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MISSING

The Canadian Engineer

WEEKLY

ESTABLISHED 1893

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The Canadian Engineer

ESTABLISHED 1893.

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TORONTO, CANADA, AUGUST 27, 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 LATE ROBERT REID.

Mr. Reid was not an engineer, but a successful merchant and manufacturer of London, Ont. Five years ago he was selected by the Dominion Government as one of the commissioners of the National Transcontinental Railway.

The good judgment he has shown as a commissioner, the care and energy and tact displayed by him has made clear the wisdom of the choice, and he will be greatly missed.

The work of the Commission is but half done. The remaining years will be trying years, and a competent successor to Mr. Reid will be very necessary.

In selecting the first Commission the Government deliberately avoided appointing men to the Board who had some knowledge of engineering and construction contracting methods, and the folly of such a course has led to blunders, and worse. In the middle of the stream they are found swapping horses. The engineering staff and the contractors are chafing under orders, directions and intimations that would not come from a board of strong engineers and contractors.

It is just as senseless to ask a tailor—no matter how good a tailor he might be—to build a railway, as it would be to appoint a grocer to a judgeship or a farmer to be health inspector at a port of entry.

The National Transcontinental Railway is not a scheme for a clever promoter. The financing is looked after by a Government Minister. The possibilities of the road being a money-maker were discussed and decided by the Dominion Cabinet.

The National Transcontinental to-day is an engineering-contracting problem, and to be successfully handled must not be nursed by lawyers, manufacturers, merchants, but given over to specialists in that class of work—the engineering-contractors.

It is no argument to say that the railroads of Canada are controlled by business men—not engineers. Quite true; but they hand over construction to trained men and do not interfere. Construction is the work of the Commission.

If manufacturers and merchants compose the N.T.R. Commission, why not engineers for the Tariff Commission?

AVIATION.

The meet at Rheims this week tends to draw attention to aeroplanes, extended flights and aviation.

A few years ago the wireless accomplished the well-nigh impossible, and startled the world with a message transmission that appeared uncanny. This year the aeroplane has demonstrated the possibilities of a new method of transportation, and the air is full of machines, imaginary and real, and the daily press has a new subject that will stand for "copy" at any time when real news is scarce.

Progress in mechanical flight is dependent upon the reliability of the motor, and the high-class racing car has led to the development of such a light, durable, reliable machine that aeroplanes have been kept afloat for two hours and more, the giving out of the fuel accounting in most cases for the limit of flight.

The distance covered and the rate of speed during these flights is difficult to determine. The record at Rheims, according to the latest despatch, gives 6 1-5 miles in 8 minutes 35 2-5 seconds as the best time.

In a recent book on "Aerodynamics," Mr. Lancaster makes some interesting calculations. As an indication of the greatest distance which could possibly be covered with the aid of the most concentrated form of fuel known, he mentions that an aeroplane carrying its own weight of liquid hydrogen as fuel could fly 86,600 miles without alighting. Using liquid hydrogen as fuel and carrying 25 per cent. of the total mean weight of the machine, assuming a yet unheard-of thermal efficiency of 50 per cent., a total mechanical efficiency of 90 per cent., and a propeller efficiency of 70 per cent., with a minimum gliding angle of six degrees, the exhaustion of fuel will be complete after a flight of 6,800 miles distance.

The distance covered and the time of flight which will indicate the winner of the $10,000, the Grand Prix de la Champagne, will surely establish a record.

LEGAL NOTES.

For over a year we have been running monthly a series of articles dealing with court decisions that are of interest to contractors and engineers. This department is being appreciated and frequently referred to—**but have you ever read it?**

It is not expected this department will make lawyers of engineers, but an intelligent reading of the reports will train a man in avoiding litigation, and impress upon him the necessity of great care and a reasonable amount of forethought.

Take the first case mentioned in this department this week. It would naturally be expected that one hole was one hole, yet the defendants "had to be shown."

We commend this department to those of our readers who in the past have neglected it.

Read it once and you will always read it.

THE CANADIAN PACIFIC RECORD.

The published statement of the Canadian Pacific Railway for the financial year ending June 30th shows a net earning of almost twenty-three million. To be more exact, the figures are:—

Gross earnings	$76,313,321
Working expenses	53,357,748
Net earnings	22,955,573
Expenses per cent. of earnings	70.0
Profits per cent. of earnings	30.8

Reading these figures with the returns for the last eight years, it will be noticed that since 1902 the earnings have doubled.

	Gross earnings.	Working expenses.	Expenses p.c. of earnings.
1909	$76,313,321	$53,357,748	70.0
1908	71,384,173	49,591,807	69.4
1907	72,217,527	46,914,218	64.9
1906	61,669,758	38,696,445	69.5
1905	50,481,822	35,006,793	69.3
1904	46,469,132	32,256,027	69.2
1903	43,957,373	28,120,527	64.0
1902	37,503,053	23,417,141	62.2
1901	30,855,203	18,745,828	60.7

The growth in per cent. of expenses is largely due to the increase in the wage schedule and in the increased price of the material they use.

On certain classes of freight and on some parts of the system the transportation rates have been lowered, and the increased business and improved methods of operation have not been able to overcome this growing expense ratio.

The amount of traffic to be moved is steadily growing. The railways are building more feeders, enlarging their area of operation, and to keep pace with this growth and be in a position to handle quickly and safely this traffic large sums must be spent on up-keep.

EDITORIAL NOTE.

The success that attended the agricultural motor competition at the Winnipeg Exhibition this year was so marked that it has been decided to hold a somewhat similar test in 1910. The conditions and regulations governing the same will be gone into most thoroughly by the judges who officiated at the last competition, and will be revised with the utmost caution, and many suggestions that have been made by manufacturers will be incorporated.

CANADA'S BANKING POSITION.

(Fred W. Field in the Monetary Times.)

	July, 1908.	June, 1909.	July, 1909.	Year's inc. or dec.	Month's inc. or dec.
Deposits on demand	$164,791,398	$226,480,468	$222,555,749	+ 35.05	— 1.7
Deposits after notice	402,964,565	445,178,476	466,337,816	+ 15.7	+ 4.7
Current loans in Canada	525,271,185	535,212,269	539,821,041	+ 2.7	+ 0.8
Current loans elsewhere	23,153,095	33,403,171	32,753,385	+ 41.5	— 0.1
Call loans in Canada	40,467,165	52,617,696	54,603,054	+ 34.9	+ 3.7
Call loans elsewhere	54,916,935	115,254,868	114,685,537	+ 108.8	— 0.4
Circulation	66,697,255	70,170,491	71,006,005	+ 6.4	+ 1.1

The advent of the July bank statement is always awaited with considerable anxiety. The figures of our chartered banks each month are now not only followed closely by Canadian, but also by United States and British interests. The amount of foreign capital now invested in Canada has caused the Canadian monthly bank statement to become of international importance. As noted elsewhere, several hundred millions of dollars are invested in industrial and manufacturing enterprises in the Dominion, which sum is controlled by United States financiers. As to the extent to which British capital is being invested, the fact that Canada went to London in July for more than ten million pounds sterling is sufficient indication.

* * * *

At the time the Canadian banks shut down sharply on credit nearly two years ago, many complaints were heard. But a word of praise is due to the Canadian bankers for the manner in which they have assisted to bring the country back to what is now almost the normal plane of prosperity. This has been done in a remarkably short period. While much of the increased loaning power has gone into industrial expansion, the crop movement undoubtedly is claiming a large amount of money.

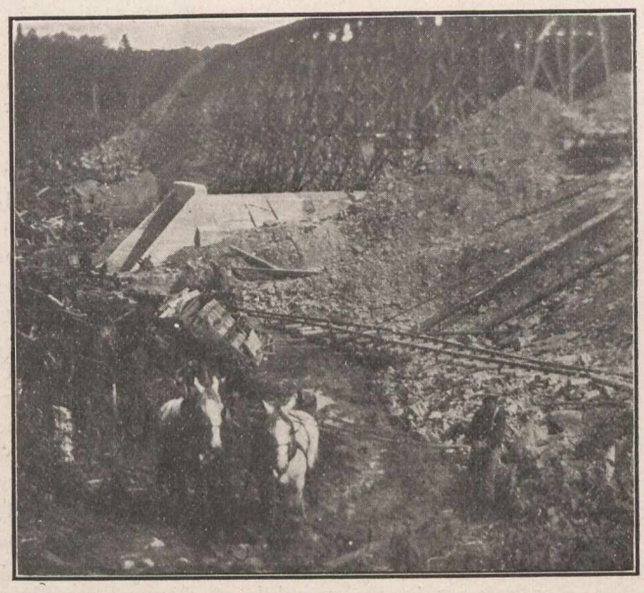
* * * *

The situation in Canada at present must strongly appeal to the man with surplus capital to invest. Not only has this country valuable and extensive natural resources, but it has proved in the past two years that it knows of an excellent way to handle a financial and commercial depression. The manner in which the Dominion stood firmly against the panic wave emanating from the United States, wrestled with its own economic problems, and brought the country back to a satisfactory position, is a record which the financial and business world may well admire.

ROCK DRILLING CONTEST.

At a rock drilling contest at Cobalt on August 19th, a enw Canadain record was established. The rock in which the drilling was done was a granite much similar to the Gunnison County granite. The winners were James Picken and Louis Page—known as the Page Bros., of Butte, Mo. They have been living at the Temiskaming mine for some time. In the fifteen minutes they drilled 43⅜ inches. Malcolm McPhail and Hector McDonald of the Gifford came next with 30⅝ inches. The Nipissing team, two Findlanders, came third with 28½ inches.

Other teams were from the Verner mine, 26⅜ inches, City of Cobalt, 24⅝ inches, Hudson's Bay, 25⅞ inches, McGuire and McMillan, 25⅝ inches, and the Otisse-Currie, 23⅜ inches.



View from Toe of Dump.

ALBERTA'S STEAM BOILERS' ACT AMENDMENT.

In 1907 hydrostatic tests of steam boilers were required to be not less than 50 per cent. above the working steam pressure according to the type of the boiler. This provision is now repealed. The regulation as to the fire line in boilers is also changed, as is also the regulation with regard to the construction of steam domes. The section of the Act of 1906 requiring inspectors, when subjecting boilers to hydrostatic pressure to assume 110 pounds to the square inch as maximum pressure in new boilers 42 inches in diameter made of plate ¼ of an inch thick, is repealed. The provision of the old Act with reference to the working pressure is also repealed.

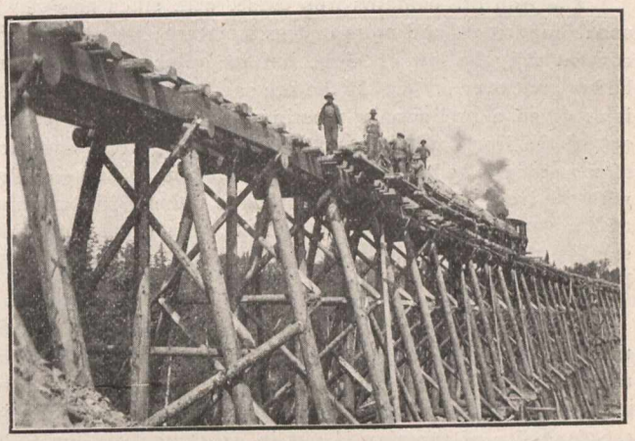
OBITUARY.

MR. GEORGE A. MITCHELL, of the contracting firm of Lyall & Mitchell Company, Winnipeg, died at his home in Winnipeg on August 20th. Of late years Mr. Mitchell was one of the best known contractors and has identified himself with nearly all the larger buildings erected in Winnipeg, one of his first enterprises here being the placing of all the interior work in the City Hall. He was one of the originators of the Manitoba Construction Company, which was organized about 1903, severing his connection with that company upon its dissolution in 1905, when the firm of Kelly Bros. & Mitchell was created. He became one of the most active members of this latter firm as well as secretary of the organization. This company eventually wound up about a year ago last fall, and in the early spring Mr. Mitchell entered the firm of Lyall-Mitchell Company, which included in its membership Peter Lyall, sr., of Montreal, and Peter Lyall, jr., of Winnipeg, and George A. Mitchell. This firm is now constructing the Union Depot at Fort Garry, and has under contract the erection of the $100,000 building for the Winnipeg Rubber Company, to be erected on McDermott Street.

MULLIN'S BROOK TRESTLE.

Six spans of one of the largest temporary trestles on the New Brunswick section of the Grand Trunk Pacific collapsed on August 14th, with the result that one workman was killed and five others had miraculous escapes from death.

The accident occurred at Mullin's Brook, four miles west of McGivney Junction, where the Grand Trunk Pacific crosses the Canadian Eastern Division of the Intercolonial.



Mullin's Brook Trestle just before the Collapse.

The trestle over Mullin's Brook comes on a curve, and is 1,100 feet long and about sixty-five feet high. The bents were of round timber, and placed at 14-foot centres. The fill contained upwards of 40,000 cubic yards of rock, and the cars filled with rock were taken out on the trestle by a small locomotive, and the rocks then dumped over the trestle.

On Saturday afternoon six of the twelve-foot spans of the wooden trestle collapsed and the donkey engine and seven four-yard cars dropped to the bottom of the gully, a distance of about fifty feet.

Trestle after the Collapse, showing Donkey Engine on Dump and Track Rails Suspended.

The only reason that can be given for the collapse of the trestle is that it was put up during the winter, and a certain amount of ice and snow remained beneath the foundation, which when melting coupled with a washout as the result of the rain, caused the collapse.

This section is being built by the Toronto Construction Co.

On our page entitled "Among the Manufacturers," in last week's issue, we printed an article headed "A Kootenay Timber Yard." The illustration which accompanied the article was a view of the yards owned by The Lindsley Bros. Company of Spokane, Wash., and situated at Nakusp on the Arrow Lakes, in the Kootenay District of British Columbia. By accident, the word "Lindsley" was spelt "Lindsay."

ELECTRIC FURNACE REDUCTION OF IRON ORE.

By Joseph W. Richards.*

In order that one can understand thoroughly the problems arising in the reduction of iron ore by carbon in an electrically heated furnace, he should first of all have a clear idea of how this reduction proceeds in an ordinary non-electrical blast furnace.

The iron ore contains iron oxide, with silica and clay as usual impurities, and more or less moisture; its phosphorous content may be low or high, but its sulphur content must be low, not over 0.5%. If the ore carries over 1% of sulphur it is given a preliminary roasting. In the furnace perhaps 99% of the iron oxide is reduced to metallic iron, 10 to 20% of the silica is reduced by carbon to silicon, which combines with the iron, all of the phosphorous is reduced into pig iron, and a varying proportion of sulphur, this proportion being smaller the more basic the slag is made with lime and the higher the running temperature.

Flux is added to make fusible slag by combining with the unreduced silica and the clay in the ore. Limestone, unburnt, is the usual flux, but magnesian limestone, carrying $MgCo_3$, is quite commonly used, the magnesia increasing the fusibility of the slag if not in greater proportion to the lime than the proportions $_2CaO.MgO$. The amount of flux added is variable; it depends on how basic the slag must be made. If the fuel is coke, and, therefore, considerable sulphur comes into the furnace, the slag formed must be nearly half lime and magnesia, to make low sulphur pig iron; if the fuel is charcoal, carrying almost no sulphur pig iron; if the fuel is charcoal, carrying almost no sulphur, and the ores carry none, the slag may be only one-third lime and magnesia and two-thirds silica and alumina, and make best quality pig iron. Such slag costs less for flux, and is more fusible than the basic lime slags.

Fuel is needed to provide heat and reducing effect. The heating effect is almost entirely produced by the combustion of the larger part of the fixed carbon (non-volatile carbon) of the fuel to carbon monoxide (CO) before the tuyeres. This combustion fills two functions: it provides the high temperature necessary to melt down the iron and slag, and it provides large quantities of reducing gas, practically indentical in composition with producer gas (30 to 35% CO. 1 to 2% H_2, rest N_2), which performs in the upper part of the furnace the larger part of the reduction.

The amount of fuel used in a blast furnace is determined by the amount which must be burned at the tuyeres to produce the necessary smelting temperature, and not by the amount necessary to perform the reduction of the metallic oxides. The amount necessary for performing the reductions taking place in the furnace is only one-third to one-half of the amount necessary to be burned to provide the smelting heat. That this statement is true of the ordinary blast furnace may be seen from the fact that if the smelting zone is increased in temperature by heating the blast, the amount of carbon used in the furnace per unit of pig iron made is at once decreased. Or, if the heat available in the smelting zone is increased by drying the blast, and thus removing the strong cooling influence which the decomposition of the moisture of the blast exerts, economy of fuel at once results. In fact, any means of getting high smelting temperature without combustion of carbon before the tuyeres decreases at once the quantity of fuel necessary to use in the furnace, since the quantity used is determined by the heat requirements in the smelting zone, and not by the requirements for reduction, which are only a fraction to the former. The ash of the fuel is largely silica, with some alumina and lime, if coke, or alkalies, if it is charcoal. This requires flux to slag it, an amount which may be considerable when using poor coke high in ash. Regard for this item of cost should be had in purchasing or valuing the fuel.

The pig iron produced contains carbon between 2.5 and 4.5%, silicon in varying quantity 1 to 4%, according to the temperature and rate of running of the furnace, practically all the phosphorus of the charge, and one-tenth to one-fourth of the sulphur. Its melting point is about 1,200° C., and it runs from the furnace ordinarily at 1,500°C. to 1,600°C., carrying out as sensible heat 250 to 300 calories.

The slag may be basic or acid, as before explained, and these varieties will average in per cents.:—

	Basic Slag. High Sulphur Charge.	Acid Slag. Low Sulphur Charge.
SiO_2	35	55
Al_2O_3	10	10
CaO	40	25
MgO	10	5

These slags melt at about 1,350°C. and 1,200°C. respectively, and ordinarily run away from the furnace at 1,600°C. carrying out as sensible heat 500 calories.

The reduction of silica and phosphorus oxide in the furnace is accomplished by solid carbon in the smelting zone. A small part (10 to 20%) of the iron oxide in the furnace is also similarly reduced by fixed carbon; the rest is reduced in the upper half of the furnace by the excess of carbon monoxide gas. So much of the latter gas, however, is produced before the tuyeres in generating the temperature necessary in the smelting zone, that only a fraction of it is converted into carbon dioxide, CO^2, in reducing the iron oxides of the charge. This is the chief reason for the excess of unused carbon monoxide in the gases of the blast furnace, an amount whose potential calorific value often represents one-half of the calorific power of the fuel put into the furnace. It is true that all the carbon monoxide in the gases could not be utilised, no matter how small its amount, but that is a limit set by the principle of chemical equilibrium or mass action, which ordinarily is not approached because of the excessive amount of carbon monoxide produced in the lower part of the furnace in the effort to get the requisite smelting heat and temperature. The proportions of carbon ordinarily consumed at the tuyeres are 9 atoms (108 parts) of carbon for each molecule of iron oxide (160 parts) reduced by the carbon monoxide gas. The chemical equation is: $Fe_2O_3 + 9\ CO = 2\ Fe + 3\ CO_2 + 6\ CO$. This equation shows us that only one-third of the carbon monoxide produced before the tuyeres in generating the smelting temperature is utilised in reduction, while two-thirds escapes unused.

Passing to the electric principle of smelting, we have here to deal with the case of all necessary heat supplied by electrical energy, no blast blown in, and, therefore, all the solid carbon utilised for reduction (always excepting the small amount which dissolves in the pig iron) in calculating the amount of carbon necessary to thus reduce the iron oxide, we meet at the outset with this difficulty. What proportion of the carbon will form CO^2, and what proportion CO? We know that when reduction takes place at a very high temperature, CO is almost the only product; but as this passes more or less slowly through the cooler portions of unreduced charge, CO^2 is formed in increasing amounts, until at a low red heat, given sufficient time, about half the CO may be converted into CO_2. The formulae corresponding to these two extremes are:

$Fe_2O_3 + 3C = Fe_2 + 3CO.$

$Fe_2O_3 + 2C = Fe_2 + CO + CO_2.$

Comparing these with the ordinary blast-furnace reaction, which requires 9 C put into the furnace for the reduction of Fe_2, we see that 3 C, or one-third as much carbon, is the greatest amount necessary in the electric furnace reduction and $_2C$, or between one-third and one-fifth as much, is the smallest amount necessary. As will be further shown, the uncertainty as to how much CO_2 can be formed in the electric furnace reduction is perhaps the chief difficulty in running the electric furnace.

*Paper read before the American Electrochemical Society, Niagara Falls.

Example.—Iron ore is to be reduced to pig iron in an electric furnace, and the flux and charcoal on hand for the charge analyze as follows:—

Iron Ore.		Limestone.		Charcoal.	
Fe_2O_3	90	$CaCO_3$	90	Fixed .C....	90
SiO_2	8	$MgCO_3$	3	Volat'e Mt'r.	6
Al_2O_3	2	SiO_2	2	SiO_2	2
				Al_2O_3.....	1
				K_2O, Na_2O..	1

Assume the pig iron made will contain 4% of carbon and 3% of silicon; that the slag may be 65% ($SiO_2 + Al_2O_3$); that the gases contain only the CO_2 from the limestone, and none from the reductions.

Required: (1) The weights of ore, limestone, and charcoal to charge per 100 of pig iron made; (2) the percentage composition of the gases; (3) the weight and percentage composition of the slag.

Solution: (1) The weight of ore needed is that necessary to supply the 93 parts (100 — 4 — 3) of iron in the pig iron. This will require 133 parts of Fe_2O_3, which will be contained in 133 ÷ 0.90 = 148 parts of ore.

The weight of charcoal needed is that necessary to furnish enough fixed carbon to reduce the iron oxide and that silica which is reduced, and to supply the carbon in the pig iron. These quantities are:—

Reduction of Fe_2O_3:	93 × 36/112 = 29.9
Reduction of SiO_2:	3 × 24/ 28 = 2.6
For carbon dissolved	= 4.0
Total requirement	= 36.5
Charcoal required 36.5/0.90	= 40.6

The weight of flux required is best found by calling it x, and then figuring out the slag, as follows:—

Silica in the slag will be that in the ore, flux, and fuel, minus that reduced to silicon. Therefore,

In ore	148 × 0.08 = 11.8
In flux	x × 0.02 = 0.02 x
In fuel	40.6 × 0.02 = 0.8
Reduced	3 × 60/28 = 6.4
Silica in slag	= 6.2 + 0.02 x

By similar calculations we find the slag to contain, as a whole:—

Silica	6.2 + 0.02 x
Alumina	3.4
Lime	0.50 x
Magnesia	0.04 x
Alkalies	0.4
Total weight	10.2 + 0.56 x

If the slag is to be 65% of silica and alumina together, then

$$0.65\ (10.0 + 0.56x) = 9.6 + 0.2x$$

from which $x = 9$.

The above solution is perfectly general, and applies to all kinds of ore, flux, and fuel, and the production of any desired kind of slag.

(2) The gases will contain the fixed carbon of the charcoal (except that part that goes into the pig iron) in the state of CO, the carbonic acid driven off the flux, and the volatile matter from the charcoal. The latter may be assumed as composed of equal parts by volume of hydrogen, carbon monoxide, and carbon dioxide, which would correspond to weights of those gases in the proportion of 2:28:44. The gases passing off will therefore be, in parts by weight:

CO from fixed carbon	32.5 × 28/12 = 75.8	
CO from volatile matter.	2.7 × 28/74 = 1.0	76.8
CO_2 from volatile matter	2.7 × 44/74 = 1.6	
CO_2 from flux	9.0 × 0.44 = 4.0	
H_2 from volatile matter....	2.7 × 2/74 = 0.1 —	0.1
Total weight of gases		82.5

Percentage composition of gases by volume:—

		Per cent.	
CO	76.8÷126 = 6.10 =	92.4	
CO_2	5.6÷1.98 = 2.8 =	4.2	
H_2	0.1÷0.09 = 2.2 =	3.4	
	6.60	100.0	

The volumes 61.0, 2.8, and 2.2 represent cubic meters of these gases per 100 kgs. of pig iron made; if multiplied by 16 they give the cubic feet per 100 lbs. of pig iron.

(3) The slag will contain, substituting x × 9:—

		Per cent.
Silica	6.4 =	42.4
Alumina	3.4 =	22.5
Lime	4.5 =	29.8
Magnesia	0.4 =	2.65
Alkalies	0.4 =	2.65
	15.1	100.00

Combined Blast and Electrical Furnace.—The electrical reduction of iron ore differs radically from blast-furnace practice in one essential particular, viz., that since no air is blown in, any excess of carbon above that consumed in reduction must remain unused, accumulate, and eventually clog the furnace. The amount to be used as a minimum cannot, moreover, be calculated until we know how much Co_2 will be formed in reduction, and that is an unknown quantity unless arrangements are made so that none can be formed. The following modifications of working an electrical pig-iron furnace are possible, with the object in view of avoiding the accumulation of excess carbon in the crucible:—

(1) A deficit of carbon may be put into the charge, thus permitting unreduced iron oxide to escape in the slag, and preventing unused carbon from accumulating. This solution leads to the disadvantages of loss of iron, heavy corrosion of lining of furnace, and heavy consumption of electrode carbon. It may have the secondary result of preventing reduction of silica or taking up of carbon by the iron, and thus furnish a metal with high melting point and approaching steel in composition. Such slag would also remove some of the phosphorous in the charge, but practically no sulphur.

(2) A charge of ore and flux without fuel may be run through the furnace whenever an accumulation of carbon occurs, as is shown by the resistance of the furnace falling off and the furnace getting cold. This was the device adopted in the experiments of the Canadian commission at Sault Ste. Marie, but while permissable in experimental work, it would not do to thus periodically derange a furnace in regular running.

Charge Sheet—per 100 of Pig Iron Produced.

Charges.	Pig Iron.	Slag.	Gases.
Ore: (148.0)			
Fe_2O_3 ..133.2	Fe 93.0		O.....40.2
SiO_2 ... 11.8	Si 3.0	SiO_2.... 5.4	O..... 3.4
Al_2O_3 .. 3.0		Al_2O_3.... 3.0	
Limestone: (9.0)			
CaO ... 4.5		CaO.... 4.5	
MgO ... 0.4		MgO ... 4.5	
SiO_2 ... 0.2		SiO_2.... 0.2	
CO_2 .... 4.0			Co_2..... 4.0
Charcoal: (4.06)	C 4.0		
Fx'd C .. 36.5			C.....32.5
CO 1.0			CO..... 1.0
CO_2 ..... 1.6			CO_2.... 1.6
H_2 ..... 0.1			H_2..... 0.1
SiO_2 .... 0.8		SiO_2.... 0.8	
Al_2O_3 ... 0.4		Al_2O_3 ... 0.4	
$(NaK)_2O$. 0.4		$(NaK)_2O$. 0.4	
Totals 197.9	100.0	15.1	82.8

(3) The fuel may be calculated only for the production of CO in the furnace, and this condition approximated by

leading off the gases from the hot part of the furnace and not allowing them to cool in contract with the ore. In this way reduction by CO is avoided, and the fixed carbon in the charge may be consumed almost entirely to CO without formation of CO_2. This would bring the furnace consumption of carbon nearer to a definite amount, and by avoiding reduction except by solid carbon tend to use up all the carbon charged, the amount of which would be calculated by this manner of working (as in the numerical example worked out for illustration).

(4) The best solution of this difficulty may be to provide tuyeres by which air can be sent into the crucible of the furnace, and thus burn any accumulation of carbon. A given quantity of air will always burn a given quantity of carbon, and therefore the cure would seem to lie in having a variable supply of air, which is increased whenever the falling resistance of the furnace indicates that carbon is beginning to accumulate, and diminished to a small minimum supply, only enough to keep the tuyeres open, when the furnace is in good electrical running order. It would represent a combined electrical and blast furnace, with the blast so regulated as to overcome the chief difficulty of the purely electrical furnace—the accumulation of unused carbon in the crucible.

It may be quite possible, by some such device as Mr. Taylor's large electrical furnace, to practically combine the blast furnace and the electrical furnace. The writer is quite confident that any practical method of introducing electrical heat into the crucible of a blast furnace will result in large economies in the furnace working. Only one-quarter of the heating power of the fuel is developed around the blast tuyeres, and yet if half of this could be replaced by electrically-generated heat, an economy of 50% could in all probability be reached upon the fuel bill. To put it into figures, it takes 1.2 tons of coke to make a ton of pig iron in the blast furnace, and about three-quarters of a ton is burnt by the blast, producing at the smelting zone about 25% of the calorific power of the coke. If electrical energy could be made to supply one-half of this, the furnace would make iron with half the previous coke supply, that is, with 0.6 ton of coke per ton of pig iron, and this with an expenditure of electrical energy equal to 12.5 per cent. of the calorific power of but 0.15 tons of coke.

The question of economy in this case will not be, then, the simple replacement of fuel heat energy by an equivalent amount of electrical heat energy, but the comparison of fuel heat energy with the cost of one-fourth its amount of electrical heat energy. This may be quite possible in many localities, and the combined furnace would work more regularly than a purely electrical furnace. The question awaits the coming of the electro-metallurgical engineer who can make practicable the requisite combination. A possible solution may be to use cheap electrical power to superheat the hot blast, and thus to make the blast itself the agent for carrying electrically developed heat into the furnace.

CEMENT—CONCRETE.

Quebec.

MONTREAL.—A. T. Chapnon has secured a contract for cementing the wading pool in Lafontaine Park, at $1,975.

British Columbia.

VANCOUVER.—After calling for tenders for five miles of conncrete walks the city has decided to do the work by day labor. Two firms bid 14c a square foot.

Ontario.

OTTAWA.—A merger of Canadian cement companies has been affected. The capital is $30,000,000. Sir Sanford Fleming is president, and ten cement plants in this country are involved. It is reported that negotiations have been completed for the purchase of the following companies, except, possibly the Belleville plant of the Lehigh Company, with which a contract has not yet been completed. The Vulcan Portland Cement Company, Limited, of Montreal. The Lehigh Portland Cement Company, Limited, of Belleville, Ontario. The Belleville Portland Cement Company, Limited, Belleville, Ontario. The Canadian Portland Cement Co., Ltd., with properties at Marlbank and Port Colborne, Ontario. The International Portland Cement Co., Ltd., of Hull or Ottawa. The Western Canada Portland Cement Co., Ltd., with properties at Exshaw, Alberta. The Lakefield Portland Cement Co., of Montreal. The Lakefield Portland Cement Co., Ltd., of Lakefield, Ontario. The Owen Sound, Portland Cement Company, Limited, of Owen Sound, Ontario. The Alberta Portland Cement Co., Ltd., of Calgary, Alberta. The new company also proposes to construct plants immediately at Winnipeg and Victoria, B.C., where large deposits of suitable material have been discovered. As far as can be learned, the authorized and issued capital of the merger will be as follows:—

	Authorized	To be issued
Bonds	$ 8,000,000	$ 5,000,000
Preferred	11,000,000	9,000,000
Common	19,000,000	12,500,000
Total	$38,000,000	$26,500,000

Of the $9,000,000 preferred, $4,000,000 will go to pay for properties, so that only $5,000,000 will be issued to the public. A strong group of both Canadian and English financiers are already identified with the project. The provisional directors are: Sir S. Fleming, W. M. Aitkin, Hon. W. Edwards, J. S. Irvin, Hon. R. Mackay, R. Forget, M.P., J. R. Booth, F. B. Dunsford. The Bank of Montreal will be the bankers for the new company, and the Royal Trust Company will act as trustees for the bondholders.

PRESCOTT.—Last week's issue of the Canada Gazette contains notice of the incorporation of the Canadian Cement Casket Co., with a capital of $99,950. Mr. H. E. Whitney, of Prescott, is a director.

PETERBOROUGH.—E. A. Hay, city engineer, invites tenders for the erection of a reinforced concrete bridge over the River Otonabee.

(Continued from page 231).

Small factories or steam engines	5	to	25.00
Restaurants, club and pool-rooms	4	to	20.00
Taverns	10	to	25.00
Wholesale liquor stores (unmetered)	25	to	50.00
Light wagon horses, including water for washing carriage, each			2.00
Omnibus, coach or truck horses, each			1.00
Cows, each			1.00
Stalls, each			0.50
Hand hose (jet not to exceed ⅜ inch) to be used before 9 a.m. and after 5 p.m.			0.50
Soda fountains			3.00
Photograph studios	$5	to	10.00
Drug stores	3	to	10.00
Laundries not using steam power	5	to	10.00
Other places where water is used from 50 cents upwards.			
Water supplied for building purposes:			
Ordinary frame house			2.00
Large frame house			3.00
Ordinary brick house			5.00

Larger buildings by meter at the rate of five dollars for fifty thousand gallons, or less, and one cent per one hundred gallons for any quantity over fifty thousand gallons, the meter to be placed to the satisfaction of the Board at the expense of the applicant.

Repairing and re-modelling buildings.

Each barrel of lime or cement ..... .05

But no charge less than one dollar.

WATER RATES OF THE CITY OF WINNIPEG, MAN.

Number of Rooms	Consolidated Rate, including extras per quarter
4 or less	$1.50
5	1.80
6	2.10
7	2.40
8	2.70
9	3.00
10	3.30
11	3.60
12	3.90
13	4.20
14	4.50
15	4.80
16	5.10

Over 16 rooms 30c. a room per quarter.

The consolidated rate includes all fixtures. No fixture shall be used unless it has been first approved of by the city.

Allowance: Consolidated rate, 20 gallons per room per day.

Special Rates: For brick work, 5c. per 1,000 brick.

For plastering, 25c. per 100 square yards.

For concrete work, 5c. per cubic yard.

For stone work, 5c. per cord.

Water, according to meter rate, 20c. per 1,000 gallons, subject to discount as follows:

A single consumer using in respect of any one building 200,000 gallons and less than 400,000 per quarter, is entitled to a discount of 5 per cent.

A single consumer using in respect of any one building 400,000 gallons and less than 600,000 per quarter is entitled to a discount of 10 per cent.

A single consumer using in respect of any one building 600,000 gallons and less than 800,000 gallons per quarter, is entitled to a discount of 15 per cent.

A single consumer using in respect of any one building 800,000 gallons or upwards per quarter, is entitled to a discount of 20 per cent.

In no case, however, shall the amount charged be higher than the minimum paid by consumers in the next highest class.

These discounts are in addition to the regular 5 per cent. discount allowed for prompt payment.

WATER RATES OF THE CITY OF ST. JOHN, N.B.

Schedule C.

One family	$ 3.00
Each additional family in the same house	3.00
One water closet with cistern and self-closing flush	4.00
Each additional water closet with cistern and self-closing flush in same house	4.00
One water closet without cistern and self-closing flush	6.00
Each additional water closet without cistern and self-losing flush in same house	6.00
Baths, each	3.00
Urinals, each	3.00
Set wash bowls with taps attached, each	0.50
Boarding houses, not less than	4.00
General stores and shops, from $2 to	50.00
Small shops in remote districts, not to exceed	1.00
Offices	3.00
Barber shops, one chair	2.00
Barber shops, each additional chair	2.00
Blacksmith shops, one fire	2.00
Blacksmith shops, each additional fire	1.00
Other workshops, from $2 to	10.00

(Continued on previous page.)

WATER RATES OF THE CITY OF MONCTON, N.B.

⅜ inch service, one family now in use	$ 8.00
½ inch service, one family rate	10.00
⅝ inch service, one family rate	12.00
And for each additional family supplied from one service	4.00
Water closets, fed by tanks	3.00
Water closets, fed direct from pipe	7.00
Bath tub	2.00
Urinal, approved style	2.00
Horse and carriage, with hose	3.00
Each additional horse	2.00
Cows, each	1.00
Hose for lawns and watering pavement, etc	3.00

Livery Stables.

½ inch service	$10.00
⅝ inch service	12.00

In addition to service, $2.00 per stall or 25 cents per 1,000 gallons, at option of the City Council.

Hotels.

25 cents per 1,000 gallons, or by special agreement with the City Council.

Engines and Boilers.

$5.00 for horse power per year, not exceeding 12 hours per day, metered at 25 cents per 1,000 gallons, at option of City Council.

Building Purposes.

	Per 100 cubic feet.
Bricks, per 1000	.10
Stone, per cubic yard	.05
Plastering, per 100 yards superficial	.40

Manufacturing and other purposes, by special agreement with the Council.

For purposes not named in Schedule, and for peculiar circumstances, contracts will be made by the City Council.

WATER RATES OF THE CITY OF VANCOUVER, B.C.

The Vancouver City Water Works reserve the right, at their pleasure, to substitute in lieu of the above rates the rate of 16 cents per 100 feet.

Meter Rates.

	Cents per 100 cubic feet.
500 to 5,000	16
5,000 to 10,000	15
10,000 to 20,000	14
20,000 to 30,000	13
30,000 to 40,000	12
40,000 to 50,000	11
50,000 to 60,000	10
60,000 to 70,000	9
70,000 to 80,000	8
Over 80,000	7

Manufacturers' Rate.

	Cents per 100 cubic feet.
Up to and including 50,000 cubic feet	10
50,000 to 75,000 cubic feet	8
Over 75,000 cubic feet	7

A discount of 20 per cent. if paid within 20 days.

Meter Rent.

5-8 inch meter		25 cents	per month
3-4	"	50 "	"
1	"	75 "	"
2	"	$1.50	"
3	"	2.00	"
4	"	2.50	"
6	"	3.00	"

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Aug. 21		STOCK QUOTATIONS TORONTO				MONTREAL			
				1909	1908	Price Aug. 20 '08	Price Aug. 13 '09	Price Aug. 20 '09	Sales Week End'd Aug20	Price Aug. 20 '08	Price Aug. 13 '09	Price Aug. 20 '09	Sales Week End'd Aug20
Canadian Pacific Railway	8,920.6	$150,000	$100	1,555,000	1,336,000	172½	188 187¼	184¾	289	173	172⅜	187⅜ 187¼	125½ 185	586
Canadian Northern Railway	2,986.9			175,100	162,500									
*Grand Trunk Railway	3,536	226,000	100	857,003	798,254		*1st. pref. 106, 3rd pref. 58⅝, ordinary 24½							
T. & N. O.	334	(Gov. Road)		33,839	18.411									
Montreal Street Railway	138.3	18,000	100	76,463	71,550					177¾	177	215½ 214½	213½ 212¼	235
Toronto Street Railway	114	8,000	100	72,251	66,228	106¾	126½ 126	125¼ 125	10	106	105	126 125½	125 123¾	202
Winnipeg Electric	70	6,000	100			163 161½		190 188	158				187½ 186½	

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

RAILWAY EARNINGS.

The gross earnings of all United States roads reporting for the first two weeks in August amount to $10,834,463. a gain of 12.4 per cent. over the same period last year, and 8.9 per cent. as compared with 1907. Railroad earnings continue to exhibit most satisfactory increases and for the month promise to approximate the record year 1907. In the following tables is given earnings of United States roads so far reporting for the first two weeks of August and the same roads for July; also the more complete reports for July and the two preceding months:

Gross Earnings

	1909	Gain	Per Cent.
August—two weeks	$10,834,463	$1,202,013	12.4
July—two weeks	10,613,095	498,463	4.9
July	44,198,684	3,503,660	8.6
June	45,538,286	4,223,790	10.2
May	44,591,299	5,599,683	14.5

One more road, the Baltimore and Ohio, the only one of the Eastern Trunk lines, has reported for July, and it shows a very large gain over last year, although there is still a loss of 4.0 per cent. as compared with 1907. Total gross earnings of all United States roads so far reporting for July amount to $44,198,684, a gain of 8.6 per cent. over the same period last year, but there is still a loss compared with 1907. All classes of roads help to swell this large increase over last year, and the gains are especially large on Eastern Trunk, Other Eastern and South-Western. The statement follows:

Gross Earnings

July	1909	Gain	Per Cent.
Trunk Eastern	$ 6,950,872	$1,228,767	21.4
Trunk Western	5,707,005	308,914	5.7
Other Eastern	823,510	150,881	22.1
Central Western	6,264,183	294,905	4.9
Granger	1,711,950	133,151	8.4
Southern	13,324,467	586,344	4.8
South-Western	9,416,697	800,698	9.3
United States roads	$44,198,684	$3,503,660	8.6
Canadian	7,004,000	808,000	13.0
Mexican	4,422,621	209,000	4.9
Total	$55,625,305	$4,520,660	8.8

CANADIAN NORTHERN RAILWAY.

Earnings and operating expenses for July:

	1909	1908	Increase
Gross earnings	$843,500	$728,500	$115,000
Expenses	613,900	525,600	88,300
Net earnings	229,600	202,900	26,700
Mileage in operation	3,094	2,874	220

Statistics just issued by the Board of Trade in London, Eng., show that not a single passenger in the United Kingdom lost his life in a train wreck during the year 1908, though many persons were killed by railway trains in various other ways, such as crossing the tracks, trespassing, etc.

GRAND TRUNK SYSTEM.

The Grand Trunk Railway reports as follows for the six months ended June 30 last:—

	1909	1908	Changes Increase
Gross earnings	£2,866,400	£2,919,200	*£52,800
Operating expenses	2,079,200	2,137,300	58,100
Net earnings	£ 787,200	£ 781,900	£ 5,300
Other income	58,100	.....	58,100
Total income	£ 845,300	£ 781,900	£63,400
Charges	498,600	485,900	12,700
Balance	£ 346,700	£ 296,000	£50,700
Can. Alt. def.	41,100	68,900	*27,800
Det. Gd. Hav. def.	25,700	46,600	*20,900
Surplus	£ 279,900	£ 180,500	£99,400

* Decrease

SITTINGS OF THE DOMINION RAILWAY BOARD.

It is the intention of the Railway Commission to make a trip to the Pacific coast. Sittings will be held as follows: Winnipeg October 11; Brandon, October 13; Regina, October 14; Saskatoon, October 15; Prince Albert, October 16; Edmonton, October 20; Calgary, October 22; Vancouver, October 27; Victoria, October 29, and at Nelson and Lethbridge at later dates. Assistant Chairman Scott will preside at the sittings.

The annual meeting of the Grand Trunk Pacific Railway will be held in Montreal on September 21, and that of the Grand Trunk Pacific branch lines company on the 15th of September.

The earnings of the Grand Trunk Railway for the six months ended June 30 show good advances. The net clearings show an increase of $26,500, and the surplus now amounts to $497,000. The expenses have been reduced considerably and general improvement is shown.

PERSONAL.

MR. J. M. CAMERON, formerly C.P.R trainmaster at Grand Forks, succeeds Mr. S. L. Prenter as trainmaster at Vancouver.

MR. G. H. BRYSON, formerly of Ottawa, and recently city engineer of Nanaimo, B.C., has been appointed assistant to City Engineer Topp of Victoria, B.C.

MR. ROBERT REID, of Ottawa, a member of the National Transcontinental Railway Commission of Canada, died suddenly on August 22nd at the Sparhawk Hotel, in Ogunquit, Maine. He was born in London, Ont., 53 years ago, and had lived there previous to his residence in Ottawa. On the establishment of the National Transcontinental Board in 1904, Mr. Reid was one of the first chosen to act on it, his appointment dating from September 1, 1904. He had held office continuously since that time. He was an Anglican in religion and was a member of both the Rideau and the Country Clubs, having resided in Ottawa for the last five years.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

LINDSAY OZONIZATION AND THE ONTARIO PROVINCIAL BOARD OF HEALTH.

A few weeks ago we had occasion to make some remarks upon the ozonized water at Lindsay. The criticism was confined to an examination of an analysis made by Dr. Archibald, of Toronto University. The deductions made were: (a) That the analysis showed that ozone removed less bacteria than the rough filters by which the water was primarily treated. (b) That the total number of bacteria removed by the joint process of both rough filtration and ozone was below the standard required of ordinary mechanical filters. The above deductions were simply matters of fact apparent at once upon an examination of the analysis.

The local Lindsay newspapers, however, made other deductions and came to different conclusions. In fact, they went into hysterics over the wonderful work and efficiency of the plant. It was stated that mose impure water was rendered pure by ozone to a degree never rendered by any other method. These conclusions have been advertised by other papers, with the result that an altogether false impression has got abroad with reference to this, the first instalment of ozone water purification in Canada.

The town council of Lindsay, we consider, are much to blame in the matter. Instead of waiting until the supreme authority of Ontario, viz., the Provincial Board of Health, has given its verdict on the plant, they adopted the plant as satisfactory on the strength of Dr. Archibald's analysis, which he, himself, admits as being practically useless as a measure of the efficiency of the ozone, there being so small a degree of biological contamination in the raw water to commence with.

For some reason or another a report has been circulated that the Provincial Board of Health has shown no anxiety to test or examine the Lindsay plant; in fact, have looked askance upon the whole venture. It is a fact that up to the present the Board of Health has not made any final or conclusive test, nor has it pronounced any verdict upon the process. Apart from the above report, however, we find that another has also got abroad, viz., that the Provincial Board of Health has accepted the process as satisfactory. This is no doubt due to a false understanding that Dr. Archibald has some connection with the Board. Dr. Archibald's tests, analysis, and reports are entirely in a private capacity, and are not recognized by the Board.

As to the question of any apathy on the part of the Provincial Board, we find, on enquiry, that the facts prove the reverse. It, as a body, is anxious and ready at the present time to make a thorough and complete examination and report, but is only stopped from so doing by those responsible for the plant, as they claim that certain alterations and additions have yet to be made to complete the work. It is expected that these alterations, etc., will be completed about the 10th of September. As soon as the plant is in a complete state, and ready to the satisfaction of those responsible for the process, the Board will make a thorough and extended examination, taking samples for analysis from day to day, in order to show the efficiency of the preliminary filtration and the amount of purification effected by the ozone contact.

There exists neither in this journal nor in the mind of the Provincial Board of Health any prejudice in the matter. Ozone treatment of water is no new experiment; it is new, however, in Canada. There exists no definite data anywhere as to the practical efficiency of ozone as a sterilizing agent in practice, although many laboratory experimental results have been published. Unfortunately, laboratory experiments have a tendency to give efficiencies which are not always obtained in practice. It is, therefore, natural that we keep an open mind until some real working data based on conclusive tests are made. We have said that the council are much to blame, in that conclusive deductions were published before the works received the Board's sanction. As a matter of fact, the Lindsay council at the very commencement of the work ignored Section 30 of the Public Health Act, and never submitted plans or gave notice of their scheme to the Board of Health. It was not until Dr. Amyot was communicated with on May 3rd, 1909, that the Board had any knowledge that such work was in progress. Dr. Hodgetts (Secretary to the Provincial Board of Health) at once called the attention of the Lindsay authorities to this section of the Act, and on May 13th Lindsay supplied the Board with particulars and copy of contract with the company responsible for the installation.

On June 1st, the earliest date possible, a meeting of the Provincial Board of Health was held, it was decided that the chairman (Dr. Sheard) and secretary (Dr. Hodgetts) should inspect the plant and decide what tests and examination were necessary.

On June 7th, the Provincial Board received a letter from the contractors, asking that the visit be deferred, as some improvements to the works were yet necessary.

On June 26th, the contractors asked that an appointment be made for the above inspection. Dr. Hodgetts replied that he would arrange with Dr. Sheard to make the inspection at an early date, Dr. Sheard being at that time on a vacation. In the meantime the Lindsay authorities asked for sterilized bottles in order to convey samples of the water to Dr. Amyot for analysis. Dr. Hodgetts replied on June 30th that no analysis or test should be made until the Board had made its inspection and arrange for such. The inspection was delayed, owing to Dr. Hodgetts having to visit the West on or about the return of Dr. Sheard to Toronto. Lindsay then determined to ignore the Provincial Board of Health for a second time, and called in a private chemist, who produced the analysis on which we have formerly commented, and which, as far as the efficiency of the plant is concerned, is of no value.

On July 20th, the Provincial Board of Health "en masse" made a visit to the Lindsay plant, and at the request of the mayor undertook to at once make a complete test and examination of the whole plant. Dr. Amyott and Dr. Nasmith visited the works to make the arrangements, and were informed by the contractors that such could not be made until the 10th of September as the works required further alterations and additions to complete them.

Authorities in Ontario should learn that the Provincial Board of Health exists for their benefit, and if duly and properly consulted can give good and sound advice. It does not exist, however, for the purpose of bolstering up any fad, or providing a pull on behalf of any company or patent vendors. Dr. Sheard (the chairman) is not handling his own funds, and is, therefore, not likely to advise or agree with experimental work carried out with other people's money, and when he, through his Board, gives advice, it is natural that he insists that such advice is based on known and proven data. We cannot expect him to form opinions and to advise his Board to come to any conclusion on this Lindsay plant until these requisite data are before him.

The value of a central health authority to Ontario is great in checking what may be useless expenditure and insisting upon efficiency; but that value depends, in its practical application, upon the confidence and willingness of local authorities to act in unison with that central authority, and not attempt either through ignorance or carelessness to ignore the authority as Lindsay has evidently done in this case.

[Proofs of the above article were submitted to the chairman of the Provincial Board of Health, who stated that this article fairly and accurately represents the facts of the case, and suggested no alterations to the original proof.—Ed. San. Rev.]

MECHANICAL FILTERS.

So many enquiries have of late been sent in relative to mechanical filtration as applied to water supplies that we consider a few remarks embracing such enquiries will best meet the occasion.

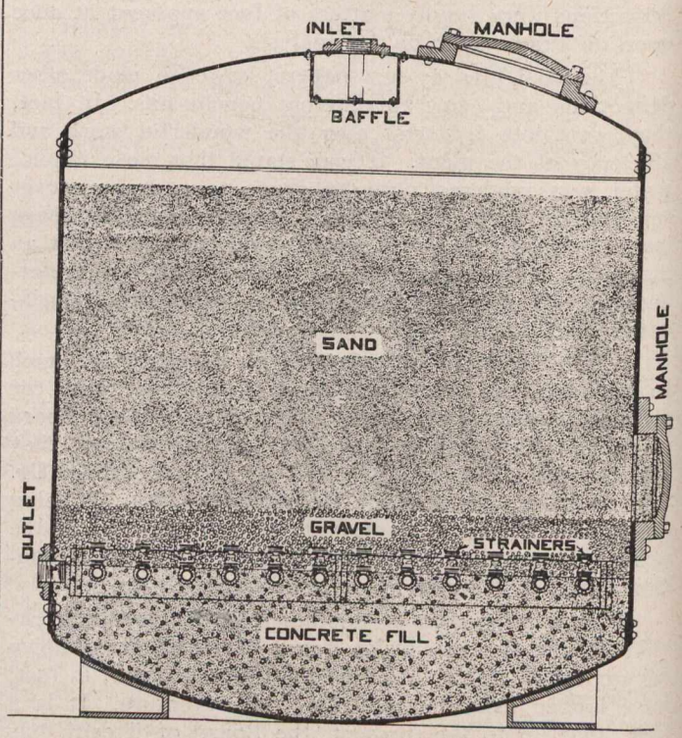
Mechanical filtration of water is not a perfect process, neither is slow sand filtration, and up to the present all methods of sterilization in practice also show certain degrees of imperfection. There are many who are content to judge of an apparatus or process entirely from its inefficiency standpoint without giving due consideration to its efficiency, and comparing reasonably the degree of efficiency of any particular process with others. We find such people in everyday life taking this standpoint relative to ordinary things. For instance, the man who could easily afford a motor car, and who would enjoy the use of one, is content to do without, because he thinks that the motor car may yet arrive at a greater degree of perfection. As absolute perfection, in human contrivances, is unobtainable; such a man goes through life without ever enjoying the leading products of his age.

How often we find the statement made: "Filtration of water is all very well if properly attended to, but it requires care and nursing in order to obtain satisfactory results." Is there any machine or mechanical structure which will give its maximum efficiency if not properly attended to? Why judge of the efficiency of a machine when it is the efficiency of attention which is at fault?

Slow sand filtration in the past has not been the success in America which it has in the countries of Europe. This is not the fault of slow sand filtration; it is entirely the fault of those in charge of the works. Mechanical filtration may be said to be more purely American in its use. It was first used in connection with paper mills to remove the larger particles of matter from the great quantities of water used. At first these filters were simply constructed of wood in the form of cylinders filled with sand and gravel, filtering at the rate of from one to two million gallons per acre per day. Great improvements, however, have been made in their construction; and, with additional precipitation, by aid of coagulants, they have been operated for municipal supplies with most satisfactory results. The 1908 annual report for the city of Harrisburg, Pa., shows efficiencies of 99.62 per cent. for bacterial removal, this being the average for the whole year. The above result is not unusual, as the writer is acquainted with a number of plants giving average efficiencies of 99.5 per cent. and 99.75 per cent. It is the custom, however, and we ourselves must confess to be guilty, of referring more generally to plants which by no means attain such high efficiencies. Criticism, as a rule, is directed at defects, but in dealing with the question generally, it is fair to point our really what can be done, and is done, with proper attention. In all cases of failure the cause can generally be detected, and is invariably found to exist apart from any inherent defect in the filter. Causes of failure are frequently found in inattention to cleaning, improper use of coagulant, the omitting of any coagulant when such is necessary, too great a rate of filtration for the filter capacity, etc.

The Imperial Board of Health of Germany in 1894 drew up articles relative to filtration of surface water for the direction of public supplies. Two of these articles are as follows:—

(a) "The operation of a filter is to be regarded as satisfactory when the filtrate contains the smallest possible number of bacteria, not exceeding the number which practical experience has shown to be attainable with good filtration at the works in question. In those cases where there are no previous records showing the possibilities of the works and the influence of the local conditions, especially the character of the raw water, and until such information



SECTIONAL VIEW OF FILTERS, STYLE "L"

is obtained, it is to be taken as the rule that a satisfactory filtration will never yield an effluent with more than about 100 bacteria per cubic centimeter.

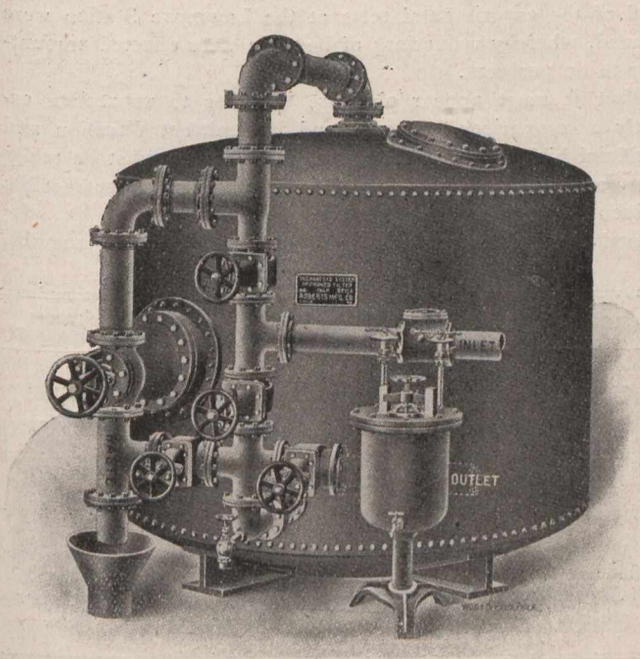
(b) "The filtrate must be clear as possible, and, in regard to color, taste, temperature, and chemical composition, must be no worse than the raw water."

From the above we see that more importance is given to biological purity than to chemical. The German biological standard has been greatly accepted, and makers of mechanical filters undertake to give a guarantee to meet this standard. There is no difficulty whatever, with care and attention in producing an effluent of a higher degree of purity than this standard, as we shall shortly see. It is necessary to reduce bacterial removals to percentage figures in order to compare processes and gage individual efficiencies. It must be noted that percentage removals, no matter how high, are no criterion of the purity of a drinking water, as such percentages may apply to water containing enormous numbers of micro-organisms, and a 99.9 per cent. removal may still leave a number of bacteria far above the standard limit for drinking waters. The percentage removal is an absolute test of the work done by the

filter; the bacteria remaining is a test of whether the water can possibly be made into a drinking water by the process.

We have said that the addition of a coagulant greatly improves the quality of a filtrate. In this connection we would quote from a Report of the "Joint Special Committee to Examine and Report Relative to the Pollution of the Water Supply and the Best Method of Filtration."—City Document No. 15 of the city of Providence, R.I.:—

"If the diameter of matter floating about in water is much less than that of the interstices between the grains of sand composing the filter-bed, such matter, except as much as is caught upon the sharp edges of the quartz, will go right through the filter with the water.



Roberts' Steel Tank "L" Filter.

"Now, if a substance could be introduced, drop by drop, into the water before it comes to the filter-bed, which would have the effect of curdling the matter together, so that every one hundred or so of the smaller particles were made to join together and become one large particle, much as vapour or steam is condensed into drops, it would follow that they would be caught and held from going through the filter. This is accomplished by adding dissolved sulphate of alumina (alum) to the water as it flows to the filter.

"The amount required is from almost none at all to about three-quarters of a grain, according to the state of the water, say, an average of from one-quarter to one-half grain per gallon in the ordinary condition of the Pawtucket River water.

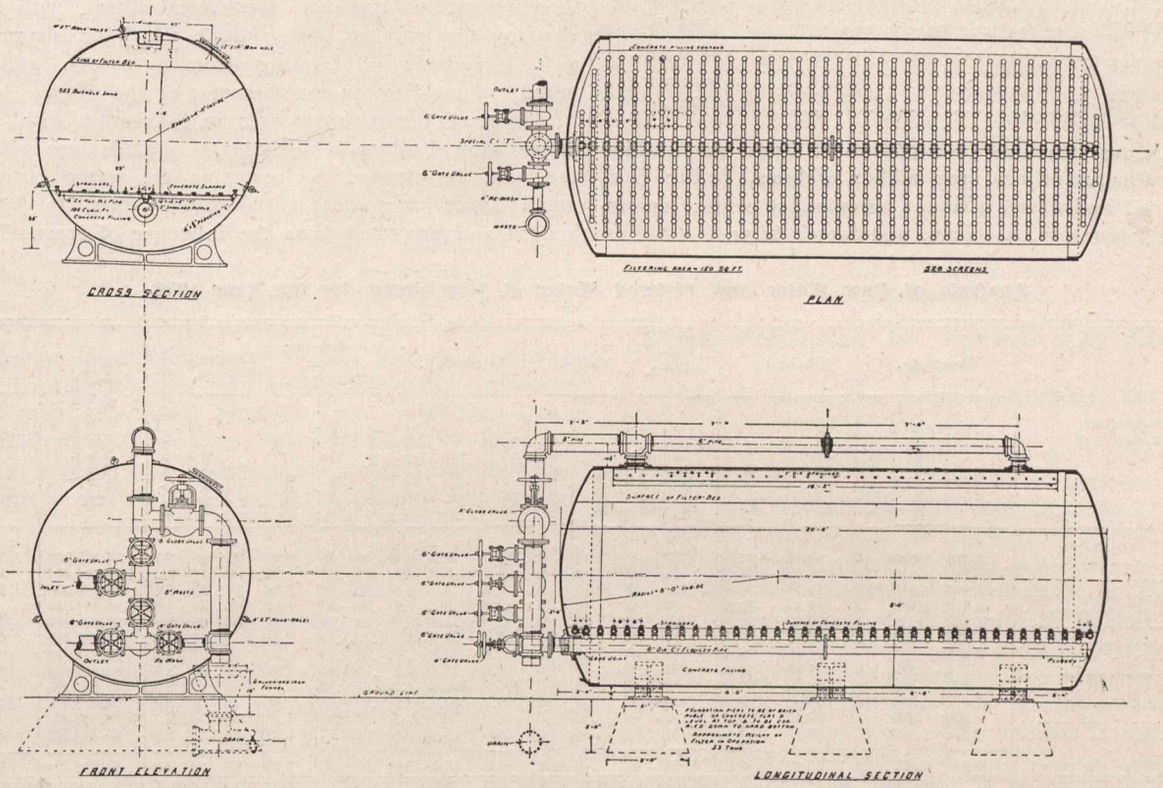
"The action is the same as when coffee is cleared by means of the white of egg. No white of the egg goes to the drinker of the coffee—it is all drained out with the grounds; and, as no alum goes to the drinker of the water, it unites with the impurities in the water and settles in feathery flakes of insoluble hydrate on the top of the filter, and is washed out with its accumulation of impurities when the filter is cleaned.

"The analysis of the purified water shows no trace of the alumina used, while the analysis of the wash water shows that the alumina is all washed out with other impurities. This feathery bed of precipitate flakes produced by the alum forms a filtering material of insoluble mineral matter which is well nigh perfect in its character. Bacteria are like the very fine particles of clay of some water, so small as to pass the sand or quartz, but they are caught by the feathery precipitate of alumina hydrate, much as the bacteria contained in the air are prevented from entering a vial closed with sterilized cotton."

The above is a very lucid and exact description of the use of a coagulant, and its importance in connection with a filter will be at once appreciated when understood. With reference to the amount of alum required, we may state that one drop of alum solution in one hundred drops of fresh water is an appreciable proportion, and would probably impart a slight taste; one drop in one thousand is scarcely comprehensible; one drop in ten thousand is inconceivable, and would be difficult to detect by the most delicate chemical tests.

One drop of alum in solution to one hundred thousand drops of water (about six-tenths of a grain to the gallon) is sufficient to render an average turbid water bright.

The operating expenses for the Harrisburg mechanical filtration plant for the year 1908 were as follows: Treating 3,358,029,150 gallons, of which 3,271,782,550 were delivered



Sectional Views of Roberts' Standard Horizontal Pressure Filter.

to the pumps and 86,246,600 gallons, or 2.6 per cent., of the whole used in washing, as follows:—

Coagulant	$ 5,919 27
Coal	2,043 92
Oil and waste	297 39
Supplies	837 95
Repairs	639 89
Laboratory	1,395 76
Labor	8,209 33
Total	$19,343 00

The above amounts to a charge of $5.91 per million gallons. Coagulant cost per million gallons, $1.81; coal, 62 cents; oil and waste, 9 cents; supplies, 26 cents; repairs, 20 cents; laboratory, 42 cents, and labor, $2.51.

sand filtration; they will also compare equally with the best results of slow sand filtration. There is no reason why equally good results may not be obtained by proper attention and care at any mechanical plant installation, granted, of course, a properly designed filter of suitable capacity.

By permission of the Roberts Filter Co., of Philadelphia, U.S.A., we are enabled to produce illustrations showing various types of mechanical filters, with sections showing the working parts. Style "L." for instance, per unit, is capable of treating from 84 to 200 gallons per minute, depending on the diameter of the filter.

Some of the main features in connection with the use of mechanical filters in this country are the ease with which they can be cleaned by reversing the water current, the small space they occupy, allowing them to be easily housed and protected from the influence of frost. There is

Analysis of Raw Water and Filtered Water at Harrisburg for the Year 1908.

Daily Average for the Month of	Bacteria.			Efficiency.		Tur-bidity.		Color.		Alkalinity.			Grains per Gallon Coagulant.			Length of Runs.		% Used in Washing.	Average Rate per Million Gallons per Acre per Day.	Tap Water		
	River.	Sed Basin.	Filtered.	Sed. Basin.	Plant.	River.	Filtered.	River.	Filtered.	River.	Filtered.	Parts Used.	Sed. Basin.	Coag. Basin.	Total	Hours.	Minutes.			Bacteria.	Turbidity.	Color.
January	5,059	2,040	15	59.68	99.71	33	0	11	0	13.2	6.7	6.5	.48	.52	1.00	13	58	2.7	84,492,000	16	0	0
February	22,152	6,610	99	70.15	99.57	93	0	13	0	25.8	19.0	6.8	.82	.45	1.27	16	12	2.3	90,914,400	83	0	0
March	15,894	4,113	23	74.12	99.85	162	0	17	0	13.3	4.3	9.0	.89	.63	1.52	15	50	2.4	87,100,000	22	0	0
April	3,812	1,165	5	69.44	99.87	36	0	12	0	12.2	5.1	7.1	.60	.54	1.14	16	49	2.0	85,487,040	9	0	0
May	5,168	1,283	4	75.17	99.91	96	0	15	0	12.6	4.7	7.9	.73	.56	1.29	16	06	2.2	84,388,000	13	0	0
June	588	299	6	49.92	98.98	11	0	6	0	34.7	29.6	5.1	.11	.61	.72	12	47	2.6	86,676,480	26	0	0
July	2,275	580	8	74.50	99.65	119	0	10	0	60.0	55.6	4.4	.25	.71	.96	13	21	2.6	87,824,320	36	0	0
August	654	333	9	49.08	98.66	21	0	6	0	79.6	73.5	6.1	.15	.68	.83	16	06	2.3	83,147,904	78	0	0
September	997	475	11	52.36	98.99	12	0	4	0	106.9	102.6	4.3	.05	.70	.75	9	52	3.3	87,723,360	60	0	0
October	1,099	873	19	20.53	98.25	16	0	5	0	98.1	92.9	5.2	.20	.71	.91	9	43	3.6	91,470,960	32	0	0
November	306	223	4	27.11	98.86	5	0	3	0	98.3	90.6	7.7	.50	.60	1.10	14	15	2.1	90,400,320	6	0	0
December	2,731	1,473	68	46.06	97.50	17	0	5	0	95.3	85.7	9.6	.62	.77	1.39	12	12	2.6	85,240,000	59	0	0
Daily average for the year	4,949	1,662	19	66.43	99.62	52	0	9	0	54.6	47.6	7.0	.45	.64	1.09	13	29	2.6	87,658,704	36	0	0

The above analysis of a year's working leave nothing to be desired as far as efficiency is concerned, and the results will compare favorably with the averages from slow sand filtration, a distinct tendency being shown to adopt this method of filtration of river or surface water in the Western Provinces, where the question of frost is a great consideration.

SEWAGE DISPOSAL.

REMOVAL OF PUTRESCIBILITY.

Chapter III. (Continued).

Land Intermittent Filtration.

In our last issue we dealt with the question of the removal of putrescibility by discharging settled sewage on to land divided into plots or portions, so that each plot, or portion, would receive a certain dose of sewage intermittently. Certain towns, where this process has been in operation for a considerable time, were quoted, such as Framingham and Brockton, Mass., such being the direct result of the Lawrence experiments; and also at Berlin, Ontario, being the results of experiments carried out by the Ontario Provincial Board of Health. It has been shown that, given a certain quality and quantity of friable soil, satisfactory results may be obtained, as far as the removal of putrescibility is concerned.

In furnishing our readers with the analysis of the effluents from the Framingham and Brockton plants, no mention has been made with reference to removal of bacteria. Referring to the introduction to these articles, several of the experimental tests at the Lawrence Station were quoted, whereby reductions of bacteria were effected amounting to 97 per cent.

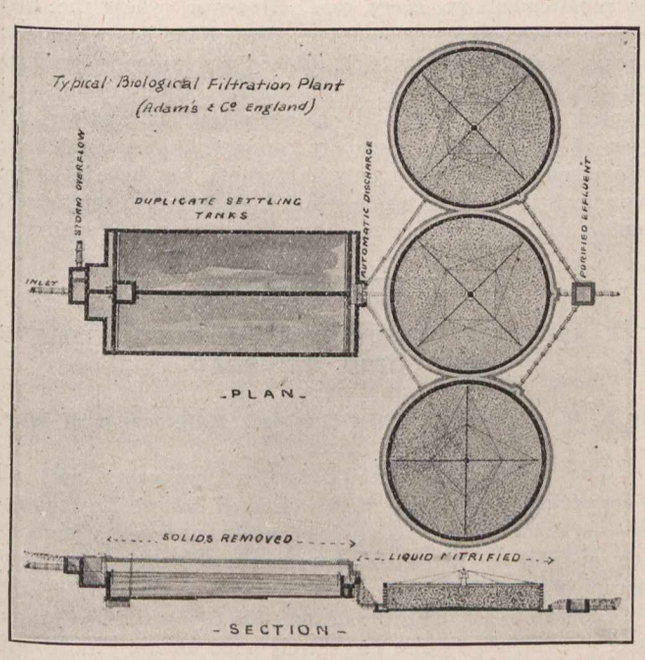
Now it must appear obvious, in order to appreciate exactly a comparison between land intermittent filtration and artificial biological filtration, that more issues must be taken into account than the rendering of a more putrescible effluent. A more putrescible effluent may be obtained by either process. There will always remain, however, many who will incline towards land treatment as biologically efficient and as an economical method of utilizing the manurial properties contained in the sewage as against the apparent wasteful process of artificial biological filtration.

The points now to be dealt with in connection with land intermittent filtration are as follows:

	ALTRINGHAM	ALDERSHOT CAMP	CROYDON	CAMBRIDGE	LEICESTER	NOTTINGHAM	RUGBY	SOUTH NORWOOD
Total number of Bacteria ... (Gelatine at 20° C.)	263,400 (99%)	183,266 (99%)	1,413,200 (95%)	711,476 (94%)	532,777 (95%)	Frequently less than 1,000	637,133 (97%)	778,322 (98%)
Total number of Bacteria ... (Agar at 37° C.)	7,275 (99%)	37,308 (99%)	112,000 (97%)	78,327 (94%)	70,500 (95%)	Ditto	81,526 (97%)	35,157 (99%)
B. Coli ..... (Approximate averages)	At least 100, but less than 1,000 per c.c.	At least 1,000, but less than 10,000 per c.c.	At least 1,000, but less than 10,000 per c.c.	At least 1,000, but less than 10,000 per c.c.	At least 1,000, but less than 10,000 per c.c.	Variable, but relatively satisfactory	At least 1,000, but less than 10,000 per c.c.	At least 100, but less than 1,000 per c.c.

(a) Efficiency with regard to bacterial removal; (b) Utilization of the manurial properties of the sewage on land; (c) Cost of treatment.

There is no doubt but that suitable land is much more efficient as a means of removing bacteria from sewage than the usual methods of sewage biological filtration. With land the particles of filtering material are necessarily much finer and therefore more efficient as a strainer, a very much greater area of filtering area is consequently required per given volume of sewage. The sewage has not only to encounter the perpendicular height of percolation but has also to pass through the lateral extent of area before it reaches the main effluent discharge. The question of bacteria removal, however, is not so much one of comparative degree, so much as whether land treatment is capable of removal to the extent of rendering a water practically more infectious. The percentage removal of bacteria may in the case of both land intermittent and artificial biological filtration be as high as can be produced by even slow sand filtration for drinking waters. The bacteria remaining in the effluents, however, may be far and away above the standard count allowed for drinking water. Referring again to the Lawrence Filter No. 1 where a bacterial efficiency removal of 97.3 per cent. was obtained, we find that the number of bacteria was reduced from about 1½ millions to 40,000 per c.c. The percentage removal is higher than that required in the case of mechanical filter plants by the United



States State Board of Health. The bacteria remaining to the number of 40,000 would require a further percentage removal of 99.6 per cent. to bring the bacterial count within the German standard for drinking waters by not more than 100 bacterial per c.c.

The fifth Report of the Royal Commission on Sewage Disposal states, par 194, page 142: "Our investigations have not shown that there is any essential bacteriological distinction between effluents from land and effluents from artificial filters, though effluents from land usually contain fewer micro-organisms than effluents from the artificial filters which are at present in use. The bacteria in the filter effluents can, however, be largely reduced, if this is necessary, by some additional process, such as sand filtration or sterilization, but for the reasons which are given under the section of this Report dealing with standards, we do not consider that the further process would usually be required."

From the above statement it will be noted that the Commissioners do not consider that there is any essential difference as far as bacterial removal is concerned between land and artificial biological filtration. The term essential must be taken as applying to drinking water standards.

The previous table gives the average figures for the bacteriological analysis of the final effluents from eight land intermittent plants in Great Britain.

A glance at the above biological analysis will convince anyone that in no case can the effluents be termed fit for drinking purposes. The chief advantage of land treatment as compared with other processes is often ascribed to the fact that land is more capable of removing pathogenic germs. This advantage, however, loses a great deal of its importance when we find that the effluents are so far removed from drinking water standards. In Europe the conclusions arrived at are similar to those of the Royal Commission. Schottelius, in connection with the Freiburg sewage and land treatment reduced the number of bacteria in the sewage from 790,600 to 6,700 per c.c. or a reduction of 99.2 per cent. Beckurts and Blaseirs at Brunswick were successful in ob-

(Continued on page 248.)

SOME FEATURES OF PAVING MATERIALS.

By W. M. Brown, C.E., Collingwood, Ont.

In the consideration of the laying of a good roadway there are primarily the adaptability of the material, also its durability, and cost of execution and maintenance. Where the traffic of vehicles may be conducted with facility, and the surface material offers the least resistance, while there is no protuberance formed or hollow made by the heavy weight of passing wagons, then such a roadway may be considered as well adapted for the purpose intended. The cost of the material and the labor entailed in laying, and the necessary grade in the construction of the roadway, enter largely into the calculations. The engineer's ingenuity is also brought into requisition in the consideration of the subsoil upon which the roadway is to be constructed, as much depends upon its character for the material and manner of manipulation to be adopted. To a community that has to be taxed for the construction, maintenance and repairs of a public roadway, the cost is a very important question. Yet, the kind and quality of the material, as well as the method of construction, should have the greatest consideration, as it is upon this basis that a proper estimate can be obtained which will be productive of the best results. Of course, much will depend also upon the locality where the roadway is to be constructed and the general traffic which it is likely to receive. There are several classes of roadways, viz., those in streets of cities and towns, suburban villages, private drives or country roads. For the paving of streets in cities or towns frequently vitrified brick, sheet asphalt, creosoted wood blocks, stone blocks, or asphalt blocks are adopted. Again, for suburban roadways sometimes macadam, tar macadam, vitrified brick or petrolithic may be utilized, while for ordinary country roads gravel or earth may be adopted.

In the formation and construction of streets in cities and towns, where considerable heavy traffic may be required, or where sewerage or drainage operations are to be taken into account, the kind of material that shall meet these requirements at the least possible cost and give the greatest satisfaction, is the one which shall meet with approval and be adopted. In the forming of public streets, smoothness of vehicular traffic, the minimizing of noise, the facility with which it may be swept and kept clean in a thorough, sanitary condition, and the means of access to sewerage or drainage operations without affecting the materials, and having them replaced satisfactorily in position—these are elements that are worthy of the greatest consideration. Of course, smoothness is a very important factor, but frequently the horses are apt to slip while running at too great a speed, but this may be obviated by reducing the pace and having the horses properly shod. There are some streets in cities where heavy-loaded wagons are prohibited from travelling, and which are strictly reserved for carriage or light vehicular traffic. In such cases materials may be adopted for the highest class of construction that shall have the

greatest durability and permanence, as the traffic is prohibited that would damage or wear the surface by the frequent and heavy weight of loaded wagons. As the pavements of streets in cities or towns are to be so constructed as to meet the valuation of the assessment for such purposes, there are several important features to be considered. Thus, the class of construction that shall be suitable for the parties to be assessed, its cost at first, then the cost of maintenance and repairs, the value of conducting the usual traffic and the effect which may be produced upon the values of adjoining properties, and the general business interests. A residential locality, where the streets are wide and the dwellings of the wealthy are situated, should have the best class of pavement for light vehicular traffic. The greatest smoothness of surface and the minimizing of noise, as well as permanence of construction, should be the essential features, as the rate at which the residents will be assessed should cover all the expense incurred in attaining this high standard of excellence. In the streets where warehouses or manufactories are situated, the class of construction should have the elements which shall meet the requirements of heavy-loaded traffic. The class of traffic has undoubtedly a very detrimental effect, more or less, upon the roadway, according to the construction of the latter. Yet a roadway, according to the roughness of its surface and the difficulty which is experienced in transportation, causes a wear and tear of the vehicles and an over-exertion in the horses employed, that in both cases result in an ultimate loss, which has to be reckoned upon in estimating its cost. It is, therefore, essential to consider the necessary requirements of a street before deciding upon the class of construction which in every respect would be the most suitable. The expenditure to be incurred is usually the basis that regulates the class of material to be adopted and the general method of construction. But we would here indicate some of the kinds of material and the elements in their composition which meet certain requirements in the construction of street paving. For horses the ordinary earth roads, when in proper condition, and creosoted wood blocks when dry, are considered the best. For general wear and tear, the asphalt and brick pavements have proved to be most advantageous. Where the earth roads are in an unsatisfactory condition the wear is considerable, and in the stone block pavements it has been calculated that it is three or four times as great as on asphalt or brick.

In considering the sanitary condition of a street pavement, the permeability of the material is an important factor. For where the surface water and the refuse matter penetrate the material, then a condition may be engendered which will produce detrimental effects upon the health of the community. The objection which is made to stone block pavement is that the joints when not made sufficiently close to keep out the water and dust, is that there is a difficulty of keeping it clean. It is important that the pavement be kept as clean as possible, in order to maintain a healthy condition of the surroundings. Of course, nearly all pavements produce more or less dust, but it should be reduced to a minimum by careful sweeping and watering. Roads which are constructed of earth and broken stones are more apt to wear rapidly, and so produce dust freely in extremely dry weather, and require frequent sprinkling and sweeping to keep them in good sanitary condition. Those elements which have an influence upon the durability of a pavement may be tabulated as follows: The component qualities of the surface material, which may be hard and tough, and so be the better able to resist the abrasion made by the feet of horses or the passing of vehicles. Again, the resistance which the composite parts of the material may have upon the variations of the weather and atmospheric influences. The solidity of the foundation also is of importance, so that the loads may be properly distributed, and thus maintain a uniformity on the surface. It is also essential that the roadbed be properly drained to keep the surface dry and enable the traffic to be conducted with facility. These and several other contingencies are mainly the influences which regulate the durability of the material in pavement construction. Blocks of granite, neatly shaped, closely set, and laid upon a firm, unyielding foundation, are considered to form the hardest and most durable surface of any of those pavements which are in common use. For this reason they are frequently adopted for heavy-loaded traffic. Next to stone may be classed asphalt and brick, which are very satisfactory, except under very heavy traffic. There is no doubt that the relative durability of any material in comparison with any other depends upon the composition of the several parts, and the resistance which it affords to those influences of the weather, or the amount of heavy traffic to which it may be subjected. When we come to the consideration of wood as a paving material, we find that, although less durable than other kinds of pavement, and suitable only for comparatively light traffic, yet, if it has no other advantages commensurate with its high cost of maintenance under heavy traffic, especially in a large city, then it would possibly require to be renewed every five or six years. For country or suburban roads, the use of broken stone macadam may be adopted, although its maintenance is generally high in cost, and it wears rapidly under heavy traffic. In some cases permanent pavements may be made of creosoted wood blocks, asphalt, or vitrified brick. Each of these methods, although possessing favorable features in some respects, yet has disadvantages under certain conditions. There are so many considerations to be taken into account in the construction of permanent roadways that it is no easy matter for the engineer to arrive at a decision that would meet all the requirements in every case. However, where the cost is no obstacle in his calculations, then, if he has a suitable subsoil, a good roadbed, well drained and properly graded, and the best of material in its surface composition, well adapted to the climatic and weather variations, and for the class of traffic which is usually conducted, he should have a pavement that will not only be durable, but have also the characteristic features which will be conducive to the health, comfort and convenience of those living in the community.

THE USE OF TITANIUM RAIL ON THE BALTIMORE AND OHIO RAILROAD.

By A. W. Thompson, Chief Engineer Maintenance of Way.

The attention of metallurgists and engineers and all users of iron and steel is being directed toward the remarkable development of alloy steel, or steel containing a percentage of various materials introduced to give it special mecanical qualities. Some of the so-called alloy steels have been known to a more or less extent for a long time. Chrome steel was introduced and extensively used for ore stamps and other purposes over twenty years ago, and about the same time nickel steel was made use of in the manufacture of armor plate. Steel containing tungsten was manufactured by Mushet, who was Bessemer's rival, and manganese steel is nearly as old as the others above mentioned. In general, however, they were confined to limited fields. More recently the use of alloy steel has been greatly extended, and some of the results from the use of these alloys, either singly or in combination, have been astonishing; that is, more than one alloy combined with the iron.

One important factor in bringing these steels into prominence was the need of a metal having exceptional strength and durability, at the same time possessing light weight and occupying small space. The use of such metals was demanded by automobile service and similar light machines which had to withstand especially severe shocks and strains. This probably led to a better knowledge of these alloys, and it was a case where the higher cost of production was not a prohibitive factor.

The requirements of steel alloy might be summed up as follows:

(1) High resistance to shock.
(2) The highest possible elastic limit.
(3) Resistance to abrasion.

(4) More generally the fulfilment of several of these requirements.

Some of the alloys best known to-day are manganese, nickel and chromium. Those fast coming into use, but which are more rare, are tungsten or wolfram, molybdenum, vanadium, uranium and titanium.

The actual effect of these alloys is not well understood even by expert metallurgists, but undoubtedly they all add valuable qualities to the steel. The older alloys, such as in the chrome vanadium, steel containing 1 per cent. to 2 per cent. vanadium, have shown most remarkable properties, one of the highest tests yet obtained, after a special treatment, being a maximum breaking strength of 103 tons per square inch, the steel showing at the same time a great resistance to bending and dynamic tests, a combination of properties not usually found.

Nickel vanadium steel shows great strength, but lower resistance to bending and blows.

Manganese in steel acts as an antidote for sulphur and phosphorus and perhaps other impurities, it prevents red-shortness and tends toward the formation of close and uniform crystallization, but an excess of this alloy makes steel cold-short.

The alloy with which we are more particularly concerned in this instance is Titanium. It is practically a new alloy commercially, and, as claimed by the manufacturers, it has only been on the market since October, 1907. Titanium received its name from fanciful allusion to the Titans; its chemical symbol is Ti; its atomic weigth is 48.17.

This metal is not found native, but as manufactured has a dark gray color, having a decided metallic luster resembling iron. It is found frequently combined with the protoxide iron and mixed more or less with the peroxide of the same metal. It is a widely distributed element in nature, being found in many minerals and rocks as well as in clays and soils, resulting from their decomposition, but it nowhere occurs in large quantities in any one location. It has also been detected in meteorites and the sun. It occurs combined also with oxygen, forming titanic dioxide or titanic acid and also in oxygen combinations with iron and calcium, and in some of the silicon. One of its most remarkable properties is its power of combining with nitrogen at a high temperature. Certain copper-colored cubical crystals, which are not infrequently found in the bear of blast furnaces and which were supposed to be pure titanium, were shown later to really be a combination of that element with other elements.

As titanium enters into the composition of so many iron ores, it is natural that it should have been found in many kinds of pig iron. A considerable number of patents have been taken out covering compositions of iron and steel in which titanium has played an important part. The so-called titanic steel was at one time extensively advertised as being of great excellence, but several chemists of reputation were unable to find any portion of this element after making analysis of the metal put upon the market under that name.

According to tests made by the American Foundrymen's Association and reported at their last convention, titanium strengthens cast iron. Gray cast-iron is strengthened about 50 per cent. and white cast-iron is strengthened about 20 per cent. or less. An addition of titanium alloy giving 0.5 per cent. titanium in the casting is sufficient to accomplish the full effect, although more will not be injurious. It is stated that, for titanium alloy containing as much as 10 per cent. titanium, it is well to have the carbon about 5 per cent. as it melts more easily in the ladle.

Titanium imparts valuable properties to steel, but its production commercially on a large scale is retarded because of the technical difficulties in producing the alloy.

An ore called rutile, with a high percentage of titanium, is found in our Southern States, but it has heretofore been used mostly as a pigment in potteries. The electric furnace has, however, admitted of great progress in the separation of these ores, and it is expected that it will be of great commercial value when the large bodies of ore in the Western and Eastern continents can be utilized.

The effect of titanium on steel as understood to-day is to give the metal greater destiny and strength. It unites with the nitrogen, and so far as is known at present, the greater proportion of the titanium apears in the slag, and very little, if any, of it is ever found in the finished material. This indicates its value to be that of a scavenger. It is applied to the hot metal just before pouring, either into the ladle or converter, and the metal allowed to stand from 3 to 15 minutes. The greatest trouble in this seems to be the haste in pouring the metal before the titanium as fully done its work. This haste in pouring is owing to the fear of the metal cooling too much.

The manufacturers claim one more result in the use of titanium, and that is freedom from blowholes and prevention of segregation.

The actual work which the titanium does is not yet fully understood, but it seems beyond question that a better final product results from its use and that a great field is open to engineers and metallurgists to bring the use of this metal under their control, and to obtain all the benefits that may result from using it in steel manufacture.

The experience of the Baltimore & Ohio Railroad with this particular alloy, used in rail, has been, of course, very limited and entirely experimental. During the month of June, 1908, 19 rails were rolled by the Maryland Steel Company, of the usual composition, to which was added 1.5 per cent. titanium alloy. This alloy was claimed to increase the elastic limit, ultimate strength, and remove a large percentage of the slag; also to make the rail less brittle and avoid extreme segregation and blowholes, leaving the metal homogeneous, tough and fine grained. The use of the alloy resulted in a rail with a composition high in carbon and phosphorus, which even then successfully passed the physical test.

The analysis made by the Maryland Steel Company of this rail shows the following:

C.	Mn.	P.	S.	Si.	N.	O.
0.701	0.92	0.086	0.048	0.079	0.004	Nil

An analysis made by our engineer of tests, Mr. J. R. Onderdonk,, shows the following:

C.	Mn.	P.	S.	Si.
0.57	0.86	0.074	0.039	0.045

These analyses vary somewhat in the percentage of elements, and, as before remarked, both of them show no trace of the element titanium.

The rails above referred to are laid in the eastbound track on the east end of the Cumberland Division, on what is locally known as Kessler's Curve, between Magnolia and Paw-Paw. This eastbound track carries a heavily loaded movement. The grades are light, not over 0.4 per cent. uncompensated, but the curve is a 9-degree, having an elevation of 6.5 in. and a standard gauge of 4 ft. 8¾ in. This curve has an approximate passenger traffic of 480,000 tons per year and a freight traffic of 28,300,000 tons per year. The roadbed is ballasted with broken limestone.

The analysis of the Maryland Steel Company shows that the titanium alloy has a great avidity for nitrogen, and if this is removed a high per cent. of carbon may be possible, producing a harder and yet elastic rail, giving much greater wear.

Through the kindness of Mr. Wm. F. Meredith, president of the Titanium Alloy Manufacturing Company, who controls the present process of manufacture of this alloy, there follows a reproduction of a blueprint showing a combination of tests, indicating the lack of segregation in the Bessemer ingot after treatment with ferro-titanium; also photos of treated and untreated rails, together with a set of micro-photographs of the steel.

It is somewhat unfortunate that the titanium rail was laid partly on the runoff of Kessler's Curve, but any allowance can be made for whatever effect this might have when considering the following tables showing the wear.

Previous to the laying of this titanium rail on Kessler's Curve a test had been made of high carbon open-hearth rail,

(Continued on page 241.)

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.]

CONSTRUCTON OF CONTRACT.

Wilson et al vs. Clark et al.—Messrs. Clark & Adams were contractors for the erection of an extension to the Intercolonial Railway Station at St. John, New Brunswick, and in September 1905 they sublet part of the work to Messrs. Wilson and O'Donnell, under a contract by the latter to drill or punch all holes required in the iron-work on the extension of the station, according to plans and specifications, at the rate of five cents per hole, which will include bolting and rivetting up.

The plaintiffs proceeded with the work and presented their bill charging five cents for the hole in each separate plate to which the defendants objected, claiming the plaintiffs were entitled to be paid only for one hole, though it might pass through a number of plates welded or bolted together; in other words that they could collect 5c. for every hole shown upon the plans but nothing more, regardless as to whether that hole passed through one plate or a number of assembled plates.

The dispute is purely as to the construction and proper meaning of the contract and the Court held the plaintiffs were entitled to payment for every hole in every separate plate.—38 N.B.R. 69.

FIRE INSURANCE—GASOLINE KEPT ON PREMISES.

Thompson Against Equity Fire Insurance Company.—The plaintiff was owner of a drug store in the town of New Liskeard, Ont., and he took out a policy of insurance for $2,000 in the defendant company, to run for one year from 25th May, 1906, and containing the following clause: "The company is not liable for loss or damage occurring while . . . gasoline is . . . kept or stored in the building . . . unless permission is given by the company." The plaintiff had a druggist in his store who occupied the rooms above the store. This man had a gasoline stove and, although no permission had been given by the company, he had used the stove several times and then discarded the same, leaving in it a small quantity of gasoline.

On the 4th of September, 1906, the druggist wanted to make some fruit essences and bethought himself of the stove as a means of heating. He brought it down, left it in a back room and also lighted it. Fire ensued and there was every reason to suppose that it originated from the stove. It appeared at the trial that the greatest quantity of gasoline ever obtained was one-half gallon, and that this was kept by the druggist tenant, without the owner's knowledge and it would seem even against the owner's directions.

Judge Riddell, before whom the case was tried, upheld the plaintiff's claim, reasoning that the words "kept or stored" were no wider than the word "stored" alone, and that the plaintiff did not, nor did his tenant, store gasoline upon the premises, and even said that, to lay aside current euphemisms, the case was an attempt on the part of the fire insurance company to defraud the plaintiff by refusing to pay the loss.

The Ontario Court of Appeal was of much the same opinion but when the case reached the Supreme Court a different construction was put upon the words. The Supreme Court held that "stored or kept" was much wider in meaning than "stored" alone, and meant in case gasoline in any way was kept upon the premises, whether habitually or otherwise, and they dismissed the plaintiff's action.

The plaintiff has now asked for and obtained leave to carry his case to the Privy Council.

RECKLESS RUNNING OF CAR—INJURY TO INFANT.

Lott v. Glace Bay Railway Company.—A motorman in charge seeing a child (two years of age) approaching the tracks sounded the whistle of the car he was driving. The child's attention was attracted and it stopped for a moment and looked at the car, whereupon the motorman applied full speed without waiting to see whether the child retreated or not and without making any further effort to get the child out of its dangerous position. The child resumed its course towards the track and was struck and injured. It was held that the conduct of the motorman was recklessness for which the company was liable. It was no excuse that he was endeavouring to comply with the time-table and prevent delay to passengers, he should have taken proper precautions to avert injury to the child which was too young to exercise discretion.—42 S.C.R. 220.

SEIZURE BY RAILWAY FOR UNPAID TOLLS.

Clisdell vs. Kingston & Pembroke Railway Company.—A company may, like an individual, institute an action for the amount due by way of tolls on goods carried, but by section 345 of the Dominion Railway Act the company may instead "seize the goods in respect whereof such tolls are payable and may detain the same until payment thereof, etc."

The defendant railway company upon several days, the last of which was 15th of August, 1908, carried coal and delivered same to the Wilbur Iron Ore Company upon the latter's own property. The coal thus delivered was stacked in the stock pile upon the Ore Company's property, and the freight charges were not paid.

On the 31st August, the Railway Company, intending to retake, so far as it could be identified, the coal carried and delivered by themselves, took possession of coal from this pile. It transpired that the Wilbur Iron Ore Company was in difficulties and that a winding-up order had been made against it on August 26, and the plaintiff, who had been appointed as liquidator under the order, brought action for the value of the coal the railway had taken and claimed that the latter had no right to the coal but should rank only as an ordinary creditor.

The Court has held that the Railway Company had not by virtue of its Act a lien upon the coal carried to such an extent and of so wide an application as to allow it to retake the goods which had been delivered. The Act does nothing more than confirm and establish the ordinary carrier's lien, which would terminate with the delivery of the goods, and the right of the company to seize and detain should have been exercised and enforced before there was an absolute and unconditional delivery of the goods to the Ore Company, and the plaintiff, the liquidator for the Ore Company, was, therefore, entitled to have the coal returned to his custody.

In the meantime the Railway Company had endeavored to sell the coal but were unable to do so. Upon failure to sell after reasonable efforts, and as the cars on which the coal was placed were required, the coal was mixed with the defendant's own coal and used by the Railway Company for

their own purposes. It was held, therefore, that as the particular coal in question could no longer be followed, the Railway Company were responsible for the fair cash value of same.—18 O.L.R. 169.

NEGLIGENCE, DANGEROUS OPENING.

Collins vs. City of St. John.—In January 1906, one Jane Collins, who was living with her husband at Lepreaux, N.B., crossed by the city's ferry boat to do some shopping in St. John. The boat reached the city side about 8 o'clock in the evening and the usual warning being given that passengers might land, this woman together with others made for the landing but while getting off she fell between the boat and the wharf.

Evidence showed that the particular ferry upon which she crossed did not exactly fit the slip and that when the down tide struck her stern as in this case, the starboard bow was withdrawn from the east side of the wharf and vice versa, leaving an unprotected gap, possibly twenty inches in width. Into this aperture, Mrs. Collins fell and, though she escaped drowning, sustained injuries which resulted in her death two weeks later, and her husband brought this action for damages against the city.

It was held that it was negligence on the part of the city to leave such an opening unguarded, and that if passengers were allowed to disembark at the side, they should have been directed to the gang plank, and there should have been some sort of guarding rail to protect passengers when crossing.—38 N.B.R. 36.

SHIPS AND SHIPPING—NEGLIGENCE OF MASTER—LIABILITY OF OWNER.

Grenier et al vs. Connolly.—In August 1903 the tug known as "Mersey" and owned by Connolly left Quebec and when near Point Outward, on the Lower St. Lawrence, she was wrecked and two of her crew drowned.

This action was to recover damages in consequence of the drownings. After a formal investigation into the cause of the foundering of the ship, the wreck commissioner reported that the ship was seaworthy when she left Quebec on her last voyage, also that her lifeboat and appliances were sufficient to have saved the lives on board had the master made proper use of them, and that the evidence did not explain the cause of the casualty in which these sailors lives were lost. It was also found, however, that the master and mate had been guilty of cowardice and desertion of the ship and their certificates were cancelled. The defendant pled that his ship was seaworthy and that the disaster was due entirely to the perils of the sea and he was not answerable, but the Court has given judgment holding the owner liable. —42 S.C.R. 242.

THE USE OF TITANIUM RAIL ON THE BALTIMORE AND OHIO RAILWAY.

(Continued from page 239.)

rolled by the Maryland Steel Company, versus Bessemer steel rail, rolled by the Cambria Steel Company; and also a test of high carbon open-hearth steel rail, rolled by the Pennsylvania Steel Company, versus Bessemer rail, rolled by the Cambria Steel Company. The first-mentioned test was started on April 5, 1906, the rail being finally removed in August, 1907, after a life of 15½ months. The section of all these rails was 100-lb. A. S. C. E.

Rail No. 18 of the first test showed the following analysis:

High Carbon Open-Hearth.

Carbon	0.60	Phosphorus	0.018
Sulphur	0.21	Manganese	0.500

No analysis is on record of the rails of the second test.

The results of the first test are as follows:

	Wear.	Flow.
High Rail—Bessemer	0.54 sq. in.	0.051 sq. in.
High Rail—High C., open-hearth,	0.48 "	0.028 "
Low Rail—Bessemer	0.47 "	0.075 "
Low Rail—High C., open-hearth	0.46 "	0.048 "
Average—Bessemer	0.505 "	0.063 "
Average—High C., open-hearth	0.47 "	0.038 "

A table showing the wear in square inches of the second test, that is, the Pennsylvania Steel Company's open-hearth rail versus the Bessemer rail rolled by the Cambria Steel Company was as follows:

Pennsylvania Steel Company.

	—High Rail—		—Low Rail—	
Time.	Wear.	Flow.	Wear.	Flow.
5 months	0.13	0.00	0.15	0.04
14.5 months	0.39	0.02	0.38	0.07

Bessemer.

	—High Rail—		—Low Rail—	
Time.	Wear.	Flow.	Wear.	Flow.
5 months	0.15	0.00	0.15	0.04
14.5 months	0.42	0.01	0.40	0.10

Average Wear.

5 months—Pennsylvania Steel Co.	0.135	Bessemer.	0.15
14.5 months—Pennsylvania Steel Co.	0.395	Bessemer.	0.41

The two previous tests have shown no decided advantage of the open-hearth rail over the Bessemer rail under such heavy traffic and such heavy curvature.

From the observation of the Titanium rail, which has been in track, the following average square inches of wear was indicated:

In 2 weeks	0.027
In 7 weeks	0.133
In 17 weeks	0.180

An examination of these figures shows that in seven weeks the Titanium rail has worn as much as the other rails in approximately five months. There is something misleading in these figures, as observation on the ground seems to show that the Titanium rail is holding up considerably better than Bessemer rail. These amounts of wear were obtained from the rail section machine, and an examination of the section shows that the Bessemer rail the greater proportion of the wear was on the inside of the head on the high rail and on top of the low rail, while the sections of Titanium rail show the wear to be evenly distributed across the top. This would undoubtedly be due to track conditions; that is, from the effect of the elevation of the curve, and possibly the canting of the rail, but so far these figures show that in one place or another this number of square inches has been abraded from the rail.

Some explanation of this difference of wear may be had from tests which were made with the Scleroscope, the results of which are indicated on sections contained in the report on the Scleroscope. These tests showed most clearly that the surface of the Titanium rail was much softer than the interior, and that only the "skin" of the head was of such soft material. After wearing not more than is shown by the sections taken at the end of seven weeks, the harder material would be reached, and this metal showed about six points harder than an open-hearth rail which was tested. Thus it may be found that the increased life of Titanium rail will begin to show itself after a short period within which the soft "skin" will have been worn away.

All of these tests are in their infancy as to length of time, methods and actual knowledge of the subject being investigated, and only careful records and study will result in trustworthy conclusions.

The above notes are general and are given for what they are worth, as a step toward a better understanding of the whole matter.

The test now in progress on Kessler's Curve is to be carefully followed up, and all discrepancies will be fully investigated and an explanation given as the test progresses, but up to the present time nothing absolutely definite can be stated, as the Titanium rails have been in track only about five months, or rather less than one-half the usual period of service of the ordinary Bessemer rail.

REINFORCED CONCRETE.

By Arthur C. Auden.

MATERIALS.

An important point in connection with reinforced concrete frequently presents itself, namely, as to the nearest place where the materials, such as sand and gravel or chippings, can be obtained, and it is a question well worth close consideration because in nearly all instances the cost of the proposed structure will be of course affected by the cost of its constituents, and these are in turn much influenced by the cost of freight and carriage.

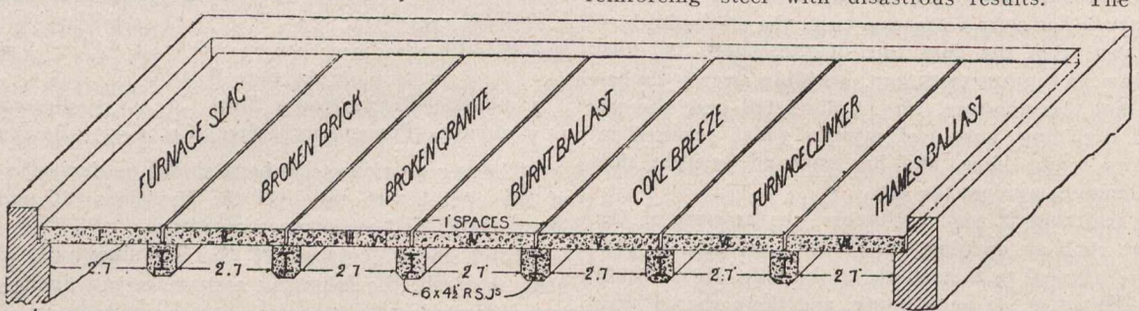
In many places the Eastern Counties flint is practically the only stone locally obtainable, but though this makes good, tough concrete, it is unreliable for fire-resisting purposes owing to its tendency to crack and "fly" under heat.

It is well known that coke breeze makes an excellent class of concrete, but it must be remembered that such cannot be regarded as being really fireproof.

In the case of ashes, only those that will float in water and which are of a uniform color and texture, and quite free from adhering pieces of coal and dirt, should be used, while with clinker only that which is really hard and clean is serviceable. In both cases if the washing and riddling or screening are carried out as one process, a more reliable result will be obtained. The question of sulphur must, however, be carefully watched.

Slag from furnaces, whether blast or cupola, makes also quite a good aggregate, provided it is hard and tough and free from dust, and its sulphur contents carefully noted.

As is well known, all clinkers, breeze, slags, etc., contain a certain amount of sulphur which is apt to attack the reinforcing steel with disastrous results. The maximum allowable percentage of sulphur in reinforced concrete aggregates is now being made the subject of tests and experiments. There is an important point in connection with the presence of sulphur, namely, that if it is in the form of "sulphate" it is practically harmless, but if in the form of "sulphide" it is very deleterious, and anything more than a very small amount indeed should not be allowed.



No. I.	No. II.	No III	No. IV	No V	No. VI	No. VII.
Top: Slab cracked across in two places.	Top: Slab cracked across in three places; slight curve downwards.	Top. Slab cracked across in three places, curved downward about ¼ in	Top No cracks; not curved downwards.	Top No cracks; not curved downwards.	Top Slab cracked across in two places, curved downwards about ¾ in	Top Slab cracked across in very many places; curved downward about 2 in
Underside; Curved downwards ¼ in.; slight cracks visible.	Underside: Curved downwards ¼ in.; slight cracks visible.	Underside. Curved downwards ¾ in.; no cracks visible; about 1 in. washed off by water	Underside: Not curved downwards; no cracks visible; about 3 in. washed off underside (in parts) by water	Underside: Not curved; no cracks visible; about 1 in. washed off underside (in parts) by water.	Underside Not curved, one slight crack visible, pitted in places about 1 in. deep by water	Underside: Curved downward 1¼ in., and had cracks all over in all directions, mainly longitudinally; much washed off by water

Fig 1.—Arrangement and results of Experiments by the British Fire Protection Committee with Concretes. composed of various aggregates.

The same remarks apply to limestone, but it has not the redeeming feature of being more fire-resisting after being broken; in fact, it is not advisable to be used at all where fire-resistance is an important consideration, as it is very apt to disintegrate to powder under the action of heat, but it is not to be condemned entirely as it is quite a serviceable material apart from increased fire risk.

Sandstone can be obtained in many parts of the country in almost unlimited quantities, but, as a rule, it is too soft, too porous and too absorbent for use in reinforced concrete work. Samples should always be taken and tested by crushing, and if it is found that it will stand about 1½ tons per square inch, and that the difference in weight, when clean and dry and after being two days under water, does not exceed 8 per cent., it may be safely used.

Quartzite stone is fairly good if not too soft and open in texture, in which case the same precautions apply as for sandstone.

With reference to what may be called artificially-produced aggregates, broken earthenware and stoneware from the potteries district make quite a good aggregate, but those who have not had experience with this material for reinforced concrete will be disappointed to learn that the same must be unglazed, thus preventing the use of the many hundreds of tons of broken crockery now existing in some of the older Pottery towns, as the glaze prevents the proper adhesion of the cement; but doubtless this difficulty will be surmounted in time.

Burnt clay and gault are quite permissable materials, provided that they are tough and hard and do not soften or "crumble" after being left in water for two or three days.

Speaking generally, broken bricks are not a good aggregate for reinforced concrete, although they have given excellent results in mass concrete. They are usually too soft and yield too much blunt dust, and have frequently old mortar adhering to them; if, however, they are hard and close in texture and free from mortar they may be safely used.

Care should also be taken with all artificial aggregates that no free lime is present; but, as in the case of sulphur, there are two forms of this material present, one the free lime referred to, which is dangerous and the other carbonate of lime which is practically harmless.

Before leaving the subject of aggregates, the author would draw attention to the recent important fire tests,

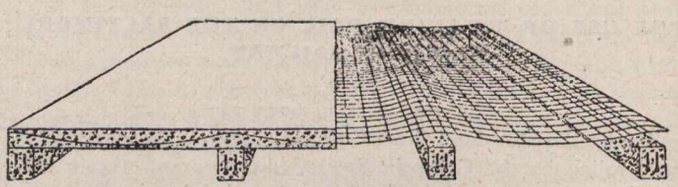


Fig. 2.—Reinforcement of Flat Surfaces; Wires or Rods held in place by Weaving.

made by the British Fire Prevention Committee, of concrete composed of various descriptions of material, the proportion of cement, sand and aggregate being identical in each case, i. e., 1-2-3, except with the burnt clay and coke breeze where there was no sand, the proportion being 1-0-5. The illustration, Fig. 1, kindly supplied by the British Fire Prevention Committee, shows diagrammatically the arrangement of the test, which was simultaneous, and exactly the same for all the slabs, which were all uniformly loaded to 224 lbs. per foot super. The remarks printed beneath each slab are of much interest as showing the behaviour of each

material after being quenched with water when practically red-hot. The slabs were all 10 ft. by 2 ft. 7 in. clear span. Engineers will be interested to know that the furnace clniker mentioned was obtained from off the bars of an ordinary steam boiler, not from destructors.

Sand.

Sand is, in some parts of the country, more difficult to obtain than any other constituent of reinforced concrete. A certain amount is absolutely necessary, and nothing up to the present is known which really and entirely supplies its place. Engineers having foundries will have a ready means of judging sand for reinforced concrete if they remember that, generally speaking, the better sand is for moulding, the worse it is for reinforced concrete. For instance, it must not "bind," that is, retain any shape when compressed, and it must be incapable of being smoothed with a trowel to a bright surface, or of "standing up" by itself when cut with a shovel; these being "rough-and-ready"

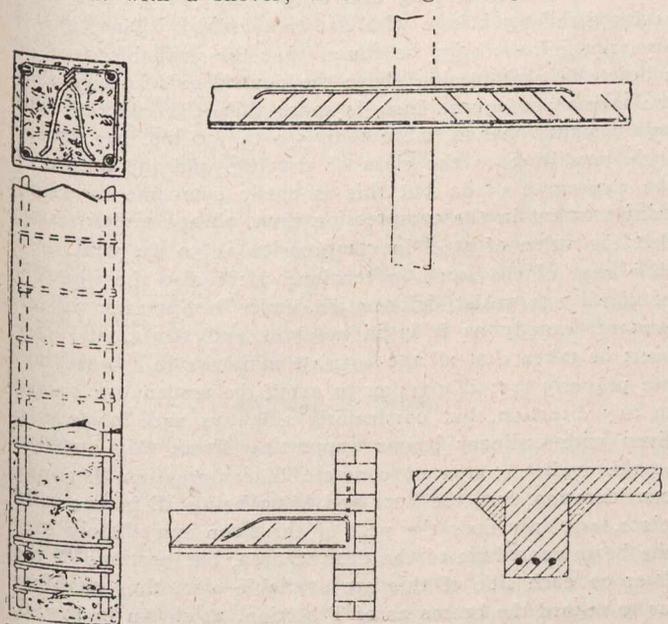


Fig. 3.—Arrangement of Column Reinforcement with vertical Rods and Loop-pieces.

Fig. 4.—Diagram showing Arrangement of Reinforcing bars and Shear Members to resist "Reverse Flexure" in Continuous Beam.

Fig. 5.—Diagram showing arrangement of Reinforcing Rods and Shear Members to resist "Reverse Flexure" in end of beam.

Fig. 6.—Diagram of Section of Beam and Floor showing increased area of Concrete in Compression.

methods of ascertainnig that the sand has what is required, namely, large sharp grains. Dirt in the form of slime, mud, or vegetable refuse is distinctly bad.

If sand is scarce or costly, some economy may be effected by regarding the very small pieces of the stone or other aggregate, below 1/8 in mesh, as sand, and mixing them with some real sand. The economy is not so apparent as appears at first because the small pieces must be screened out from the larger aggregate, and in most instances washed to remove the floury dust before being mixed with the real sand, ready for putting in the gauge boxes.

Reinforcement.

It is important that all reinforcement should be so designed as to possess a considerable amount of initial rigidity, so that it does not "sag" or "warp" or "twist" when placed in position in the mould boxes. Many illustrations regarding this could be quoted, but that of compression bars intended to be above the neutral axis in a beam, sagging down by their own weight till a portion of their length is below the said axis, where it is worse than useless, is not by any means as rare as it should be. The same remarks apply to lateral misplacement, particularly in the case of columns and struts, as well as to the pitching and spacing of reinforced bars or metal on flat surfaces such as floors, walls, etc. In these last-mentioned it is practically essential to have the bars or metal so designed that they cannot be knocked out of place, as it is almost impossible to keep a number of separate loose bars in proper pitch; it is advisable therefore that all reinforcements for this form of work be woven together, as shown in Fig. 2.

Punching or slitting solid plates into strips or bars is another efficient form of reinforcement for flat surfaces, particularly for those which are approximately square in plan, viz., where the strains are practically equal all over; but for flats where the length is considerably greater than the span, a wire meshing is cheaper os the cross-span wires take the load, the longitudinal ones being only necessary to keep the others in pitch, and it is not advisable to pay for metal and strength in the longitudinal directions where it is not wanted.

Auxiliary Tension Members in Beams and Slabs.

An examination of all the accepted specifications, for the last ten years, dealing with reinforcements will show that it is almost universally acknowledged that these important accessories must be inclined to the main tension bars and not be at right angles thereto, and also that such bars must be so designated as to retain absolutely their positions where they are connected to the main tension bars and cannot be slipped or moved along the same when ramming the concrete or otherwise.

Reinforcements of Struts and Columns.

There are two very distinct methods of reinforcement in use for these—one being that in which the vertical bars are prevented from spreading by being spirally wound with rods of wire, and the other where the same end is obtained by means of rings or loops of wire tying the vertical bars together, such loops or rings being arranged at various distances apart to suit the design and strength desired. Both these methods have good and bad points, each one being the best under appropriate conditions.

The spiral winding has given most excellent results, and is considered by many to be the best for columns, etc., as it permits the use of lighter and fewer vertical rods, but it has the disadvantage of being somewhat difficult to make it a "good mechanical job," that is, so that the spirals shall all be the same diameter and parallel in bore, otherwise some will clasp the group of vertical bars too closely and others hardly touch them, which results in unequal stresses.

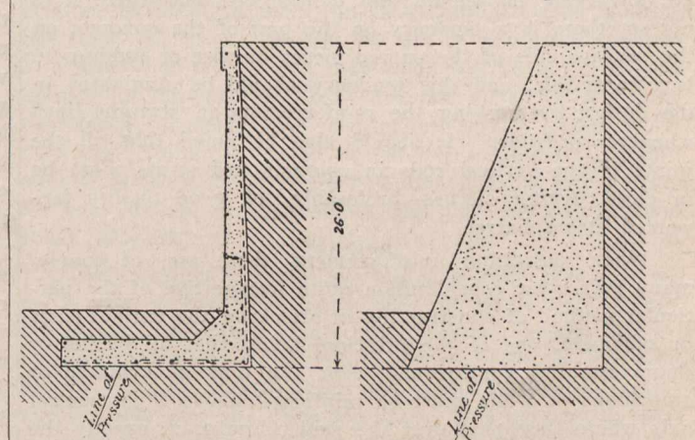


Fig. 7.—Comparison between Amount of Material required and useful space occupied in Mass Concrete and Reinforced Concrete Dock or Retaining Walls.

This is, however, generally made much easier by using bands of flat rectangular section which bend readily, and by first winding the spirals on a cylinder and then slipping them over the vertical bars when made. Great care must be taken when using spiral reinforcement in vertical columns that it is not made in too long lengths, as all the concrete has to be put in from the top of each length, and it is well known that when concrete is dropped from even a small height the mixture of its constituents becomes very uncertain. Care must also be taken that each length of spiral is "corkscrewed" well into the one below it, or otherwise there is a plane of weakness between each length of spiral. This form of reinforcement must be so designed

that the required strength is obtained without the pitch of the spiral being closer together than the size of the largest pieces of aggregate used, as if it is so, the stones become jammed between the coils and a lack of homogeneity is the result.

The second method of column and strut reinforcement above-mentioned, namely, loops or rings slipped over the vertical bars and held at the proper distance apart, as shown in Fig. 3, is also an excellent one, especially when the loops are carefully made mechanically on hard metal formers, so that each one is an exact replica of its neighbour; the result being that each one equally clasps the group of vertical bars, otherwise should one be tight and the other slack the bursting strains will not be taken up by all the loops in equal proportions. As the first desiratum of this design of column and strut reinforcement is the prevention of the vertical rods spreading apart under the load (the loops themselves, being further apart, do not resist the bursting strains on the concrete to the same extent as the spiral windings), it is not good practice to allow the loops to be curved in between the points where they touch the vertical bars. Unless the wire or rodding forming the loop is straight between its resistance points, it does not get a chance to develop its tensional strength, as it must "pull itself straight" first, which it does at a low stress. For this reason the use of comparatively high-carbon steel is often recommended for columns or strut loops, as it is stiffer to resist distortion, and as distortion is one of the main things to avoid, particularly in this phase of reinforcement, the use of harder steel, if the same can be obtained without any marked increase in cost, appears to be certainly indicated; in fact, as the elastic limit of all reinforcement is almost of as great importance as its ultimate strength, the use of bars and rods possessing considerable resistance to stretching is certainly to be recommended, provided that the said ultimate strength is not appreciably decreased. The use of high-carbon steels has been recommended for various other reasons.

It is often said that it is immaterial whether the reinforcing rods are bent or not, as, being bedded in concrete, they are immovable, and doubtless this may be true in a structure where there is no vibration and where the loads are unvarying in amount and disposition; but where it is not so, there is a tendency on the part of the concrete on the concave side of the curved pieces of wire or rodding to become friable, and this tendency should be eliminated in the design by working the reinforcement in straight lines whenever possible. It should also be noted that all the joints of the vertical rods in columns and struts must be in close fitting sleeves—preferably of good quality lap-welded steam barrel.

When designing reinforcement there are, of course, many points for consideration quite irrespective of the particular method of constructing or attaching the various parts or members, one of the principal being that all beams or floors running continuously over the tops of columns or stanchions or walls must be reinforced above their neutral axis where they pass over the said columns, in exactly the same way as they are reinforced below that axis in their clear span, as the parts in tension and compression are reversed in these circumstances. In one well-known system the bars are run along both top and bottom surfaces from end to end, but these rods or bars in the compression area or loops or stirrups in position, not as reinforcement or loops or stirrups in position, not as reniforcement against reverse flexure, nor as such in compression, this last not being needed unless the area above the neutral axis is such that it cannot stand the allowable crushing stress.

The exact position of this neutral transverse—or, more correctly speaking, diagonal—plane of "reverse flexure" has not so far been very exactly located, and it will, of course, vary with every variation in the distribution of the load. The present practice is therefore to design the reinforcemnt, over the supports, to overlap the ends of that which runs along the "belly" of the beam. The diagonal auxiliary shear-members connected to each of the main tension bars above and below the neutral axis thus become parallel to each other, as shown diagrammatically in Fig. 4, in the same way as the tension members in a lattice girder. The same arrangement must be carried out where the ends of beams rest on and in walls, and the diagram, Fig. 5, shows the reinforcements against tension due to the same reverse flexure above the neutral axis under these conditions. As will be noted, the ends of the bars are bent downwards into the beam itself when only the beam is reinforced concrete, but, should the whole structure be of this material, the beams and walls connsequently being all monolithic, it is better practice to bend the bars upwards, as shown in the dotted lines, this being also handier as the men can readily see, and, if necessary, adjust, any bar which may have been displaced by punning or otherwise.

When designing long and deep beams or girders such as for a railway bridge with flat (not arched) spans, it will also, not infrequently, be found that the available area of concrete in compression above the neutral axis is such that the stress per square inch is more than the concrete will safely stand, that is, more than 550 to 750 lbs. per square inch, according to the class of concrete and the nature of the aggregate used; but this is easily overcome by using reinforcement in the compression area, always remembering that the value of steel in compression is 50 per cent. less than that of the same in tension. Here also the question of rigidity to resist deformation under compression is important, exactly as it is in columns and struts, and care must be taken that all the separate members in compression are properly braced together to avoid the tendency to spread in any direction, but particularly sideways and downwards. Even with ordinary beams supporting floors this question of the available area of concrete in compression demands consideration, but, the floor and beam being all in one solid piece, not only does the part of the floor immediately over the beam contribute to the desired area, but portions of the floor on each side of this are available also, thus enabling us to regard the beams as of T section, as shown in Fig. 6, but except under special conditions of loading, the breadth of floor which we can consider for the purpose of this calculation should not exceed four to six times the breadth of the beam itself, according to the class of concrete and the nature of the aggregate used. But even with this reservations this fact of the beams and floors being solid together enables a wonderfully strong and light structure to be obtained. The same diagram also shows in closer section an additional means of obtaining this larger area of concrete in compression, namely, that of making fillets at the junction of the beam with the floor.

Another point to be remembered is that temperature stresses must be carefully guarded against and that extra reinforcement, in fact, increased scantlings over all, must frequently be adopted for this purpose, as the co-efficient of expansion of steel and of concrete is practically the same. In structures such as bridges these variations due to the temperature can be arranged for the ordinary hinges or expansion joints (of which the latter can be very rapidly and effectively made with thick sheet-lead, the area being such that no pressure it will experience will cause it to "squeeze out"), but in the case of structures where such are impossible, as for instance, in an exposed tank or bunker or silo, the only remedy appears to be a general increase in strength, particularly by means of increased reinforcement, and, although perhaps contrary to theory, this method has proved perfectly successful.

Centring.

With reference to the design and erection of forms or centring for keeping the soft wet concrete in place till it is properly set, there are two main conditions which must always be fulfilled. Firstly, it must be so supported and stayed that neither the weight of the concrete, nor the ramming of it, can make the centring bulge or sag; and secondly, it must be as close-jointed as possible, otherwise the

water will leak out and carry with it an appreciable amount of cement, which will weaken the structure. There are many methods of obtaining a smooth face on the finished concrete, such as painting the boards with oil or whitewash, or any material to prevent the concrete adhering to them, but, given fair flush joints in the woodwork, the passing of a thin piece of sheet steel (an old hand-saw with the teeth ground off is excellent for this purpose), between the concrete and the boards gives perhaps the best result whenever the general arrangement permits of its use. When work is to be floated or rendered, a rough surface is, of course, desirable.

The question of centring leads naturally to that of the length of time it should remain in place. The author is frequently asked to state his opinion on this in general, but no general or hard-and fast rule is possible—on some jobs or portions of them, 24 hours is ample, on others six weeks is too short. Much depends on the weather, particularly on frost, but, most of all and beyond everything, on experience; in fact, there is no material where experience on the part of the constructors is more important than in all matters connected with reinforced concrete or where more disastrous consequences are likely to follow the lack of such experience.

A contractor with considerable resources in the way of plant and materials is also very advisable. It is not long ago since a somewhat serious collapse occurred in a job where the concrete was put in on a Friday and the centring struck on the Monday, as the contractor had not, and could not get, any more timber.

Methods of Using.

Buildings in General.—All buildings should be of skeleton framework construction. The spaces or panels between the columns and beams can be ⅛ in., filled in with reinforced concrete or with brickwork, or the whole frame covered with a skin of stone or brick; but as the main strength is in the frame, such panels can be quite thin, in fact, only of such thickness as is needed for dryness, not for strength, which results in a large increase in floor area, particularly in the lower storeys, where, otherwise, the walls would have to be of considerable thickness.

Boats and Barges.—These have been successfully built for several years, and, provided several are ordered of one size, that is, made off the same moulds, they are very much cheaper than steel.

Chimneys.—From current quotations these certainly appear to be cheaper than the same in brickwork, and, of course, do not need pointing; but there may be a difficulty when one needs to be felled, as at present it is not known how to bring one down in a small area. It is, however, a simple matter if there is space available for the chimney to fall in one length.

Drain and Sewer Pipes.—Many miles of these have now been laid and are giving great satisfaction both as regards first cost and upkeep. Great care is, however, necessary in their manufacture to ensure the reinforcement, both longitudinal and circular, being exactly in its correct position, otherwise there is a great risk if the sewage or water reaching some of the metal and the life of the pipes being therefore very short. One of the great advantages of reinforced concrete sewer pipes—particularly in bad ground, for instance, over old mine workings—is that they do not cost any more per yard when made in long lengths, up to, say, 18 ft. if required; thus about 75 per cent. in the number of joints is saved, and they are able to carry the weight of themselves and contents over spans practically equal to their own lengths. The same remarks also apply to water pipes.

Dock, Retaining and Reservoir Walls.—The author has already noted the saving in space in buildings due to the use of reinforced concrete, and the illustrations in Fig. 7 show that such is even more the case with these walls, the one being in reinforced, and the other in mass concrete. Both are drawn to the same scale and calculated for the the same strength with the same factor of safety.

Engine and Dynamo Beds. — Probably many readers will remember the case of a large and important hotel in London having its own electric installation, where the vibration from its large turbo-alternator sets was a cause of serious complaint, notwithstanding the use of many different forms of soft anti-vibration materials beneath the beds. Finally, reinforced concrete bedplates were tried, the same being practically replicas (in plan) of the cast-iron ones, which rested on them, but only about 8 in. thick. These reinforced concrete bedplates are very carefully reinforced, and are only supported at points, that is, they do not rest directly on the old solid stone beds. The result has been very satisfactory, the difficulty of the vibration having been entirely eliminated.

Fence Posts.—The use of these is increasing very rapidly, but up to the present they are rather handicapped by the want of a cheaper method of attaching the wires to them, the ordinary hooks or staples being practically inadmissible, as they get bent and broken when the posts are bundled for carriage, and clips and bands or screw-plates are costly.

Magazines for Explosives, etc.—Owing to its practically absolute fireproofness, reinforced concrete is particularly suitable for these structures, and recent large and costly experiments in Germany have proved that even the explosion of huts containing 1½ to 2 tons of gelatine dynamite did no damage to their surroundings other than from the air blast. It was found that the reinforcement was only rent, but not scattered, and the concrete blown away in the form of coarse dust.

Piles, Piers and Jetties.—One of the principal points to bear in mind when considering the use of reinforced concrete piles is that they will safely carry about three times the load of such in wood of the same cross-sectional area; also, that they are no more difficult to drive; and, with reference to piers and jetties, the use of a material which does not deteriorate "twixt wind and water" is a matter worthy of very careful consideration.

Pithead gears and pit props.—These being fireproof is their strongest recommendation, and the latter, if made hollow, are, strength for strength, but very little heavier than ordinary wooden props.

Railway Sleepers.—As the most important question in relation to these is their life, not their strength, nothing but time will prove whether the use of reinforced concrete at a somewhat higher cost than wood will be the more economical in the end, but about five and a half to six years' experience of sleepers in continuous service under heavy traffic and rolling stock so far show no appreciable difference from the day they were laid down, and a recent order for over 100,000 of such shows that they are being extensively adopted.

Painting.

The question of painting, although only now referred to, is one of vital importance with all reinforced concrete structures (other than buildings such as houses, offices, etc., which are usually plastered and papered), as it is well known that all naked steel and iron work deteriorates rapidly from rust and corrosion unless it is periodically very carefully scraped and painted. Even when this is done, the amount which is, rightly, deducted for depreciation in the case of a valuation for sale, transfer, mortgage or similar, is very marked, in addition to the actual cost of such scraping and painting. This is particularly the case with bridges, owing to their exposed position, and the expense of painting them is frequently considerably increased by the extra cost of the necessary cradling and scaffolding. All this is eliminated in the case of reinforced concrete, which increases in strength with age, and is not subject to depreciation, nor are painting or scraping or other methods of preservation necessary. In fact, when comparing the cost of a reinforced concrete structure with that of a similar one in other materials, it is quite a good rule to work out the cost of the painting and upkeep, and, having capitalized the same at a rate per annum (say, 1 per cent. over the current bank rate), to deduct this sum from the estimated cost of the reinforced concrete in order to place both propositions on an equal basis for purposes of comparison.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Geo. A. Mountain; Secretary, Prof. C. H. McLeod.

QUEBEC BRANCH—
Chairman, L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, J. G. G. Kerry; Secretary, E. A. James, 62 Church Street, Toronto.

MANITOBA BRANCH—
Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—
Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University College.

OTTAWA BRANCH—
Chairman, C. R. Coutlee, Box 560, Ottawa; S. J. Chapleau, Box 203.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, R. Percy Barnes, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

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

AMERICAN MINING CONGRESS.—President, J. H. Richards; Secretary, James F. Callbreath, Jr., Denver, Colorado.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Boston & Maine Railway, Fitchburg, Mass; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, Wm. McNab, Principal Assistant Engineer, G.T.R., Montreal, Que.; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, E. Grandbois, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

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

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

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

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CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto. President, C. A. Jeffers, Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, R. H. Campbell, Ottawa.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Secretary, T. Nash.

EDMONTON ENGINEERING SOCIETY.—President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alta.

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

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian Members of Council:—Profs. F. D. Adams, J. B. Porter, H. E. T. Haultain, and W. H. Miller, and Messrs. W. H. Trewartha-James and J. B. Tyrrell.

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

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

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.

Canadian Forestry Association.—At Regina, Sask., September 3rd and 4th. Special meeting. James Lawlor, 11 Queen's Park, Toronto, Ont.

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

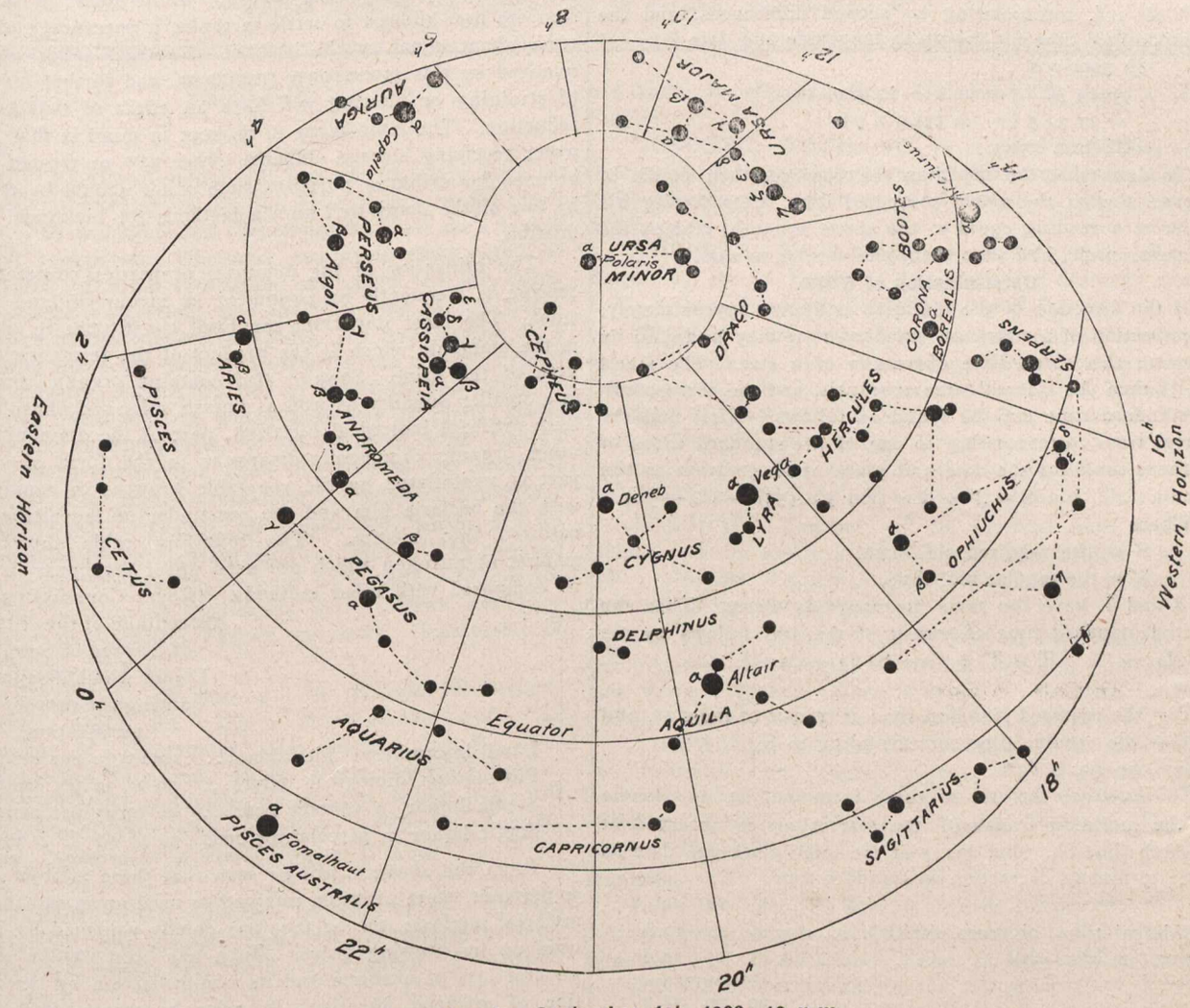
American Railway Bridge and Building Association.—October 19-21. Nineteenth annual convention at Jacksonville, Florida. Secretary, S. F. Patterson, Boston & Maine Railway, Concord, N.H.

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.

Royal Architectural Institute of Canada.—October 5-7, at Toronto, general annual assembly. Secretary, Alcide Chaussé R.S.A.; P.O. Box 259, Montreal, Que.

National Gas and Gasoline Engine Trades Association. Harry T. Wilson, treasurer, Middleton, Ohio; Albert Stritmatter, Cincinnati, Ohio. Next meeting November 30, December 1, 2, 1909, at Chicago, Ill.

ASTRONOMICAL PAGE



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

STAR MAP, SHOWING THE PRINCIPAL STARS, VISIBLE AT 10 P.M., SEPTEMBER 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 September 15th at transit across the meridian of 5h W. of Greenwich.

Star	Mag.	R. A. h. m. s.	Decl. ° ′ ″
α Andromedæ	2.1	0 03 43.4	+ 28 35 30
β Cassiop	2 4	0 04 22.2	+ 58 39 02
α Cassiop	2.5	0 35 23.3	+ 56 02 26
γ Cassiop	2.3	0 51 15.8	+ 60 13 33
α Ursæ Min. (Polaris)	2.1	1 27 21.3	+ 88 49 14
α Arietis	2 2	2 02 04.7	+ 23 02 08
β Ursæ Maj.	2.4	10 56 21.0	+ 56 52 09
α Ursæ Maj.	2.0	10 58 06.5	+ 62 14 28
γ Ursæ Maj.	2.5	11 49 02 4	+ 54 12 01
δ Ursæ Maj.	3.4	12 10 55.0	+ 57 32 17
ε Ursæ Maj.	1.8	12 50 01.0	+ 56 27 15
ζ Ursæ Maj.	2.1	13 20 15 2	+ 55 24 05
η Ursæ Maj.	1.9	13 43 57.0	+ 49 46 07
α Ophiuchi	2.1	17 30 43.7	+ 12 37 40
α Lyræ (Vega)	0.1	18 33 52.7	+ 38 42 09
α Aquilæ (Altair)	0.9	19 46 22.5	+ 8 37 50
α Cygni	1.3	20 38 21.7	+ 44 57 34
β Pegasi	2.4	22 59 24.1	+ 27 35 35
α Pegasi	2.6	23 00 16 0	+ 14 4311

Determination of Azimuth by the Pole Star.

The following table gives the azimuth of Polaris on September 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.		A	a	A	a	A	a
h. m.	h. m. s.	° ′ ″	″	° ′ ″	″	° ′ ″	″
8 00	18 42 10.0	1 36 05	+ 5	1 43 13	+ 5	1 52 06	+ 6
8 30	19 12 14.9	38 01	+ 2	45 20	+ 2	54 28	+ 2
9 00	19 42 19.8	38 16	— 2	45 40	— 2	54 52	— 2
9 30	20 12 24.8	36 50	— 5	44 10	— 5	53 17	— 6
10 00	20 42 29.7	33 43	— 8	40 51	— 9	49 43	—10
10 30	21 12 34.6	28 57	—11	35 45	—12	44 13	—13
11 00	21 42 39.6	22 37	—14	28 58	—15	36 52	—17
11 30	22 12 44.5	14 49	—17	20 35	—18	27 47	—20
12 00	22 42 49.4	05 41	—19	10 46	—21	17 06	—23

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 September 1st.

L = the longitude.

d = number of days elapsed since September 1st.

CUT HERE 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 September 8th.

Here the interpolated value of the azimuth for 8h 30m is 1° 48′ 10″, interpolating by second differences, and the corresponding time for the given longitude and date is:—

8h 30m oos
+ 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 Altair is observed at the watch time 8h. 56m. 49s. 5 at the same place and date as above; to find its correction on standard time.

		h.	m.	s.
Sidereal time, 9h. oom. (table).....	=	19	42	19.8
7 × (3m 56s. 555)	=		27	35.9
		20	09	55.7
Difference of longitude	=		20	00
S	=	19	49	55.7
R.A. of star	=	19	46	22.5
α — S	=	—	3	33.2
3.6 × os.16	=			0.6
Equivalent mean time interval.....	=	—	3	32.6
T′	=	9	00	00
T	=	8	56	27.4
Watch	=	8	56	49.5
Watch fast	=			22.1

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.

REMOVAL OF PUTRESCIBILITY.

(Continued from page 237.)

taining a 99.7 per cent. reduction, viz., 2,000,000 to 5,500 per c.c. The Berlin sewage showed a count of deplorable bacteria to the amount of 12,750,000 per c.c.; the effluent containing only 3,570 per c.c. or a reduction of 99.9 per cent.

All this points to one definite conclusion, that the effluent from the very best of well managed sewage farms is never suitable for drinking purposes. Such effluents invariably retain the bacteriological characteristics of sewage. The best effluents contain B. coli in considerable numbers, and it must be assumed that even typhoid germs may pass through the soil and reach the streams receiving the effluents. Dr Houston has made this evident in the thorough investigations he has made for the Royal Commission.

It is, however, apparent that land intermittent filtration properly managed may produce a very high efficiency in bacterial removal. Fortunately the pathogenic bacteria of sewage are not found isolated and free to move about in the sewage liquid, they are generally enclosed or in contact with diarrhœa stools or wrapt up in gelatinous masses or generally attached to suspended matter. If the solids in suspension are first allowed to settle in tanks, a percentage of bacteria about equal to the amount of settled solids will be removed by this preliminary treatment, and further methods of straining or filtering will have an effect of still greater reduction. The main point to be kept in mind is that if the water receiving sewage effluents either raw or treated is to be used for drinking purposes such water should be treated by one of the many well known methods for biological purification.

The utilization of the manurial properties contained in sewage is frequently an argument in favour of land treatment. The most important manurial constituent in sewage is the ammonia which is the product of the fermentation of urea of the urine. Sewage also contains organic nitrogen in a smaller quantity as well as potash salts and phosphates. With artificial biological filtration, part of the ammonia and other organic compounds disappear in the form of gases, part is assimilated by the vegetable growths in connection with the bacteria film and the remainder of the nitrogen is oxidized into nitrate. The following table shows the amount of nitrogen which are used up or disappear in land as compared with other methods. (Royal Commission, par 205.):

	Percentage of the Nitrogen of Sewage or Sewage Liquor which disappears during the process of purification.
Land intermittent filtration....	about 60 per cent.
Percolating biological filters...	40 to 50 per cent.
Septic liquor in contact beds...	40 to 45 per cent.
Septic liquor in percolating beds	30 to 40 % or less.

From the above it will be seen that there is from 10 to 30 per cent. more nitrogen retained or used up in soil than in artificial methods, the balance has chiefly vanished by being used up by growing crops. Much has been written of the general loss of nitrogen and its non-utilization by the adoption of artificial filtration. It must be remembered, however, that it is only in the form of nitrates that nitrogen can be of any benefit to plant life, and that the production of nitrates in soil in winter time almost ceases. Speaking generally, intermittent land filtration has only proven successful when crop growing has been entirely subservient to purification of the sewage. It is practically necessary to dose land, unless the area is very large, almost continuously. On the other hand there are times, especially in wet weather, when the plant life is destroyed by the excess of sewage liquid. No case is known where a profit is shown by growing crops in sewage dosed land when all the costs of sewage treatment are considered. Theoretically the value of a domestic sewage has been calculated at from $1 to $1.25 per head per annum. No returns in practice have come anywhere near this figure.

Over and over again the system has been tried in Great Britain and in Europe of renting the plots of land used for intermittent filtration to gardeners and others who desired to cultivate the land, the system has invariably proved a failure. All kinds of tricks are resorted to by the tenants of the plots to divert the sewage in wet weather from the land surface, by making holes direct to the underdrains or opening sluices and diverting the sewage direct to the stream. It must be either a question of sewage treatment or cropping, if cropping the purification will suffer. All the wild schemes in the past of utilizing domestic sewage for purposes of profit have proved bubbles, and it is only in exceptional cases of trade effluents and grease recovery that by-products have been made to show any profit.

(To be Continued.)

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS.

Quebec.

MONTREAL.—Tenders will be received up to noon on Tuesday, 14th September for the enlargement of the city's aqueduct, by widening and deepening the same on a length of about 27,300 feet. The work comprises about 1,176,000 cubic yards of earth excavation and about 400,000 cubic yards of rock excavation, also the formation of the slopes and banks of the widened aqueduct, the transporting to a distance of excess of excavated material, the construction of syphon culverts, the construction of dry stone wall lining in the slopes, etc., etc., the whole according to plans, cross-sections and specifications, to be obtained from George Janin, superintendent and chief engineer of the Montreal Waterworks, City Hall. (Advertised in Canadian Engineer.)

MONTREAL.—Tenders for electric light wiring and fittings for the addition to Montreal Post Office will be received until 5 p.m., Wednesday, August 25. Plans and specifications to be seen on application to A. Venne, architect, Montreal, and Napoleon Tessier, secretary, Department of Public Works, Ottawa.

MARIEVILLE.—Tenders will be received till September 6th next for the improvements of the waterworks. M. J. Meunier, civil engineer, 15 St. Lawrence Boulevard, Montreal. H. St. Marie, secretary-treas.

SHERBROOKE.—Tenders for customs fittings, etc., will be received until Wednesday, September 1, Napoleon Tessier, secretary, Department of Public Works, Ottawa.

Ontario.

PETERBOROUGH.—Tenders received up to 4 o'clock, p.m., Monday, 30th August, 1909, for construction of reinforced concrete bridge over the River Otonabee. E. A. Hay, city engineer.

TORONTO.—Tenders will shortly be invited for pole line supplies by this municipality. K. L. Aitken, Electrical Engineer. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Tuesday, Sept. 7th, for 15 tons of copper conductor. (Advertised in the Canadian Engineer).

TORONTO.—Tenders are invited until Tuesday, Sept. 7th, for construction of asphalt, vitrified block, brick and bitulithic pavements, concrete curbs, concrete walks and sewers. Joseph Oliver, mayor. C. H. Rust, City Engineer.

GODERICH.—Tenders will be received up to noon of August 31st, for the erection of a nine-roomed public school, in the town of Goderich. Plans and specifications may be seen at the office of A. J. Barclay, architect, Crown Life Building, Toronto, or A. D. McLean's clothing store, The Square, Goderich.

TORONTO.—Tenders will be received up to 12 o'clock noon on Monday, August 23rd, for Bridges and Culverts on the wagon road from the Montreal River at Smyth to Gowganda as follows: One bridge at Lost Lake, 290 feet long, with approaches. Two bridges at Long Point Lake, 25 feet long, with approaches. Four bridges between Lost and Leroy Lakes, 25 feet long, with approaches. Two bridges at Miller Creek, 25 feet long, with approaches. About 400 feet of side hill bridging near Lost Lake. And about 45 culverts. The work is to be completed by the first of October, 1909. Plans and specifications and tender forms may be seen at the office of C. H. Fullerton, Engineer, New Liskeard, or F. Cochrane, Acting Minister of Public Works.

TORONTO.—Tenders will be received until Thursday, October 14, for turbine pumps. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Thursday, October 14, for electric motors. Further particulars may be had from the city engineer. (Advertised in the Canadian Engineer.)

AMULREE.—Tenders will be received up to Friday, August 27, for the $3,695.40 debentures for drainage works. J. D. Fisher, Township Clerk, Amulree P.O., Ont.

ORILLIA.—Tenders will be received until 8 p.m. Thursday, September 9, for constructing the following works: Contract "A," Sanitary Sewers, about 15,000 lineal feet. Contract "B," Sewage Pumping Station. Contract "G," Sewage Pumping Machinery. Contract "O," Force Main, about 7,000 feet iron pipe. W. C. Goffatt, Mayor, Orillia. Willis Chipman, C.E., chief engineer, Toronto, Ont.

TORONTO.—Tenders will be received until Monday, October 4th, for erecting the Wilton Avenue Bridge. Joseph Oliver (Mayor), Chairman Board of Control. (Advertised in the Canadian Engineer.)

TORONTO.—Tenders will be received until Tuesday, 5th October, for 1,080 lengths of 16-inch cast iron pipe and 16-inch valves. Joseph Oliver, mayor. C. H. Rust, city engineer. (Advertised in the Canadian Engineer.)

CORNWALL.—Tenders for alterations to entrance doors, etc., Cornwall, Ont., public building, will be received until Wednesday, September 1. Robert Conroy, caretaker, Public Building, Cornwall. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

Manitoba.

ROBLIN.—Tenders will be received for material of steel bridge. Plans may be seen at Department of Public Works, Winnipeg. J. P. McKibbin, Reeve of Roblin Municipality.

WINNIPEG.—Tenders for the necessary work on sewage disposal and a water supply for the Sanitorium at Ninette, will be received up to Saturday, August 28. Plans and specifications can be seen at the Municipal Commissioner's Office, in the Parliament Buildings, Winnipeg, or upon application to David Marshall, architect, Brandon. E. M. Wood, Secretary Manitoba Sanatorium for Consumptives.

Saskatchewan.

SASKATOON.—Tenders will be received until Wednesday, September 22nd, for the construction of a subway under the tracks of the C.N. Ry. here. Geo. T. Clark, City Engineer. J. H. Trusdale, City Clerk. (Advertised in The Canadian Engineer).

WEYBURN. — Tenders will be received until Monday, August 30, for the following sections of proposed system of waterworks: Contract "B"—Pump house and pump well. Contract "G"—Pumping machinery (power pump and oil engine.) Contract "O"—Mechanical filters, capacity 500,000 gallons daily. Each of these contracts to be completed before November 30, 1909. Plans and specifications for "B" and "G" on file at the office of the Chief Engineer, Room 47, Canada Life Building, Winnipeg, or 103 Bay street, Toronto, also at Weyburn. Geo. Ross, secretary-treasurer, Weyburn, Willis Chipman, C.E., 103 Bay street, Toronto.

British Columbia.

VANCOUVER.—Tenders will be received up to Monday, September 6th, for grading and bridging of the Alberni branch of the Esquimalt and Nanaimo Railway Company from the 108th mile to Alberni (27½ miles). See Mr. Bainbridge, Division Engineer E. & N. Railway, Victoria; Mr. H. J. Cambie, Chief Engineer, E. & N. Railway, Vancouver, for plans, etc. R. Marpole, vice-president.

VICTORIA.—Tenders are invited until September 15 for the supply of about nine hundred tons of cast iron socket pipes and special castings. T. Lubbe, secretary, Esquimalt Waterworks Company.

CONTRACTS AWARDED.

Quebec.

MONTREAL.—The department of marine and fisheries has awarded a contract to Clarence De Sola for a hydrographic survey vessel. She will be built by the Swan Hunter firm of the Tyne, the celebrated builders of the Mauretania and other sea leviathans. The vessel will be twin screw, of a length of 273 feet, and it is to be specially devoted, it is understood, to coast survey work. Both vessel and equipment will represent the best work of their class and will prove an important addition to the Dominion Government survey department. The vessel will be of steel throughout, and will be equipped with engines capable of developing great speed.

QUEBEC.—Two tenders were received for the sale of a steam roller to the city for which $4,000 was recently voted. The tenders were Messrs. Cameron & Co., Montreal, representing the Waterous Engine Works Co., and Messrs. Bosse & Banks, of this city. The tender of Cameron & Co., for a roller of 35,500 pounds for $3,700, was accepted as the lowest and most advantageous.

MONTREAL.—The contract for the cementing of the wading pool in Lafontaine Park was awarded to Mr. A. T. Chagnon, at a price of $1,975. It was by far the lowest tender. The next was $4,290, while the highest was $5,50.

Ontario.

BRANTFORD.—The Board of Works met on Saturday to award the contract for paving East Colborne street and Market street. The Bitulithic Co. was the only firm to tender, and their offer will be accepted. The figures for the top dressing are $1.63 per yard, whereas the Colborne street work costs about $2. The city engineer will do the concrete work as follows: Foundation, 50c per yard; curb and gutter, 45c per foot. The paving company's tender is for a five years' guarantee.

KINGSTON.—J. W. Litton has been awarded the contract for excavating for the two new science buildings to be erected on Queen's University grounds, and will begin work next Monday. Power & Son, architects, will not have the plans for the building ready for five weeks. Only the foundations of the buildings will be constructed before the winter arrives.

TORONTO.—Mr. A. L. MacLennan, of Toronto, was awarded the contract for the bridges and culverts of the new waggon road from Elk Lake to Gowganda. There will be 12 bridges in all, which will be distributed as follows: One bridge at Lost Lake, 290 feet long, with approaches; two bridges at Long Point Lake, 25 feet long, with approaches; four bridges between Lost and Leroy Lakes, 25 feet long. with approaches; two bridges at Miller Creek, 25 feet long, with approaches; about 400 feet of sidehill bridging near Lost Lake, and about 45 culverts. The contract price is about $4,000. Mr. MacLennan also had the contract for clearing the route of the new road. The grading is being done by day labor, and he will follow immediately with a gang of men to construct the bridges and culverts, which are to be completed by Oct. 1.

COBALT.—S. F. Whitman, of Toronto, was awarded the contract for building the new Temiskaming & Northern Ontario station at Cobalt. The work will be prosecuted without delay.

OTTAWA.—The tender of the Canadian Oil Company, of Strathan Avenue, Toronto, at 4 8-10 cents per gallon for oil required in laying dust on the streets. was recommended for acceptance.

OTTAWA.—The Gutta Percha and Rubber Co'y., of Toronto, have secured from the City of Ottawa a contract for 2,000 feet of "New Peerless" hose at 95 cents. Other tenders were: Canadian Rubber Co., 90 cents, and Dunlop Rubber Co., 97½ cents.

OTTAWA.—Toms, Beuthillier & Slack, for $13,600, secured the contract for building the new Rideau Ward Fire Hall. Pepin and Caron tendered at $13,950 and August Boshmer $13,765. T. Smith offered to do the steel, iron, masonry, plumbing and heating for $8,495 and R. A. Bingham the carpentry, joining, painting and roofing for $5,200. There were a number of separate tenders for the smaller jobs, but on the whole Toms, Bouthillier and Slack were lowest.

Saskatchewan.

REGINA.—Tenders for 22,800 feet of trenching (contract a.) and hauling 1,710 tons 18 inch pipe, laying, caulking, backing and filling the trench (contract b.) were recently opened, from the following firms: McVean & Craig, Moose Jaw, A and B, 58c per ft., or $13,338. City Engineer, machine, A and B, 59 6-10c per ft. City engineer, hand, 68 6-10c per ft. John Brodt, Regina, machine, A and B, 70½c per ft. John Brodt, Regina, hand, A and B, 78c per ft. W. J. Gray, Winnipeg, A and B, 92c per ft. Saskatoon Construction and Engineering Co., A and B, 93c per ft. Murphy Bros., A and B, 94c per ft. F. F. Frey, Toronto, A and B, 94c per ft. Municipal Construction Co., A, 22c per ft. Geo. H. Archibald, Winnipeg A, 27½c per ft. The engineer pointed out with regard to the first mentioned tender that at 58c per ft. the total should be $13,224. The tenders were referred to the Works Committee.

REGINA.—The tender of McVean & Craig, contractors, Moose Jaw, for trenching, hauling pipe, laying and caulking, and backfilling trench for water works new pipe line from compensating basins to city for $13,338, was accepted.

British Columbia.

VANCOUVER. — Five miles of concrete walks, for which tenders were recently invited, will be constructed by day labor. Fourteen cents a foot was the figure sent in by the Paterson Lumber Co. and Lawrence & Hull. Palmer Bros., who underbid the present contractors now doing the work, did not bid. The price of the present contract is 12 cents. The cost last year when done by the city was 15.2 cents, including grading.

VICTORIA.—Tenders for cast iron pipe were received from the following: R. P. Rithet & Co., $50,930; W. G. Winterburn, $49,892; Stavely Coal & Iron Company, $49,592; Robertson Godson & Co., Vancouver, $50,131; A. Rickaby, $44,190; Robert Ward & Co., $51,191; R. Angus, $48,969; Findlay, Durham & Brodie, $51,776; M. & L. Samuel Benjamin Company, $54,381.

United States.

CINCINNATI. OHIO.—The Cincinnati Southern Railroad has awarded at $125,000 a contract for the removal of 200,000 cubic yards of earth in preparation for construction of a new bridge over the Kentucky River at High Bridge, Ky. The new bridge will be 306 feet above the low water mark, one of the highest in the world.

FINANCING PUBLIC WORKS.

The following municipalities have recently sold debentures:—

Cobalt, Ont., $100,000, for waterworks.
Morris, Man., $12,000, local improvements.
Sudbury, Ont., $11,800, for waterworks.
Magrath, Alta., $14,000, local improvements.
Clinton, Ont., $51,000, waterworks.
Rivers, Man., $12,000.

Quebec.

COATICOOK.—On Monday, August 30, the ratepayers will vote on a by-law to raise money for electric light plant and extensions.

HULL.—By-laws authorizing the borrowing of $115,000 for civic purposes have been ratified.

Ontario.

AYLMER.—The proposal to erect a new bridge here at a cost of $55,000 has been rejected.

DUNNVILLE.—The by-law to raise $7,000 for extension of waterworks was defeated.

EXETER.—The by-law granting $22,000 for waterworks was carried by 122 majority.

PRESTON.—Debentures amounting to $32,000 are offered for sale by H. C. Edgar, treasurer of this municipality.

Saskatchewan.

YORKTON.—The by-law to raise $30,000 for waterworks extensions carried, only three voting against it.

Alberta.

TABER.—The Town Council are asking the ratepayers to support a by-law to raise $55,000 by 20-year debentures for the purpose of the erection and construction of a standpipe, water mains and hydrants.

CALGARY.—By-laws are being advertised for the issue of debentures to the extent of $85,000 for city hall and other purposes.

British Columbia.

CRANBROOK.—The ratepayers will take over the waterworks system at a cost of $70,000.

RICHMOND.—A by-law will be introduced to raise $275,000 for waterworks purposes.

RAILWAYS—STEAM AND ELECTRIC.

Quebec.

MONTREAL.—The opening of regular passenger service on the new "Shore Line" of the Canadian Northern Quebec Railway between Quebec and Montreal took place last Sunday, when the first through trains ran from each end. The train from Mnotreal left the Moreau Street station at 11.30, and was made up entirely of new equipment of the most modern type. The line throughout has been laid in a very substantial manner, with 80-pound rails, and every equipment of a modern railway.

MONTREAL.—By an agreement with the C.P.R. the Canadian Northern has the use of Place Viger Station, and they will run their trains from there to Quebec. In return they give the C.P.R. running rights over their line into the city, thereby saving a steep grade and eleven miles of haul. The C.N.R. began their new short line service Sunday.

Ontario.

ST. THOMAS.—The Pere Marquette began the grading on Monday for three tracks to a new coal hoist, which will be erected near the roundhouse. It will be of a different pattern to the former one, and will be of the pocket variety, having four shoots, while the hoist, which was destroyed, possessed but the one.

TORONTO.—The Dominion Railway Commission has ordered the construction of a high level bridge over the railway tracks on Queen Street at the Don, and the cost of the work, which will probably exceed two hundred and fifty thousand dollars, is to be borne on the following percentage basis: City of Toronto, 15; Toronto Street Railway, 15; Canadian Pacific Railway, 35; Canadian Northern Railway, 25, and the Grand Trunk, for the old belt line, 10.

Manitoba.

WINNIPEG.—Extensive additions are planned by the Winnipeg Street Railway Co., including a nine-track barn in the north end. The terminals at that point are used jointly by them and the Winnipeg, Selkirk and Lake Winnipeg line.

WINNIPEG.—Dominion Government engineers are at present working on the final location surveys for the Hudson Bay Railway, and it is expected that by January 1st at least 125 miles of the permanent location will have been staked out. Party No. 1, in charge of R. D. Fry, left for The Pas, August 11th, and will proceed to a point forty miles north before beginning work. Mr. Fry took three men from Winnipeg with him and recruited the balance of his party in the north. It was he who carried the preliminary survey to Nelson Harbor, and made the survey of the north of the river there. The second party will leave about September 1st in charge of W. J. Clifford, who returned on Friday last from Fort Churchill, where he made a careful survey of the harbor facilities. He has turned over his field notes to the draughting-room staff, and the maps and plans are now in course of preparation. His party will work from The Pas to Frog Creek.

British Columbia.

NEW WESTMINSTER.—The British Columbia Electric Railway Company is preparing to commence the actual laying of steel on the first section of the Chilliwack extension of its line from New Westminster. Monday next will see the work of steel laying commence on the grade of the south side of the Fraser River Bridge. The first section of the Chilliwack line from New Westminster to Abbotsford, a distance of 38 miles, is now graded and ready for the steel. The steel for the first 12 miles, as far as Cloverdale, is at New Westminster. The rails to be laid will weigh 70 pounds to the yard and are about forty feet in length. A new style of track laying machine is being used, which does away with the necessity of handling the rails so much. As each rail weighs about 933 pounds this is an important item. It is estimated that fully sixty working days will be required for the steel to reach Abbotsford, making this well on in November. No wiring will be done on this line until the steel has reached Cloverdale, as all the steel for this part of the line is at New Westminster and will have to be taken out over the completed line. It is pretty certain that the line to Abbotsford will be in operation this year, although it will be late in the autumn before the line is completed.

PRINCE RUPERT.—The Grand Trunk Pacific has awarded to Foley, Welch & Stewart a new contract for the second section east of Prince Rupert. It will be 140 miles from Copper River east to Aldermere. This leaves a gap of less than 500 miles, and contracts for this may be let before the end of the year. The new contract is for approximately $10,000,000. There are several long tunnels, one a half-mile in length. The line will cross the Skeena by a cantilever bridge sixteen miles below Hazeltown.

VANCOUVER.—Chief Western Engineer Hoagland, of the Great Northern, says that the recent surveys of the V.V. & E line from Princeton to Vancouver through Hope Mountains show a westbound grade of a maximum of one per cent., and an eastbound of two per cent., a considerable reduction on former surveys.

PRINCE RUPERT.—The Grand Trunk Pacific has awarded to Foley, Welch & Stewart a new contract for the second section east of Prince Rupert. It will be 140 miles from Copper River east to Aldermere. This leaves a gap of less than 500 miles, and contracts for this may be let before the end of the year. The new contract was for approximately $10,000,000. There are several long tunnels, one half a mile in length. The line will cross the Skeena River by a cantilever bridge sixteen miles below Hazleton.

VANCOUVER.—The location plans of the Howe Sound, Pemberton and Northern Railway, which is now under construction from Squamish Landing to Chee Kee, have been filed to the twenty-mile post. The ultimate destination of the road is Lillooet, on the Fraser.

VICTORIA.—The promoters of the Esquimalt and Barkley Sound Railway are losing no time in acquiring the necessary data preparatory to the building of that much-needed line.

Foreign.

CHICAGO, ILL.—The old Union Station in Chicago will be replaced by a $25,000,000 structure, according to announcement made recently. The new building will be erected on plans in harmony with the City Beautiful idea.

GREENSBURG (PA.).—The Pennsylvania Railroad has asked for bids to be tendered on about $1,000,000 worth of

construction and improvement work in and about Greensburg, Pa. The Pennsylvania lines west of Pittsburg and Erie are also planning to spend several million dollars in building double track roads and removing grades.

SEWERAGE AND WATERWORKS.

Manitoba.

PORTAGE LA PRAIRIE.—The water system is now perfect and the service is the best in the history of the city, A new well has been installed at the river, and the railway companies now use water from this well, which is pumped to the power house by a motor. It cost $1,350 to dig the well, and that much or more will be expended in fitting it up with galleries.

MARKET CONDITIONS.

Montreal, August 25th, 1909.

Conditions in the United States are showing a very decided improvement all along the line. Not only are prices advancing, but furnaces and mills are in receipt of good orders, and many of them are now behind on deliveries. Pig iron prices are now firmer, on a basis of $13.50 per gross ton at Birmingham, for Southern, and $15.25 f.o.b., Valley furnaces, for No. 2 foundry iron, and $16 Valley furnaces, at a minimum, for Bessemer iron. This shows an advance of $1.50 to $2 per ton from the low prices which prevailed last March, and while demand has been less aggressive during the past few days, prices continue firm, with higher figures being asked for future deliveries. As a matter of fact, some furnace interests have withdrawn from the market and are declining to quote for future delivery this year. Some makers are asking $1 advance on present prices for 1901 deliveries. The volume of iron now being made is quite up to the high record of 1907—that is, at the rate of 25,500,000 per year. Last month's production was at the above rate, and this may be exceeded during the present month.

English and Scotch markets are also being influenced by the improved conditions in the United States and here, and the optimistic reports which are the result. Cleveland warrants have shown an advance of 1s. 6d. during the past week and prices have advanced in the Scotch markets by fully 2s. 6d. per ton within the past ten days. Even now, there is an indisposition on the part of Scotch makers to book orders for large quantities at the advance. Stocks of warrants in Connell's stores continue to show an increase, but a slight improvement in trade conditions would soon alter this condition. Prices on finished material have not as yet reflected this advance in London and Scotland, this being due to some extent to the fact that German and Belgian makers continue to quote low figures. Conditions in both Germany and Belgium are very flat, and attractive prices can be had for large lots.

Local conditions are showing a steady improvement, not only in the matter of prices, but in the volume of business done. Many consumers, particularly large ones, have apparently reached the conclusion that the present is the time to buy, and a fair tonnage has recently been booked, particularly for import iron. The Eastern Canadian furnaces are not pushing sales. The furnaces of the Hamilton Steel and Iron Co. are at present out of blast, for repairs, the only furnaces in Canada in a position to offer prompt shipment being the Midland, of the Canada Iron Corporation, the Deseronto furnaces of the Deseronto Iron Co. and the Antikoken furnaces of the Antikoken Iron Co. The latter two are only able to supply special grades of iron. The result is that prices are showing a decidedly upward tendency, asking figures being now fully $1 per ton higher than a month ago. This advance corresponds approximately with the higher figures obtaining in the United States and Scotland. Generally speaking, the foundry trade in Canada is rapidly taking on a much more healthy tone.

The steel trade is also improving and the market is firmer all round, in sympathy with the situation on the other side, where prices are up about 30c.

In manufactured and semi-manufactured goods, the tone of the market is firm and demand is showing some improvement. Price changes are becoming rather more frequent, as will be seen from the list this week, as follows:

Antimony.—The market is steady at 8¾ to 9c.

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:—1½ and 2-inch tubes, 8¼c.; 2½-inch, 10c.; 3-inch, 11¼c.; 3½-inch, 14 1-2c.; 4-inch, 18 1-2c.

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

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

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

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

Copper.—Prices are strong at 13¾ to 14c.

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 strong. The following prices are for carload quantities and over, free on dock, Montreal, prompt delivery: No. 1 Summerlee, $20 to $20.50; selected Summerlee, $19.50 to $20; soft Summerlee, $19 to $19.50; Clarence, $17.50; Midland or Hamilton pig is quoted at $20 to $20.50, Montreal. t is said Dominion and Scotia companies are not quoting prompt delivery. Carron special, $19.50 to $20; Carron soft, $19.25.

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.55 to $3.65.

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight rate of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5.. 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 follow: '—$31 for 6 and 8-inch pipe and larger; $32 for 5-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-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 10½c. 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 $2.35 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

Telegraph Poles.—See lumber, etc.

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

Tin.—Prices are unchanged, at 32 to 32½c.

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

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Toronto, August 26th, 1909.

The now almost certain prospect of good crops in the North-West, the general success of Canadian farmers in securing good prices for their products, are reflected in the earnings in other departments of the country's industry. Business of all kinds is more active and prices are in many cases looking up, metal being a notable example. It is regrettable to learn of the disablement, at a time of increased production and very active orders, of one of the furnaces of the Hamilton Iron & Steel Works. The loss which the company must suffer is placed at a high figure.

In Great Britain, the price of iron for future delivery is advancing, and there is greater buoyancy in the trade. In the United States, as we note elsewhere, there is a genuine improvement, not bolstered by special interests.

Toronto finds business active, especially so in the way of house-building, which is in a great danger of being overdone, if not already so. The Industrial Exhibition promises to be a good one this year, and the retail activity will be thereby increased.

An experienced New York observer says there is every appearance of a sound actual revival in business in the iron and steel trade, which may be expected to grow and spread to other lines. "With the tariff now out of the way, and a bumper crop promised, basic conditions are now sound and promising.". If, it is added, a reduction should come in the shape of a decline from the extravagant prices to which some securities have been forced in Wall Street, it would make very little impression on the generally favorable mercantile position and prospects in the U. S.

In harmony with this prediction of greater general activity, is the appearance of a circular from an important shipping house to its Canadian clients, dated 24th August, which says:

"We beg to advise that there is a serious car shortage impending which the railroad people now regard as certain between the present time and the coming winter, and we inform you of this so you may anticipate your requirements in our line as much as possible, sending in your specifications for immediate and future shipment."

When it is remembered that hundreds of thousands of cars were reported lying idle only a month or two ago, the significance of the announcement is great.

Antimony.—Demand inactive, market unchanged 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. Season over, nothing doing.

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

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 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.—Cement is being offered at the low price of $1.55 per barrel in car lots, including cotton bags, and sales have been made within the month at 5c. less than this. Until the consumption increases, prices will not improve. Smaller dealers report a fair movement in small lots at $1.40 per barrel in load lots delivered in town, bags extra. In packages, $1.40 to $1.50, including paper bags.

Coal.—Retail price for Pennsylvania hard, $6.75 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.75. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is 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 market is very firm, but heavy stocks still act as a drag. We quote as before $13.85 to $14.05 in this market, with a fair movement.

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

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

Roofing Felt.—An improvement in demand of late, no change in price.

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, $2.90; 12-14 gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, $3.85; 29, $4.15; 10¾, $4.50 per 100 lbs. Fleur de Lis—gauge, $4.50; 26-gauge, $4.25; per 10 lbs. This downward change is the result of dissolution of an agreement between British and U. S. makers. Impossible to say how long it will last.

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

Iron Pipe.—Black, ¼-inch, $2.03; ⅜-inch, $2.26; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.90; 2½-inch, $15.81; 3-inch, $20.76; 3½-inch, $26.13; 4-inch, $29.70; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.50, per 100 feet. Talk is still heard of an advance, but nothing definite.

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

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

Lumber.—The local demand for stuff is maintained, but there is not so much doing outside. Southern pine continues to move, and the stock on hand is depleted. Spruce flooring is not so much heard of here, since better prices can now be had for spruce at home in New Brunswick and Quebec. Hemlock is steady, but not active. Lath are held stiffly at quotations, and none too plentiful; many are being made up north to go to the States. The 32-inch lath, so long a feature of the market, are nearly all gone. We quote dressing pine, $32 to $35 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $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 fairly active at $3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20 per ton.

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.—More demand during the past few days, at catalogue prices before quoted.

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

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

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Business steady; price, 73 per cent. off list at factory for car-load lots; 65 per cent. 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, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over: Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43.

Sheet Steel.—Market steady, at the former prices; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a quantity of light sheets moving.

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

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

Tin.—The feeling in tin is firm, and we quote an advance of ½c., say 31½c. to 32c.

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 firm at $5.50 to $5.75.

CAMP SUPPLIES.

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

syrup, $1.90 to $1.95; raspberries, 2s, $1.90 to $1.95.

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

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

Dried Fruits.—Raisins, Valencia, new, 6 to 6¼c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, 7½ to 9c.; fancy, 11 to 12c.; extra fancy, 14½ to 15c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 12 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 8c.

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

Lard.—Now quite scarce. Tierces, 14¼c.; tub, 14¾c.; pails, 15c. per lb.

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

Pork.—Short cut, $25 to $26 per barrel; mess, $23.50.

Potatoes.—Ontario, old, 75 to 90c. per bag in car lots on track.

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

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

Smoked and Dry Salt Meats.—Long clear bacon, 13¾c. to 14c.; firm, tons and cases; hams, large, 13 to 14c.; small, 15½ to 16c.; rolls, 13 to 13½c.; breakfast bacon, 17c.; backs (plain), 17½c. to 18c.; backs (peameal), 18c. to 18½c.; shoulder hams, 12c.; green meats out of pickle, 1c. less than smoked.

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

Sugar.—Granulated, $4.75 per 100 lbs. in barrels; Acadia, $4.65; yellow, $4.35; bags, 5c. lower; bright coffee, $4.60; bags, 5c. less.

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

Teas.—Japans, 18 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

* * * *

Winnipeg, August 24th, 1909.

As stated last week country orders are exceptionally quiet. The repair shops and implement men are doin ga rushing business. Harvest is in full swing all over the west and a bountiful crop is being reaped. Locally the dealers in builders' supplies continue to be kept very busy filling orders, as are also the local iron working shops. The Dominion Bridge Co. are this year more than doubling their capacity, and the Manitoba Bridge & Iron Works have also greatly enlarged their plant, and are now able to take care of the largest bridge work required in the West. Both these firms are working up to the limit keeping pace with the steel buildings being erected in Winnipeg and other large centres. Quotations on beams and channels remain steady, there being scarcely any variation on this market. Railway supply firms report business to be quiet, but most of them have had a fairly good season. One dealer in cement brick machines and other concrete machinery called on last week, reported to have done a good business in the West this year in the lines that he handled.

All quotations on the Winnipeg market are firm and are as follows:—

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

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

Cement is again somewhat quiet and prices are pared down very low. A good demand is also noted for a better class of brick this season.

Winnipeg quotations are as follows:—

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¾c.; anvil and vice combined, each, $5.50.

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

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

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

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

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

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $9.75 large lots, to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winni-

peg, 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.

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

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

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

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

Dynamite.—$11 to $13 per case.

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

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.

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

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

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

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

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

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

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Rope.—Cotton, ¼ to ½-in. and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¾c.; British Manila, 11¾c.; sisal, 10½c.

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

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

Staples.—Fence, $3.40 per 190 lbs.

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

Tool Steel.—8½ to 15c. per pound.

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

PATENT NOTICE.

Notice is hereby given in regard to Canadian patent No. 100,980, Caulking Strip for Steam Turbines, granted Sept. 11, 1906, that Allis-Chalmers-Bullock, Ltd., Montreal, owners of rights under said patent, is prepared to supply devices covered by this patent.

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