 Bay Street, Toronto; Room 47, Canada Life Building, Winnipeg, or at the office of the Secretary-Treasurer, North Battleford.

The lowest or any tender not necessarily accepted.

J. A. GREGORY, Mayor. S. COOKSON, Sec.-Treas.
WILLIS CHIPMAN, Chief Engineer.

TO CONTRACTORS.

Sealed Tenders endorsed "Tenders for Concrete Foundation Work," addressed to the undersigned, will be received at this department until noon on Monday, the 5th July, 1909, for the concrete foundation work required in connection with the extensions to the Ontario Government Buildings, Queen's Park. Plans and specifications may be seen at the offices of George W. Gouinlock, Architect, 1108 Temple Building, Toronto.

An accepted cheque, payable to the order of Hon. J. O. Reaume, Minister of Public Works, for 5 per cent. of the amount of the tender, and the bona-fide signatures and addresses of two sureties, or the name of a guarantee company, approved of by this department, must accompany each tender.

The department will not be bound to accept the lowest or any tender.

By Order.
H. F. McNAUGHTEN,
Secretary Public Works.

Department of Public Works, Ontario.
Toronto 21st June, 1909.

(Newspapers publishing this advertisement without authority will not be paid for it.

TOWN OF CHAPLEAU, ONTARIO

TENDERS FOR WATERWORKS.

Sealed Tenders will be received by the Clerk until 8 p.m. on Monday, July 5th, 1909, for the following sections of the proposed Waterworks System:—

Contract "A"—Pipelaying.
" "B"—Pump House.
" "C"—Water Tower.
" "D"—Cast Iron Pipes and Specials.
" "E"—Hydrants, Valves, etc.
" "G"—Steam Pump.
" "H"—Two Boilers.

Plans and Specifications may be seen at the office of the Clerk, Chapleau, or at the office of the Chief Engineer, Toronto, on and after June 21st.

GEO. B. NICHOLSON, Esq. Mayor, Chapleau, Ont
W. H. FARRELL, Esq. Town Clerk, Chapleau, Ont.

WILLIS CHIPMAN, C.E.,
103 Bay Street, Toronto, Ont.
Chief Engineer,

NEW INCORPORATIONS.

(Continued from Page 9.)

Bathurst, N.B.—George Eddy Company, $24,000; G. Eddy, T. M. Burns, C. Eddy.

St. John, N. B.—Barnes & Co., $49,000; G. F. Barnes, J. W. Barnes, E. Barnes.

Ottawa, Ont.—J. Moyneur, $40,000; D. Moyneur, J. B. Moyneur, M. Cleary.

Fabre, Que. — Fabre Silver Mines, $800,000; A. C. Thornburn, S. E. Boulter, W. W. Thompson.

Cobalt, Ont.—Montreal River Navigation Company, $40,000; A. G. Smith, Latchford; R. J. Jemmett, H. H. Lang, Cobalt.

Fort Erie, Ont.—Fort Erie & Buffalo Ferry Company, $20,000; B. F. Matthews, P. B. Troupe, J. J. Foster.

Three Rivers, Que.—Robert Ryan Company, $150,000; C. Dumoulin, P. Dumoulin, Three Rivers; T. R. Murray, Montreal.

Sherbrooke, Que.—Page Neverdrop Hook Company of Canada, $45,000; S. R. Page, G. Beaudoin, C. Beaudoin, St. Ludger.

British Columbia. — Michel Water, Light & Power Company, $50,000. Dry Belt Settlements Utilities, $50,000. F. H. Lantz Company, $100,000. McDougall Jenkins Engineers, $50,000. San Juan Construction Company, $150,000

Winnipeg. — Keith's, $500,000; T. J. Murray, P. C. Locke, C. G. Keith. J. H. Tremblay Company, $125,000; J. H. Tremblay, J. P. Tremblay, J. A. Tremblay, Winnipeg. Northwestern Battery Company, $200,000; H. W. Darby, F. J. Drew, T. B. Campbell. Peace & Company, $100,000; W. T. Peace, W. P. Padmore, B. S. Brammall.

(Continued on Page 44.)

CONTRACTOR'S SUPPLIES

NEW INCORPORATIONS.

(Continued from Page 43.)

Thornbury, Ont.—Thornbury Transportation & Reduction Company, $500,000; K. Davidson, M. Vail, A. L. Jamieson, Meaford.

Joliette, Que.—Joliette Limestone Quarry Company, $49,000; C. T. T. de Lanaudiere, Joliette; J. Hamel, A. Baby, Montreal.

Bruce Mines, Ont.—Bruce Mines Saw Mills Company, $60,000. F. H. Lawrence, Macdonald Township; J. L. O'Flynn, G. W. Goodwin, Sault Ste. Marie.

St. Boniface, Man.—General Machinery Manufacturing Company, $20,000. T. F. Ennis, M. G. Macneil, J. E. Ennis.

Quebec, Que.—Eastern Canada Portland Cement Company, $2,750,000. C. A. Irvin, P. H. Saver, S. F. Bell.

St. Dominique de Jonquieres, Que.—Vaillancourt & Perron Company, $49,000. L. Vaillancourt, St. Cyriac; J. Perron, St. Dominique de Jonquieres; J. Samson, Quebec.

British Columbia.—British Columbia Platinum Company, $200,000. Crescent Lumber Company, $100,000. Depew, Macdonald & McLean Company, $25,000. Flathead Trading Company, $50,000. Pacific Exploration Company, $300,000. Vancouver Towing and Lightering Company, $75,000. British Columbia Sash & Door Company, $50,000.

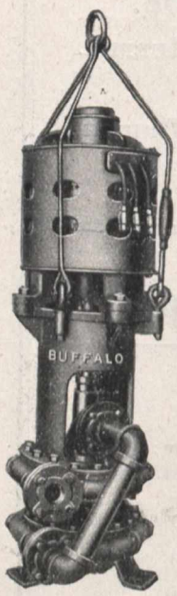
(Continued on Page 49.)

AMONG THE MANUFACTURERS

A department for the benefit of all readers to contain news from the manufacturer and inventor to the profession.

UNUSUAL CENTRIFUGAL PUMP.

The accompanying cut shows a 2½-inch compound vertical shaft sinking pump, driven by a 20 horse-power motor, designed to handle from 120 to 180 G.P.M. against varying heads up to 225 feet. The pump is equipped with bronze runners each made in two pieces to facilitate furnishing the interior waterways exactly to template, brass glands, forged steel shaft and cast iron casings and side plates. Also note that the action of the thrust is balanced for the pump, suction inlet is at the bottom of the lower or first stage, while the inlet for the second stage from the first is above at the top of the upper casing. The thrust bearing on the motor was built sufficiently heavy to bear the weight not only of the motor rotar but also of the moving parts of the pump, the shafts being connected only by flange coupling each half being held securely to shaft by taper pin.



When in place in the mine shaft the motor is protected from stones dropping down by a circular conical baffle or deflector made of ¼-inch boiler plate and slung below the ring on the three rods supporting the pump from the tackle. A similar plate is attached to the bottom of the machine to guide it down the shaft to prevent catching on cross timbers. Water is taken through about ten feet of Marlin wound heavy rubber hose connecting with the suction inlet and protected at the lower end by an ample strainer.

The pump construction as shown in the cut weighs without motor 650 pounds, with motor 1,500 pounds, and was recently shipped to a customer abroad by the Buffalo Steam Pump Company, of Buffalo, N.Y.

ALLEN RIVETERS IN DEMAND.

The improvement in business generally noticable is reflected in recent advices from the firm of John F. Allen, 370-372 Gerard Avenue, New York City, builders of the well-known "Allen" Riveting Machines.

They state: "Our May output was the largest since October, 1907. June opened up with a satisfactory amount of orders on hand and development of orders to date is very satisfactory, promising to close out the month with an increased output over last month.

"During the depression we took occasion to devote closer study to improving our machines, the result being that we have succeeded in developing greater tonnage on the dies and with a much smoother movement, eliminating the jar noticeable at times in pneumatic riveters and which some users have found objectionable."

IMPORTANT STEAM WHISTLE INVENTION.

Mr. Willett Bruce, the well-known superintendent engineer of the White Star Line, has invented an electric and automatic controlled steam whistle. Its efficacy in the qualities, which are claimed for it, have been thoroughly substantiated on board White Star liners, and the control and manufacture of the patent has been taken over by Mr. T. Downie, the well-known engineer of 5, Castle Street, Liverpool.

The great importance and desirability of having an efficient and effective equipment so as to ensure clear, distinct, and regular timed whistle blast signals in thick or foggy weather, as encountered by every class of steamer, is apparent. Yet comparatively little has been done in the past to accomplish such improvements as are clearly necessary. It is quite an every-day occurrence on the river for some passing steamer to fail in giving a blast, and for water and steam instead of sound to come out from the whistle orifice. Such a defect has more than once been the subject of comment in Admiralty court collision cases when sounds have never been heard, and mistakes have followed.

Probably no company has realized more fully the advantages of having good and powerful whistle apparatus than the White Star Line, and this is practically demonstrated by the careful and complete tests which they have given to Mr. Willet Bruce's patent. It is fitted among other vessels on the Cedric, where it has been for eighteen months, during which time it has given entire satisfaction, both as regards reliability and regularity, and her commander is enabled to signal most effectively and distinctly with it, particularly at such times as when going up North River to New York.

The Macbeth Iron Company, of Cleveland, engineers, founders and machinists, builders of blowing engines, etc., and the Bruce-Meriam-Abbott Company, also of Cleveland, builders of gas engines, were consolidated on June 1st, the name of the new company being the Bruce-Macbeth Engine Company.

Both of the above companies have been long established in Cleveland, and their amalgamation makes one of the largest and strongest companies of its kind. The Macbeth Iron Company dates from the year 1870, having been known until late years as Macbeth & Company. The Meriam-Abbott Company, predecessors of the Bruce-Meriam-Abbott Company, was organized in 1900, and has been one of the pioneers in the manufacture of the commercial gas engine and its development to the present standard of perfection.

It is the purpose of the Bruce-Macbeth Engine Company to continue the business of both of the former companies on a much larger scale than before. The manufacture and development of the gas engine will be continued, and the former line of work of the Macbeth Iron Company, building of blowing engines and general machine and foundry work, will be conducted as heretofore.

It is the intention of the new company to concentrate the two present plants in the former plant of the Macbeth Iron Company on Center Street, N.W., Cleveland. Alterations to the present buildings will be made and several new buildings will be erected to accommodate the enlarged business, and the combined equipment of the two companies in one plant will make a very complete and modern shop.

The officers of the company are as follows: President, W. C. Bruce; vice-president, C. W. Kelly; secretary and treasurer, C. J. Snow; manager, C. E. Curtiss. The above, with A. D. Macbeth, J. B. Meriam and F. B. Abbott, constitute the board of directors. Mr. Bruce, president, was formerly president of the Bruce-Meriam-Abbott Company. Messrs. Kelly, Snow and Curtiss retain the same positions formerly held in the Macbeth Iron Company.

THE SAO PAULO TRAMWAY. LIGHT AND POWER COMPANY'S ANNUAL REPORT.

The Sao Paulo Tramway, Light and Power Company was incorporated in Ontario in 1899 as a street railway, lighting and power company. They operate eighty miles of street railway in the city of Sao Paulo, Brazil. The franchise ex-

tends for forty years from September, 1898, with renewal privileges. Wm. Mackenzie, of Toronto, is president; W. N. Walmsley, of Sao Paulo, Brazil, is manager.

The gross earnings for 1908, $2,287,410.56, show an increase over the previous year of $175,887.42 or 8.33 per cent., while the net earnings, $1,504,359.78, show an increase of $108,486.28, or 7.77 per cent.

Statistical Statement.

	1908	1907	1904
Gross Income:			
Railway Dept.	$1,614,754.04	$1,488,815.77	$1,020,006.54
L. & P. Dept.	672,656.52	622,707.37	399,331.96
Total	$2,287,410.56	$2,111,523.14	$1,419,338.50
Operating & Maintenace charges	$ 783,050.78	$ 715,649.64	$ 460,558.50
Operating % gross income	34.2	33.9	32.4
Net earnings	1,504,359.78	1,395,873.50	958,780.00
Net income % capital	12.5	12.4	9.16
Passengers carried	24,598,518	23,435,476	19,611,355

Eleven pounds of nails will nail on the 1,000 laths required to cover 70 square yards of surface.

(Continued from Page 44.)

Toronto.—General Construction and Dredging Company, $300,000. R. Eustace, D. L. Leask, W. J. Tubman. Wigmore Gold Mines of Sturgeon Lake, $500,000. R. L. Cowan, W. D. P. Barker, R. E. Southby. Mascot Mining Company, $500,000. G. Russell, J. C. MacDonald, E. Cass. Toronto Boxbarrel Company, $50,000. F. Denton, W. E. Brown, Miss L. O. Richardson. Shaw Magnetic Sand Steel Company, $120,000. W. J. Shaw, W. H. Metcalfe, B. B. Jenkins.

Winnipeg, Man.—Hazelwood & Company, $20,000. T. Hazelwood, R. T. Wilson, G. N. Broatch. Canadian Chronophone Company, $60,000. T. H. Morris, E. Nesbitt, G. P. Woods. J. A. Christie & Company, $15,000. J. M. Moorhouse, D. W. Ferguson, R. G. Thompson. Boyds, $20,000. N. Boyd, W. J. Boyd, W. S. Boyd. Gas Traction Company, $1,000,000. R. C. McPherson, J. A. Anderson, R. W. Killey. Sylvester Auto-Threshers & Engines, $500,000. R. H. Sylvester, R. Sylvester, Lindsay; G. A. Bull, Winnipeg.

Montreal, Que.—Harris Construction Company, $50,000. F. H. Markey, J. C. Hickson, G. C. Papineau-Conture. A. Guay et Cie, $99,900. A. B. Charbonneau, J. A. Godin, H. Gagnon. British American Oil Company, $500,000. S. R. Parsons, W. A. Manion, A. L. Ellsworth. Crystal Springs, $125,000. J. M. Kennedy, A. de Sambor, R. Robillard. Navigation Company of Canada, $20,000. L. Lacouture, L. E. Morin, Jr., Montreal; A. Couture, Sorel. A. Nault & Sons Co., $5,000. A. Nault, Sr., A. Nault, Jr., F. Nault. French Gas Saving Company, $500,000. C. C. Laluau, J. A. H. Hebert, C. Galibert. Berger Company, $20,000. N. Stern, L. S. Margolese, S. G. Tritt.

WHERE TO BUY

An Engineering Trades Directory.

FOR INDEX TO ADVERTISERS SEE PAGE 3.

Air Compressors
Mussens Limited, Montreal, Que.
Reavell & Co., Ltd., J. F. B. Vandeleur, agent, Toronto, Ont.

Anvils
Leslie & Co., A. C., Montreal, Que.

Arc Lamps
Northern Electric & Mfg. Co., Limited Montreal, Que.

Bars, Steel
Priddle, Arthur, San Francisco, Cal.

Belting
McLaren, D. K., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal.

Boilers, Marine, Stationary and Water Tube
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.

Bonding for Concrete
Canada Wire Goods Mfg. Company, Hamilton, Ont.
Priddle, Arthur, San Francisco, Cal.

Books, Technical
John A. Hart & Co.

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

Bridges, Roof Trusses, etc.
Canadian Bridge Company, Ltd., Walkerville, Ont.
Cleveland Bridge & Engineering Co., Ltd., Darlington, Eng.
Dominion Bridge Co., Ltd., Montreal.
Hamilton Bridge Works Co., Ltd., Hamilton.
Manitoba Bridge & Iron Work, Ltd., Winnipeg, Man.
Pennsylvania Steel Co., Steelton, Pa.
Stewart, James A., Hamilton, Ont.
Structural Steel Co., Ltd., Montreal, Que.

Buckets (Clam Shell, Coal and Concrete)
Beatty & Sons, Ltd., M., Welland, Ont.
Mussens Limited, Montreal, Que.

Cableways
Mussens Limited, Montreal, Que.

Car Hauls (Wire Cable and Chain)
Jeffrey Mfg. Co., Montreal, Que.

Cement, Portland
Owen Sound Portland Cement Co., Owen Sound.
Thorn Cement Co., Buffalo, N.Y.

Cement, Machinery
Mussens Limited, Montreal, Que.

Coal Cutters
Jeffrey Mfg. Co., Montreal, Que.

Coal Handling Machinery
Northern Engineering Works, Detroit, Mich.

Coal Tipples and Screens
Jeffrey Mfg. Co., Montreal, Que.

Concrete Mixers
Dominion Equipment & Supply Co., Winnipeg, Man.
Mussens Limited, Montreal, Que.
Rogers Supply Company, Toronto.

Contractors
Cleveland Bridge and Engineering Co., Ltd., Darlington, Eng.

Contractors' Supplies.
Dominion Equipment & Supply Co., Winnipeg, Man.

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

Conveyors
Jeffrey Mfg. Co., Montreal, Que.

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WHERE TO BUY.

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Cranes
Advance Machine Works, Ltd., Walkerville, Ont.
Dominion Bridge Co., Ltd., Montreal.
Mussens Limitied, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Pennsylvania Steel Co., Steelton, Pa.
Structural Steel Co., Ltd., Montreal, Que.

Crossings, Railway
Ramapo Iron Works, Ltd., Niagara Falls, Ont.

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

Derricks
Dominion Bridge Co., Ltd., Montreal.
Manitoba Bridge & Iron Work, Ltd., Winnipeg, Man.
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Structural Steel Co., Ltd., Montreal, Que.
Keuffel & Esser Co., Hoboken, N.J.

Ditchers
Beatty & Sons, Ltd., M., Welland, Ont.

Draughting Supplies
Berger & Sons, C. L., Boston, Mass.
Hart Co., John A., Winnipeg, Man.
Keuffel & Esser Co., Hoboken, N.J.

Drawing Material
Keuffel & Esser Co., Hoboken, N.J.

Drills
Canadian Buffalo Forge Co., Montreal and Toronto.
Mussens Limited, Montreal, Que.

Dust Separators
Canadian Buffalo Forge Co., Montreal and Toronto.

Drying Apparatus
Canadian Buffalo Forge Co., Montreal and Toronto.

Dynamos
Laurence Scott & Co., Ltd. (J. F. B. Vandeleur, agents, Toronto, Ont.)
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Excavating Machinery
Harris Mfg. Co., Ltd., J. W., Montreal, Que.
Parsons, Co., G. W., Des Moines, Iowa

Electric Apparatus
Hill Electric Mfg. Co., Montreal, Que.
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Electrical Supplies
Hill Electric Mfg. Co., Montreal, Que.
Phillips, Eugene F., Electrical Works, Ltd., Montreal, Canada.

Elevators
Jeffrey Mfg. Co., Montreal, Que.
Northern Engineering Works, Detroit, Mich.

Engineers, Consulting
Barber, F.
Beaubien, Gaspe de, Montreal.
Cleveland & Dutcher, ancouver, B.C.
Francis, W. J., Montreal, Que.
Fuce, Ed. O., Galt.
Gagne & Jennings, Toronto, Ont.
Haffner, H. J., Calgary, Alta.
Mitchell, C. H., C.E., Toronto, Ont.
Nold, Henry N., Hamilton.
Rebbeck, J. R., Victoria, B.C.
Richmond, J. Stanley, Toronto.
Standard Inspection Bureau, Limited, Toronto, Ont.

Engineering Instruments
Cooke & Sons, Ltd., T., London, Eng.
Keuffel & Esser Co., Hoboken, N.J.

Engines
Canadian Buffalo Forge Co., Montreal and Toronto.
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Reavell & Co., Ltd. (J. F. B. Vandeleur, agent, Toronto, Ont.)
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.

Fans and Blowing Apparatus
Canadian Buffalo Forge Co., Montreal and Toronto.

Fence, Fencing, Wire
Owen Sound Wire Fence Co.

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

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

Foundry Supplies
Mussens Limited, Montreal, Que.

Frogs, Railway
Ramapo Iron Works, Ltd., Niagara Falls, Ont.

Generators, Alternating and Direct Current
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Company, Hamilton. Ont.

Heating and Ventilating Machinery
Canadian Buffalo Forge Co., Montreal and Toronto.

Hoists, Electric and Pneumatic
Northern Engineering Works, Detroit, Mich.

Hydraulic Machinery
Canadian Buffalo Forge Co., Montreal and Toronto.

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

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

Ladles
Northern Engineering Works, Detroit, Mich.

Locomotives (Electric)
Jeffrey Mfg. Co., Montreal, Que.

Mechanical Draft Motors

Measuring Tapes
Keuffel & Esser Co., Hoboken, N.J.
Canadian Buffalo Forge Co., Montreal and Toronto.

Motors
Laurence Scott & Co., Ltd. (J. F. B. Vandeleur, agent, Toronto, Ont.)
Mussens Limited, Montreal, Que.
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Company, Hamilton, Ont.

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

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

Poles, Telegraph and Telephone
Lindsley Bros. Co., Spokane, Wash.

Portland Cement
Hartranft Cement Co., Wm., Montreal, Que.

Posts
Lindsley Bros. & Co., Spokane, Wash.

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

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

Prison Work
Canada Wire Goods Mfg. Company, Hamilton, Ont.

Pulleys
Mussens Limited, Montreal, Que.

Pumps—Steam and Power
Beatty & Sons, Ltd., M., Welland, Ont.
Canadian Buffalo Forge Co., Montreal and Toronto.
Mussens Limited, Montreal, Que.
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.
Reavell & Co., Ltd. (J. F. B. Vandeleur, agent, Toronto, Ont.)
Wood & Co., R.D., Philadelphia, Pa.

Purifiers
Wood & Co., R. D., Philadelphia, Pa.

Rail Joints.
Rail Joint Co., of Can., Ltd., Montreal.

Railway Supplies
Beatty & Sons, Ltd., M., Welland, Ont.
Coghlin & Co., B. J., Montreal, Que.
Mussens Limited, Montreal, Que.
Koppel Co., Arthur, New York City.

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

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

Reinforcing Materials
Canada Wire Goods Mfg. Company, Hamilton, Ont.
Priddle, Arthur, San Francisco, Cal.

Road Preservatives
Paterson Mfg. Co., Ltd.

Rock Crushers
Mussens Limited, Montreal, Que.

Rope, Manilla and Wire
Mussens Limited, Montreal, Que.

Screens
Canada Wire Goods Mfg. Company, Hamilton, Ont.

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

Sewer Pipe
Hamilton & Toronto Sewer Pipe Co.

Sheet Metal Work
Canadian Buffalo Forge Co., Montreal and Toronto.

Shovels, Steam
Dominion Equipment & Supply Co., Winnipeg, Man.
Mussens Limited, Montreal, Que.

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

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

Steel, Structural
Cleveland Bridge & Engineering Co., Ltd., Darlington, Eng.
Dominon Bridge Co., Ltd., Montreal.
Hamilton Bridge Works Co., Hamilton, Ont.
Pennsylvania Steel Co., Steelton, Pa.
Structural Steel Co., Ltd., Montreal.
Montreal Steel Works, Montreal, Que.
Mussens Limited, Montreal, Que.
Allen & Co., Edgar, Sheffield, Eng.

Stone Crushers and Screens
Mussens Limited, Montreal, Que.

Surveying Instruments
Berger & Son, C. L., Boston, Mass.
Cooke & Sons, Ltd., T., London, Eng.
Hart Co., John A., Winnipeg, Man.
Keuffel & Esser Co., Hoboken, N.J.

Switches, Railway
Ramapo Iron Works, Ltd., Niagara Falls, Ont.

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

Ties, Railroad
Lindsley Bros. Co., Spokane, Wash.

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

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

Transformers
Toronto & Hamilton Electric Company, Hamilton, Ont.

Trenching Machines
Beatty & Sons, Ltd., M., Welland, Ont.
Harris, J.W., Mfg. Co., Ltd., Montreal.
Parsons, Co., G. W., Des Moines, Iowa

Trucks
Northern Engineering Works, Detroit, Mich.

Valves
Wood & Co., R. D., Philadelphia, Pa.

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

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

Wire Rope
Coghlin & Co., B. J., Montreal, Que.
Mussens Limited, Montreal, Que.

Wirework
Canada Wire Goods Mfg. Company, Hamilton, Ont.