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The Canadian Engineer

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PITOMETER SURVEY OF WATER MAINS.

The means of rapidly determining water losses by mechanical means will be greatly appreciated by waterworks engineers and others having occasion to give serious thought to the subject.

There has of late been brought to a very satisfactory state of perfection an instrument known as the pitotmeter, which is designed to indicate water waste and main losses. A great advance over other methods of water waste investigation has been brought about in this instrument, inasmuch as the main does not have to be cut. This instrument is primarily a rate meter, depending on the velocity of the water in the main. Two brass tubes bent at their lower ends with carefully formed orifices of ⅛-inch internal diameter are held in a suitable cap which screws upon a standard 1-inch corporation cock through which the tube may be readily introduced into any main and as easily withdrawn. Heavy cloth-insertion rubber tubing connects the orifice tubes with a long glass manometer oe U-tube, and blow-off cocks are provided to remove the air from the instrument.

The Pitometer Company, 220 Broadway, New York, recently made a pitotmeter survey of certain sections of Toronto, and their report was made to the city a few weeks ago. Mr. E. A. Howland was in charge of the survey for the Pitometer Company.

A district about six blocks square (larger on matters according to the consumption) was taken and all the boundany valves closed except one. A photo recording pitometer was placed on this main and the flow gauged for forty-eight hours. If the district was residential and showed a high night rate between the hours of twelve and five, it was subdivided between those hours to find the cause.

The U-tube was filled with a mixture of carbon-tetrachloride and benzine having a specific gravity of 1.25 and when in use the water from the pipes filled the remaining space in the U-tube.

This was done by closing the inside valves supplying the various streets, and noting the drop in flow as the valves were closed.

If a street was found to have an abnormal flow, the curb cocks were closed, and if a house had any waste the amount would at once be shown by the fall of liquid in the manometer. The curb cocks were sounded with an aquaphone, before being closed, and if leakage was detected, again after. If the flow stopped on closing the curb cock, the leakage was evidently on the house side of the curb cocks. After all the curb cocks had been shut off the valve on the main supplying this street would be closed, if a drop in flow was then noted, it would be caused by leakage on the main or services up to the curb cocks. This could then be located by means of the aqua-phone and connections.

The orifices are set to receive the maximum velocity within the main, which is usually near the centre, and is indicated by the deflection in the manometer.

This deflection, by virtue of the differential action of the water and the slightly heavier and insoluble liquid, is just four times that due to the actual difference of water head on the orifices produced by the flowing stream.

The current impinges directly on one orifice, but the other is turned directly down stream and gives something less than the static head within the main, thus increasing the difference of pressure produced. This difference is then multiplied in the U-tube, the result being that a low velocity within the pipe produces a readable deflection.

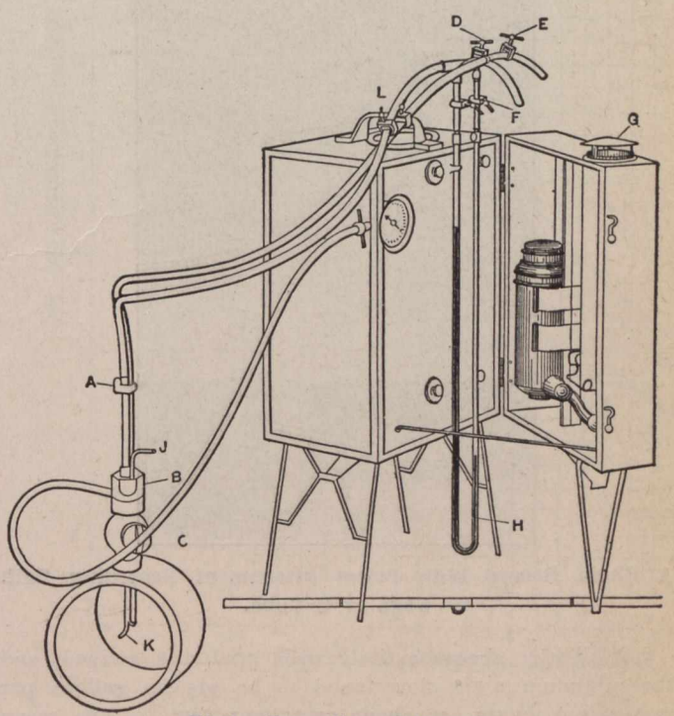


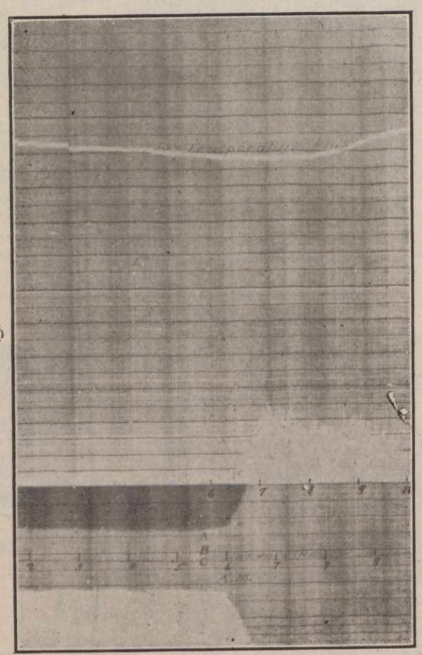
Photo Recording Pitometer.

The photo recorder consists of a portable box in which a drum carrying sensitized paper revolves before a fine vertical slit just in front of which is locked one leg of the U-tube, in such a position that the rays of light from a lamp will be partly interrupted on their way through the colored liquid in the lower half of the U-tube. As the liquid rises and falls with the velocity in the pipes it will record a line or band of shade on the velox paper whose ordinates vary according to the well known formulae $v = c\sqrt{2gh}$ in which h is ¼ of the U-tube deflection in feet or half of the recorded ordinates on the paper, C=0.84 the calibration coefficient of orifices. A prism attachment records the full deflection at low velocities.

Autographic horizontal lines are formed by notches in the drum split, spaced so as to **correct** for the angularity of the light and enable the true deflection to be readily taken **from the diagram at any point.**

To determine the quantity of water being discharged, a traverse is first made of the pipe at the gauging point, and from this traverse the pipe coefficient (mean velocity divided by center velocity) is obtained. The orifices are then left at the center and the mean velocity at any rate of flow may always be found by multiplying the center velocity by this coefficient.

A preliminary test of the first district was made in August, 1911. There was then a steady flow between 1.30 a.m. and 5 a.m. at the rate of 395,000 gallons per 24 hours. The district was subdivided and it was found that this high night rate was quite evenly distributed over all the streets. The services were sounded with an aqua-phone and a large number of houses were found to have a continuous flow of water during the night. The mains were also carefully sounded and no evidence of leakage could be found. Inspection of the fixtures in the houses in this district showed a large number of leaks, but in several houses with a continuous night flow, the fixtures were found to be in good condition, thus showing wilful waste.



A Photo Record With Prism Attachment Recording Both Legs of U-Tube.

A district almost entirely residential was gauged, and the minimum night flow found to be 395,000 gallons per twenty-four hours, or about 77.75 per cent. of the mean flow.

A few services were found to be leaking between the curb cock and the main, and these were repaired. After these repairs had been made and the houses inspected, the night flow was again taken and showed a reduction of only 50,000 gallons per twenty-four hours.

As this district was still in a very unsatisfactory condition, the engineers took the streets with the heaviest night flow and shut off all the services; it was then found that the flow to these streets stopped. This showed that the waste was in the houses and that there was no leakage in the mains.

A leak of 170,000 gallons per twenty-four hours was found; this was caused by a break in a 1-inch service pipe, which singularly enough occurred just inside a sewer through which it passed.

The twenty-two districts gauged with the recording pitometer showed a total mean flow of 10,618,000 gallons per twenty-four hours, and a minimum night flow at the rate of 7,185,000 gallons per twenty-four hours, or about 67½ per cent. of the mean flow.

In the districts subdivided, it was found that the high night flow is almost entirely caused by waste inside the houses. This is due to leaking fixtures, careless and wilful waste, and can only be controlled by the installation of meters.

The mains in these districts are remarkably free from leakage, as shown by our tests, for after closing all the curb cocks the flow practically stopped, thus proving the mains to be tight.

CONCRETE ROADWAYS.

Concrete roads have been the principal type of road built by Wayne County, Michigan, and concrete roads are the accepted standard of construction. The road commissioners state that their aim is to provide the county with durable, permanent roads. They believe that the concrete road that they devised and built has accomplished their purpose, and that that type of road is the coming roadway. It is a road that is low in ultimate cost, pleasing to the eye, smooth, dustless, and affords excellent traction for all types of vehicles. While their early efforts at concrete road building were somewhat experimental they have devised several means in their methods of construction which will add materially to the life of concrete roads. Among the more important improvements have been.

(1) The increase of the amount of cement used in the mix, changing from 1-2-4 mix to 1-1½-3 mix;

(2) More stringent specifications as to quality of stone and sand;

(3) An increase in the depth of the work to not less than 7 inches;

(4) A protecting plate at the expansion joint.

The Eureka road in Wayne County is a typical example of the type of roads built. Eureka road is one of the principal roads leading into Wyandotte. It is built of concrete of a 1-2-4 mix with 12 feet of metal, 23 feet over all at its narrowest point. It was built last fall, and additional mileage will be constructed at an early date.

The following is a statement of the expenditures on Eureka road, a stretch one mile in length, up to and including September 30, 1911:—

Roadway Proper.

	Cost.	
Teams	$ 980.00	
Other labor	3,364.15	
Pebbles, tons 2,014	1,657.78	
Sand, tons 700	684.94	
Cement barrels 1,218	1,723.97	
Coal, tons 60.75	189.45	
Expansion joints	77.60	
Lumber and engineers stakes	14.31	
Water supply	110.14	
Blue prints, advertising photos	11.47	
Lubrication, waste, etc.	48.51	
Liability insurance	49.41	
Hardware and repairs	27.50	
Express, messenger and auto	53.03	
Miscellaneous	48.81	
		$9,041.07

Drainage.

Open ditch	$ 265.01	
Tile drains	48.84	
		313.85
Total cost of roadway proper with drainage		$9,354.92

SOME NOTES ON COLUMN DESIGN.

By F. Tissington.

During the course of some ten or twelve years structural designing the writer has found it necessary on more than one occasion to compare the different column formulæ that are being constantly used, in order to get a true idea of their respective values.

Nearly every handbook issued by the different steel companies, as well as most of the current text books on designing, specify a particular formula having its own peculiar merits, and these, together with government specifications, produce a most formidable array of figures, which, to the average draughtsman and designing engineer, makes it almost impossible for him to select a particular formula as most suitable to his case.

Some years ago the writer compiled a series of tables and curves relating to column and strut formulæ in use at that time in England, and he found there was a large difference of opinion between the various authorities as to what constituted a safe load for a particular case, and in consequence of this he came to the conclusion that the only remedy, in order to design in a safe as well as in a commercial sense, was to pick out one particular set of figures and stick to them.

Professor Fidler's formula was the one finally adopted, and this was chosen in preference to any of the others, in consequence of the fact that it made an allowance for initial set or eccentricity of loading, which is almost certain to occur in any strut or column from one of several causes. For instance, it is almost impracticable to produce commercially either a simple or compound strut perfectly straight, and with the centre of gravity of every cross-section exactly coincident with a straight line drawn from two points at either end of the member which do coincide with the centre of gravity at those points.

Again, no structural material yet produced has been perfectly homogenous throughout, and this state of affairs produces the same effect as that outlined above, even supposing the member could be made perfectly symmetrical with the centre of gravity line.

A slight modification was made to Fidler's formula by adopting a sliding factor of safety. This consisted of the following:

Factor of safety for dead loads $2.5 + .01\,h$

Factor of safety for live loads $3.0 + .015\,h$

where h = value $\frac{Z}{r}$

Z being unapported length in inches.

r = least radius of gyration.

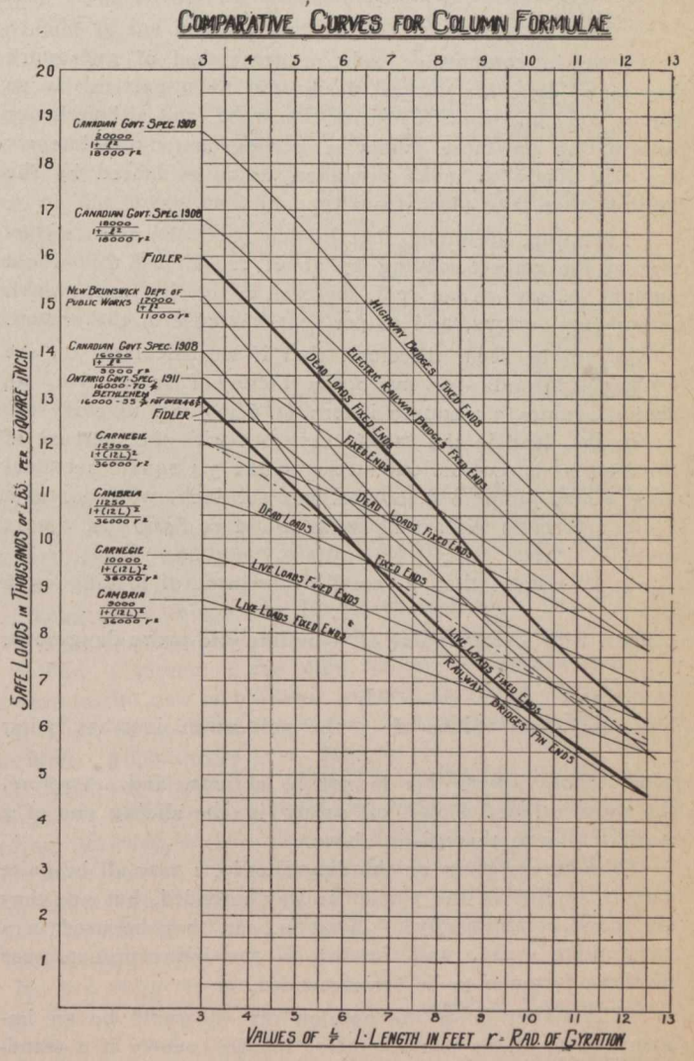
Since the writer has been over on this side he has found the same trouble, and nearly every design has to be figured on by a new set of column formulæ. The consequence is that there is very little practical value to be obtained from the compiling of tables of made-up struts and columns unless a new one is made for each new formula.

The diagram No. 1 will give a very good idea of what is meant, and the curves represent a fair sample of the different sets of figures the average designer meets in the course of a few months.

For the sake of comparison Fidler's formula, as used by the writer, has been plotted, and the two heavy lines represent the dead and live load curves for fixed ends as specified.

It will be noticed that the Canadian Government specification, 1908, for highway bridges for struts with fixed ends gives the highest value, but it should be remembered that there is an impact increment to allow for, consisting of $\frac{L^2}{L+D}$ where L = live load stress and D = dead load stress.

This, taken in a general way, reduces the allowable stress per square inch by about 35 per cent., in order to compare same with the other figures, and this new value is shown by the dotted line.



The other two curves belonging to the same specification —one for electric railway bridges and the other for railway bridges—would be reduced in a similar manner, but have not been shown.

The Cambria and Carnegie hand books give curves which represent very low values of permissible stress for low values of $\frac{L}{r}$ and relatively high values as the ratio $\frac{L}{r}$ increases.

This appears to the writer to be bad practice, as these formulæ do not take advantage of the stiffness of short columns and neglect to allow for the extra amount of flexure in long columns.

It was for this very reason the sliding factor of safety was adopted by the writer, although there is another point of view which ought to have some bearing on this as well.

For instance, if you take, say, a column of four square inches sectional area, and assume two cases,

(1) Where the value of $\frac{L}{r}$ is 3.

(2) Where the value of $\frac{L}{r}$ is 12

By using, say, the Fidler formula for live loads we obtain the following:

	Permissible stress, square inch.	Area.	Total load allowable.
(1).....	13000	4	52000
(2).....	5500	4	22000

Now, in computing loads, a great deal of guesswork has to be done for general designing, more particularly so far as wind and snow loads are concerned, and although our information on these points is getting more complete we are still likely to make mistakes, as is evidenced by the failures that take place from time to time.

Therefore, assuming that in this particular case we arrive at the correct loading by about 10,000 lbs, this would amount to, say, 20 per cent. increase in the first case, which is not very serious, and 50 per cent. increase in the second.

It will be seen, therefore, that if we calculated on the Carnegie formula for live loads factor of safety five, we should require 3.4 square inches @ 6,400 lbs. to carry the 22,000 lbs. load in the second case but with the increase of the load to 32,000 lbs. our stress on the 3.4 square sectional area would jump to 9,400 lbs. per sq. inch, whereas, with Fidler's formula the actual stress would be 8,000 lbs. square inch.

It is evident that a small increment of loading on a column with a large value of $\frac{L}{r}$ is likely to prove dangerous, but with small values of $\frac{L}{r}$ the percentage increase being considerably lower, this is not so serious, and, therefore, the most rational factor of safety is the sliding one of a similar type to that given above.

The curves given on the diagram No. 1 may all be quite safe if applied in the particular way intended, but are they all sound commercially? That is, can they be used in a competitive sense, and further, is the indiscriminate use of these formulæ to be recommended?

The writer is of the opinion that it would be an immense gain to the manufacturers in this country if a standard series of curves could be arrived at, and there does not seem to be any reason why one set of figures should not meet the case.

Starting, say, with columns for dead loads, fixed ends, it would be a simple matter to fix a reduction of so much per cent. for live loads and a further reduction per cent. for impulsive loads. The same could be done for pin ends, and the whole thing would then lend itself very well to the compiling of standard tables, which would count for efficiency and a great saving in labor in the designing office.

A LONG TUNNEL.

The Nepton tunnel, now being driven in the Pachuca, Mexico, district, will be over six miles long when completed. It lies at a depth of about 1,400 feet below the city of Pueblo. It was started 18 years ago, but only about two miles has been completed. It will drain the Pachuca mining district and afford an outlet for the different mines.

TELEPHONE COMPANIES OF CANADA.

Canadian Telephone statistics compiled to the end of June, 1911, have been completed by the Department of Railways and Canals, and issued in the form of a report. This is the first attempt of the Department to prepare statistics relative to the telephone in Canada, and it is to be regretted that more managers did not comply with the request of the Department in furnishing material for a more comprehensive and larger report. In all 537 companies forwarded a complete or semi-complete statement, and of these the province of Ontario was shown to have the bulk of Canadian telephone business by a great lead. The report, when divided into provinces, resulted as follows:

Ontario	319
Quebec	32
New Brunswick	16
Nova Scotia	14
Alberta	4
Saskatchewan	143
Manitoba	3
British Columbia	5
Prince Edward Island	1
	537

In the provinces of Manitoba, Alberta and Saskatchewan the Provincial Government has, in a certain measure, taken over the management of the telephone companies in their respective provinces. This is particularly the case in the two former provinces; as all the separate organizations which previously existed have been merged under the control of the government. In Saskatchewan the process of government absorption has taken definite form, but at the close of the month of June last there were still 142 companies holding their independence.

Of these 537 companies a great number are classed as rural, and these have, as a rule, an equipment of the lowest possible monetary value, and represent the so-called "party lines."

The combined capital of these 537 companies amounted to $40,043,982.29; of this total the province of Quebec had a combined capital of almost $19,000,000. This is the largest amount of money invested in telephones of any province of Canada, and may be accounted for by the fact of the heavy capitalization of the Bell Telephone Company in Montreal.

The gross earnings reported totaled $10,068,220, and of this sum $6,979,045 was operating expense; being a percentage of operating expense to income of 69.32 per cent.

At the close of June, 1911, the combined length of telephone wire of the various Canadian companies was represented by 687,728½ miles of wire, and to this length 302,759 instruments were connected. The mileage of wire was divided into 576,712¾ miles for urban use, and 111,015¾ miles for rural purposes.

The energy required to operate these instruments is derived from two sources, viz., central energy and magneto. Of these 174,994 were operated by the latter means and 127,765 by the former.

A FLOODED SUBWAY.

The Wellington Street subway of the Grand Trunk Railway in Montreal was so badly flooded by the thaw recently that street cars were held up, and passengers were put to much inconvenience. As soon as the drains were opened up the regular service was resumed.

REPORT ON VICTORIA HARBOR.

The report of Mr. Louis Coste, M.I.C.E., the engineer sent by the Public Works Department at Ottawa last December to investigate the requirements of Victoria, B.C., with a view to equipping this port for the great shipping development of coming years, have been made public. They outline the preliminary details for the construction of adequate harbor works for Victoria, the first part of a great scheme of development. Mr. Coste's plan is for progressive construction, making provision for enlargement as the trade develops, and no time is to be lost in beginning the work. Construction is expected to begin on the breakwater from Ogden Point, the first work, in the near future.

A breakwater of concrete blocks surmounted by a concrete wall, 2,500 feet in length, is to extend westerly from Ogden Point, with a concrete pier 1,100 feet long on the inner side, the breakwater to cost $1,250,000. Four other large concrete piers, with spacious warehouses and modern cargo-handling facilities, and a railway ferry slip where the car-ferries can load and unload their trains, will be built. The piers will be of 500, 700, 720, 800 and 1,100 feet in length, and these will be built immediately following a survey and borings, the construction of the first of the piers being hurried to increase the present accommodation for large ocean going steamers in view of the rapid increase of the shipping of the port. It is estimated that this pier will cost $400 000. The proposed piers will offer 6,400 feet of berthing for steamships and with the outer wharf piers accommodation will be provided for over a score of ocean-going steamers.

To connect the harbor works with the railroad terminals on the Songhees reserve a bascule bridge will be provided from the reserve to Laurel Point with trackage on Montreal Street to the various piers. The railroads will thus be enabled to move their trains to and from the seven great warehouses and the grain elevator to be provided.

For the growing coastwise trade the inner harbor is to be greatly developed, a comprehensive scheme for dredging, deepening and the clearance of obstructions being outlined. Much reclamation work is to be done, and the haror lines are clearly defined.

Mr. Coste recommends that the placing of the port under a harbor commission be considered. His reports follow:

The harbor of Victoria is situated at the southeast end of Vancouver Island, practically at the junction of the Strait of Georgia and the Strait of Juan de Fuca. This harbor is divided into two parts, known locally as the inner harbor and the outer harbor.

The inner harbor extends from Shoal Point on the east side and McLaughlin Point on the west side, to the east end of James Bay in an easterly direction, a distance of one and a half miles, and to Selkirk waters in a northerly direction, a distance of nearly two miles. The available depth of water, at lowest tide, in the channel, and close in to the principal wharves, is 20 feet, obtained almost altogether by dredging and blasting operations. This depth of twenty feet is, in my opinion, the maximum depth to which that part of Victoria harbor should be dredged, as the restricted area of possible navigable water limits the sizes of the steamers which can utilize it to a maximum length of 350 feet, and a draft of 17 feet.

This inner harbor is a very valuable asset to the city city of Victoria, to the province, and to Canada generally. Its coasting trade is very large, and is increasing annually at a rapid rate, but it is not possible to accommodate large ocean liners within its limits, and this has rendered necessary the creation of the outer harbor, with which this report deals exclusively in so far as required works are concerned.

The outer harbor of Victoria is immediately south of the entrance to the inner harbor. It may be said to extend from Shoal Point to Holland Point, on the east side, a distance of 6,000 feet, and from McLaughlin Point to Macaulay Point, on the west side, a distance of 3,000 feet, comprising an area of nearly 300 acres of water, varying in depth from 30 to 80 feet. In that harbor the spring tides rise 7 to 10 feet, and the neaps 5 to 8 feet, the low tides being very irregular. The datum for excavation by the Public Works Department is the zero of the gauge of the old customs wharf.

Mr. Coste suggests that a breakwater 2,500 feet in length should be built of a rip-rap foundation surmounted by a concrete wall protected on the seaward side by concrete blocks. This will protect all the wharves and the entrance to the inner harbor. The estimated cost of this breakwater is as follows:

Rip-rap stone, 365,000 cubic yards at $1.40.....	$ 511,000
Concrete wall, 36,000 cubic yards at $8.00.....	288,000
Concrete blocks, 4,000 cubic yards at $9.00.....	365,000
	$1,164,000
Superintendence and contingencies	86,000
	$1,250,000

The project of wharf development comprises a railway ferry slip, four piers respectively 500, 700, 720 and 800 feet in length, and in addition a wharf 1,100 feet in length along the inner face of the breakwater.

Among other things Mr. Coste recommends:

1. That the breakwater be built; cost, $1,250,000;

2. That a survey of the outer harbor be made at once to ascertain the cost of building wharves as shown on plan;

3. That, as soon as the survey is completed, pier No. 1 be built. Approximate cost, $400,000;

4. That negotiations be entered into with the Provincial Government, the Canadian Pacific Railway and the Canadian Northern Railway, with a view to affording rail connections to the outer harbor, by the construction of a bridge between the Songhees Point and Laurel Point or otherwise;

5. That the question of placing the whole of the harbor of Victoria in commission, be considered.

He also suggests for the inner harbor:

1. That a thorough survey of the harbor of Victoria be undertaken at once, boring being essential;

2. That the programme of works to be done by the plant owned by the government, recommended in this report, be approved, and instructions given accordingly for carrying it out;

3. That the shoal east of Songhees Point be removed by contract work as soon as the survey of the harbor is completed;

4. That that part of the harbor known as West Bay be thoroughly examined, to ascertain whether or not it is feasible to build in that bay a modern railway terminus, consisting of ferry slips and wharves.

As an emergency putty a new use was recently found for old newspapers. A party being in need of a crack filler and not being in a convenient position to obtain the real article made a boiling mixture of one pound flour and three quarts water and then soaked the paper, when the liquid had assumed a pasty condition.

The filler dried hard and did not shrink to any extent.

STEAM AND HYDRAULIC MACHINERY.

For many years Messrs. W. H. Allen, Son & Co., Ltd., of Queen's Engineering Works, Bedford, England, (and who are now represented in Canada by Messrs. Chapman & Walker, of Toronto) have occupied a prominent position as makers of high-speed vertical steam engines, steam condensers and their accessories, centrifugal and turbine pump and water power turbines. We therefore give below an illustrated account of some of the types of machinery just referred to which is certain to prove of interest to our readers, especially as Messrs. Allen's engines and pumps are to be found on all the leading ships in our navy, and on practically all the largest liners afloat.

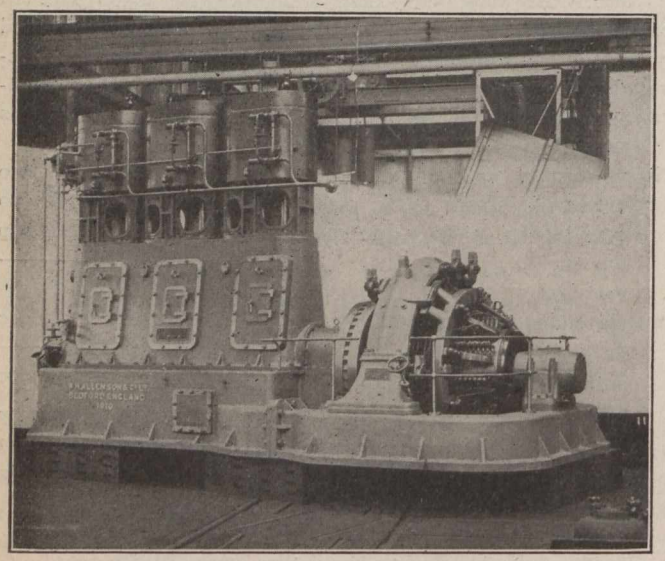


Fig. 1.

Engines.—These are built in both the open and the enclosed high-speed types. The enclosed high-speed engines are of the vertical forced lubrication type, the oil being supplied under pressure by a small valveless plunger pump driven direct from one of the main eccentrics. The cylinders stand upon a massive cast iron trunk, which completely encloses the working parts, the whole resting on a substantial cast-iron box section bedplate containing the oil pump, reservoir and filter, to which oil is supplied under pressure to the various working parts.

These engines are exceedingly neat in appearance and occupy the minimum floor space for the power developed, and are designed for use in connection with electric driving, and have been installed in large numbers in many of the leading British power stations where they are called upon to run for many months at a time without a stop.

The governor is of Allen's standard crankshaft type, and is fitted at one end of the crankshaft. It operates a double beat throttle valve situated next to the high-pressure valve chest. Hand gear is also provided by which the speed of the engine can be regulated while running through a considerable range above and below the average speed. A tachometer is fitted in close proximity to this wheel, which indicates the speed of the engine.

Figure 1 shows a three-crank compound high-speed enclosed engine in which the three cylinders are cast separately with their valve chambers.

The stuffing box packings, except where otherwise specified are of special metallic type.

Special care has been devoted by the makers to the question of balancing, the arrangement of the cranks and the disposition of the weights of the various parts being such as to ensure the very least possible amount of vibration. In the larger engines, especially those of the 3-crank type, both compound and triple expansion, special balancing weights are attached to the crankshaft, thereby reducing the unbalanced forces and couples to their least possible values.

Condensers.—For many years Messrs. W. H. Allen, Son & Co., Ltd., have made a specialty of condensing plants, and have built surface condensers together with air-pumps and circulating pumps, arranged to be driven either electrically or by steam, up to the very largest sizes required for modern power plant.

The condenser body and the water box are usually made of cast-iron, the tube-plates of rolled brass and the tubes solid drawn brass and fixed in the tube plates by means of tape packings and screwed brass ferrules.

The circulating water is drawn through the tubes by means of one of the "Conqueror" type centrifugal pumps either electrically or steam-driven, and the condensed steam and air are removed by means of an Allen-Edwards air-pump, which may be a single-cylinder, twin, or triple, according to requirements. Where the condensed water has to be delivered to a hot-well at a considerable height, an extra water force pump is provided for this purpose to relieve the air-pump valves of any water pressure.

The covers of the condenser water box are fitted with inspection doors, through which the water boxes can be cleaned.

The top of the condenser body is also fitted with a soda cock through which soda solution can be admitted to the condenser for the removal of any grease from the surface of the tubes.

Figure 2 shows a steam driven surface condensing equipment arranged to deal with 66,000 lbs. of steam per hour and maintaining a vacuum of 28 in. of mercury, with the barometer at 30 in.

The company also construct jet-condensers of a variety of patterns specially adapted to suit local conditions.

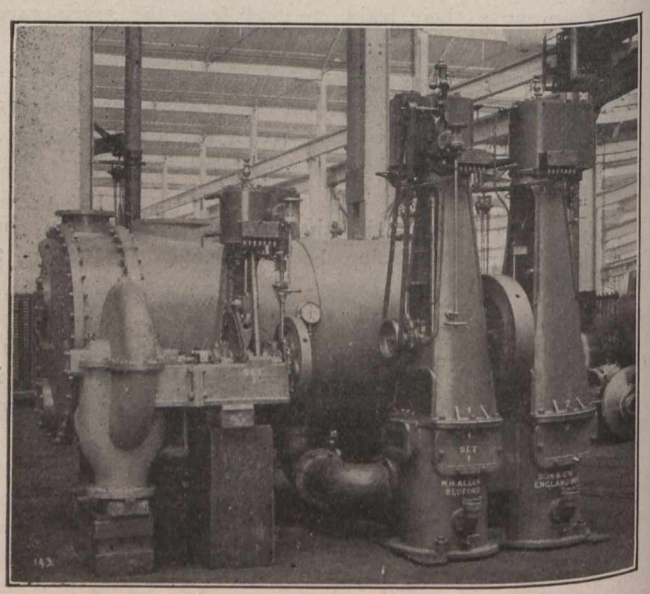


Fig. 2.

Centrifugal Pumps.—These pumps are particularly well adapted for conditions where the plant is required to run for long periods with the minimum of attention, and where limited space only is obtainable. Furthermore, with their large experience, Messrs. Allen have been able to continually improve the design of these pumps so that their efficiency is now brought to the very highest possible figure, while the design of the various parts has been improved along with the production of various improvements in the materials available for construction.

Fig. 3 shows a group of "Conqueror" centrifugal pumps coupled direct to continuous current motors. As will be seen, these pumps are so constructed that the casing is in two halves, one half being readily removable, thus permitting of easy access to the impeller and bearings.

The body and impeller can either be of cast-iron or gun-metal, and the spindle of steel or bronze according to the nature of the water to be dealt with.

All parts are finished to standard gauges and can easily be renewed. The pump is of the very simplest construction throughout, and at the same time has a good efficiency, and as there are no fine clearances the wear on the parts is practically nil, and the pump can consequently run for many years without incurring any costs for repairs or renewals, and is unaffected by water containing solid impurities.

Turbine Pumps.—Figure 4 shows a high-lift turbine pump and motor, the one illustrated being capable of delivering 525 gallons per minute against a head of 1,450 feet. These pumps embody all the latest improvements in turbine pump construction, and great care has been bestowed upon the internal design of the water passages and the selection of materials of construction, producing a pump of the very highest class and giving excellent results.

Owing to the very complete nature of the equipment of the workshops, the workmanship of these pumps is all that can be desired, the whole being finished to standard gauges.

This type of pump finds a large application in connection with mining work as it occupies a very small space and requires practically no attention whatever while running, the bearings being of the self-oiling type.

As these pumps have been designed to give the highest possible efficiency every care has been bestowed upon the finish and materials employed for the internal parts, the impellers and guide blades being constructed of high tension bronze and the spindle of nickel steel. An automatic arrangement is also provided to balance the end thrust upon the impellers and a ball thrust bearing is provided to maintain the shaft in its proper position.

All Allen's centrifugal pumps are adapted for driving either direct by a steam engine or electric motor, and can be arranged for rope or belt driving.

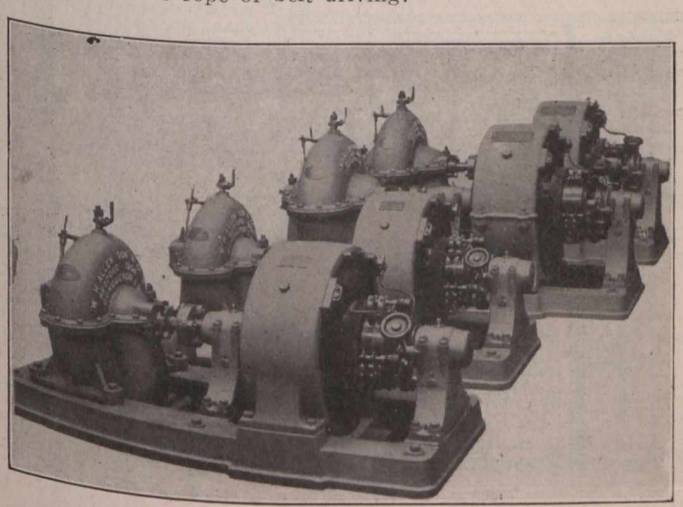


Fig. 3.

When necessary, foot valves can be fitted to the suction pipes or where steam is available an air ejector can be fitted for priming the pump, or the air exhauster may be of a special positive type, which can be driven direct from the pump shaft.

Water Power Turbines.—The increasing number of opportunities which now present themselves for the introduction of water turbines, owing to the opening up of so many districts where suitable supplies of water for driving water turbines are available, has led Messrs. Allen to give great attention to the further development of this class of machinery.

For water turbines up to 400 b.h.p. output Messrs. Allen design and construct their own special type of turbine, but for outputs above 400 b.h.p. and up to 10,000 b.h.p. in one unit, the company have a working agreement with the firm of Piccard Pictet & Co., of Geneva, Switzerland, under which they construct large turbines of their design.

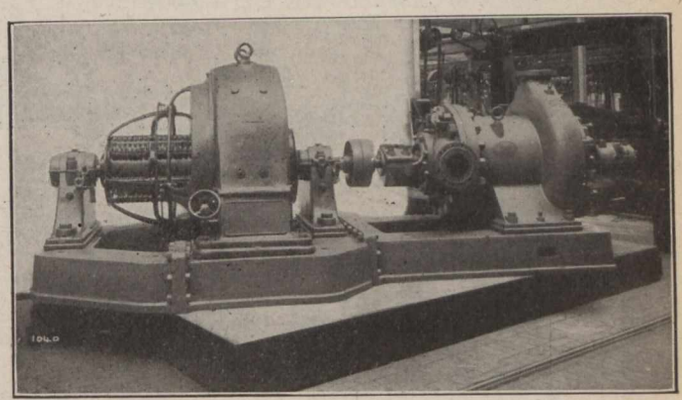


Fig. 4.

As the conditions may require, the turbines may be furnished with either an automatic governor or with regulation by hand only. If an automatic governor is fitted it is usually belt driven from a pulley on the main shaft of the turbine.

The governor, which is of a very sensitive design, by means of special gearing, actuates the regulating blades or shutters in the interior of the turbine, which control the admission of the water to the wheel as the case may be. The latest type of governor proper, which Messrs. Allen supply, is of a design in which the governor weights are suspended entirely by springs, thus eliminating all friction, inseparable from other designs of governors; it is not only a very cheap, but also a most sensitive governor, and is not subject to any wear. The auxiliary governors are either of the hydraulic or mechanical type.

DESIGNING OIL ENGINE PORTS.

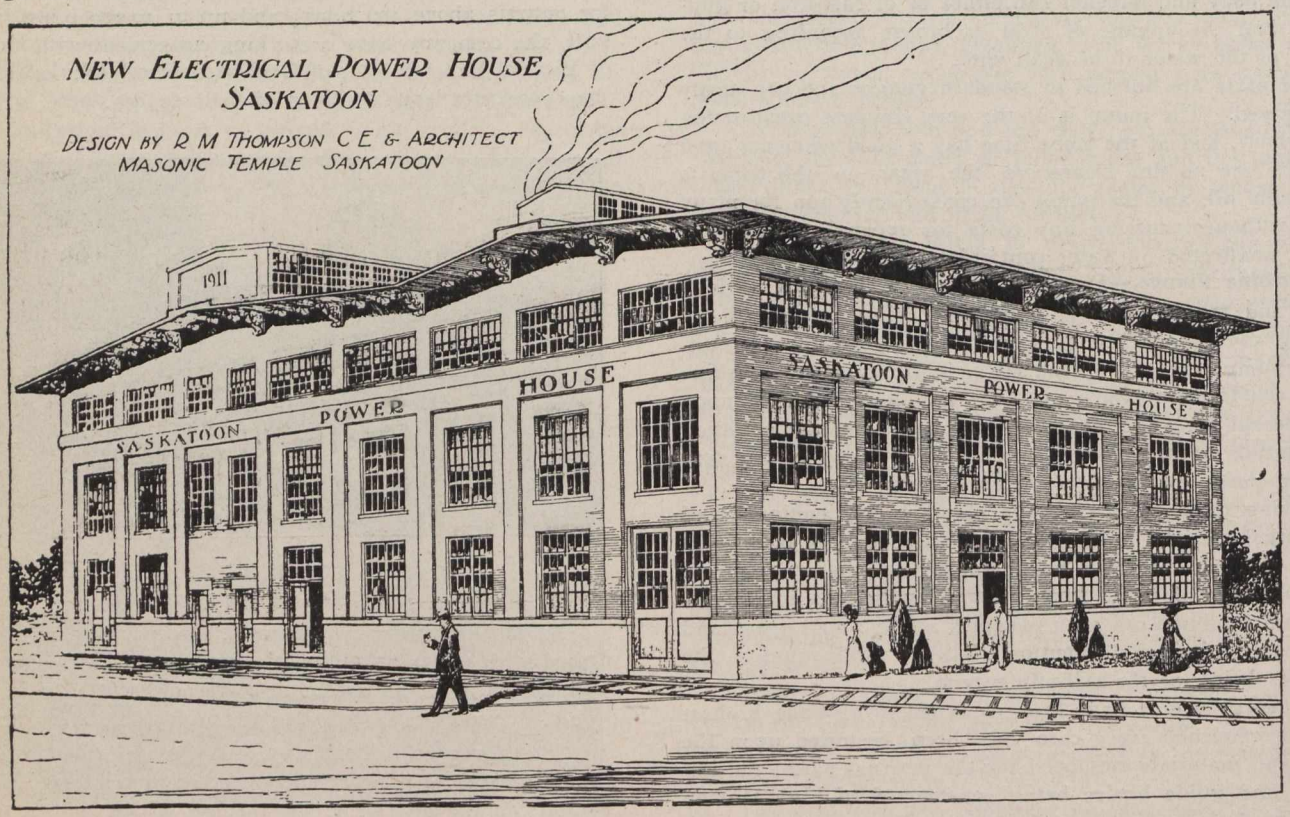
In a recent discussion regarding oil engine ports Mr. Wolcott Remington, designer of the two-cycle Blanchard Oil Engine, stated that in this type of oil engine the height of the exhaust port should be about one-seventh of the stroke of the engine. This, of course, is only general for average speed because the piston speed or the number of revolutions per minute of the engine would have to be taken into consideration in getting at the height of the exhaust port.

The height of the inlet port for average speed would be about half the height of the exhaust port. This is necessary in order to give the exhaust gases sufficient time to escape from the cylinder before the new charge of air starts to enter. These proportions are based on the supposition that the average charge of air will enter at about 5 lbs. pressure.

Mr. Remington is strongly in favor of the two-cycle engine as far as oil engines are concerned, as with the four-cycle type experience has shown that the collection of carbon causes valve cutting and leaky valves with a consequent loss of compression, the real governing factor of the efficiency of an oil engine.

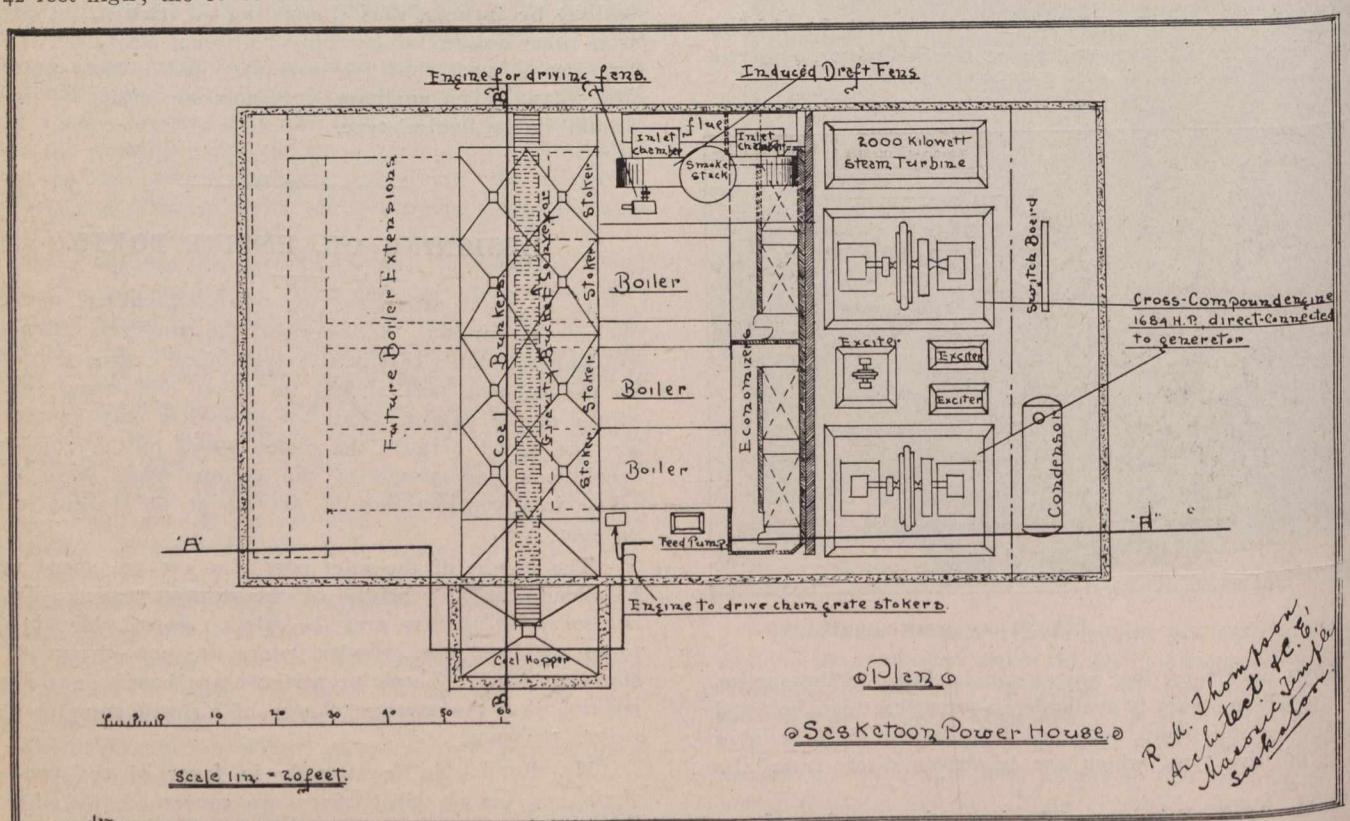
NEW POWER HOUSE AT SASKATOON.

The new power house stands on the corner of Spadina Crescent and Avenue A, Saskatoon, and is one of the show buildings of the city.



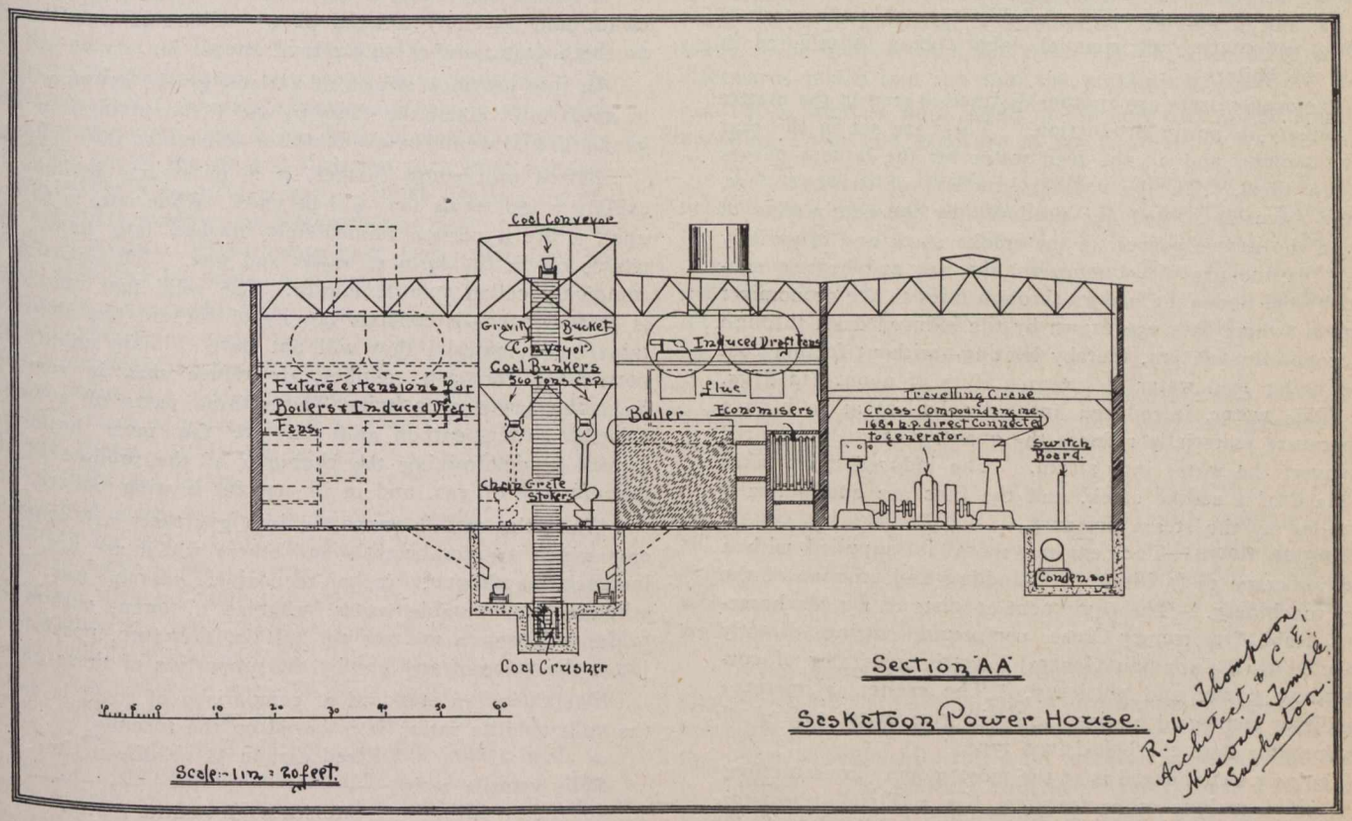
The construction is of steel, brick, and concrete, and is fireproof. The dimensions are 85 by 154 feet, and the walls are 42 feet high; the construction is of the most modern for buildings of this class, and is eminently fitted for the economical and convenient handling of the work. It is designed to admit of the extension of the plant up to 4,000 horse-power before any addition is made to the building, when, if additional space is required, the building will be extended in accordance with plans already in hand.

Equipment.—The equipment of the building with suitable machinery is the most important factor. Commencing in the boiler-room, the boiler equipment consists of three double cylinder water tube Babcock and Wilcox boilers, each of a rated capacity of 500 horse-power, but used in conjunction with the economizers, will deliver 650 b.h.p. to the engines, or a total of 2,000 horse-power. These boilers are equipped with Grime automatic chain grate stokers, which

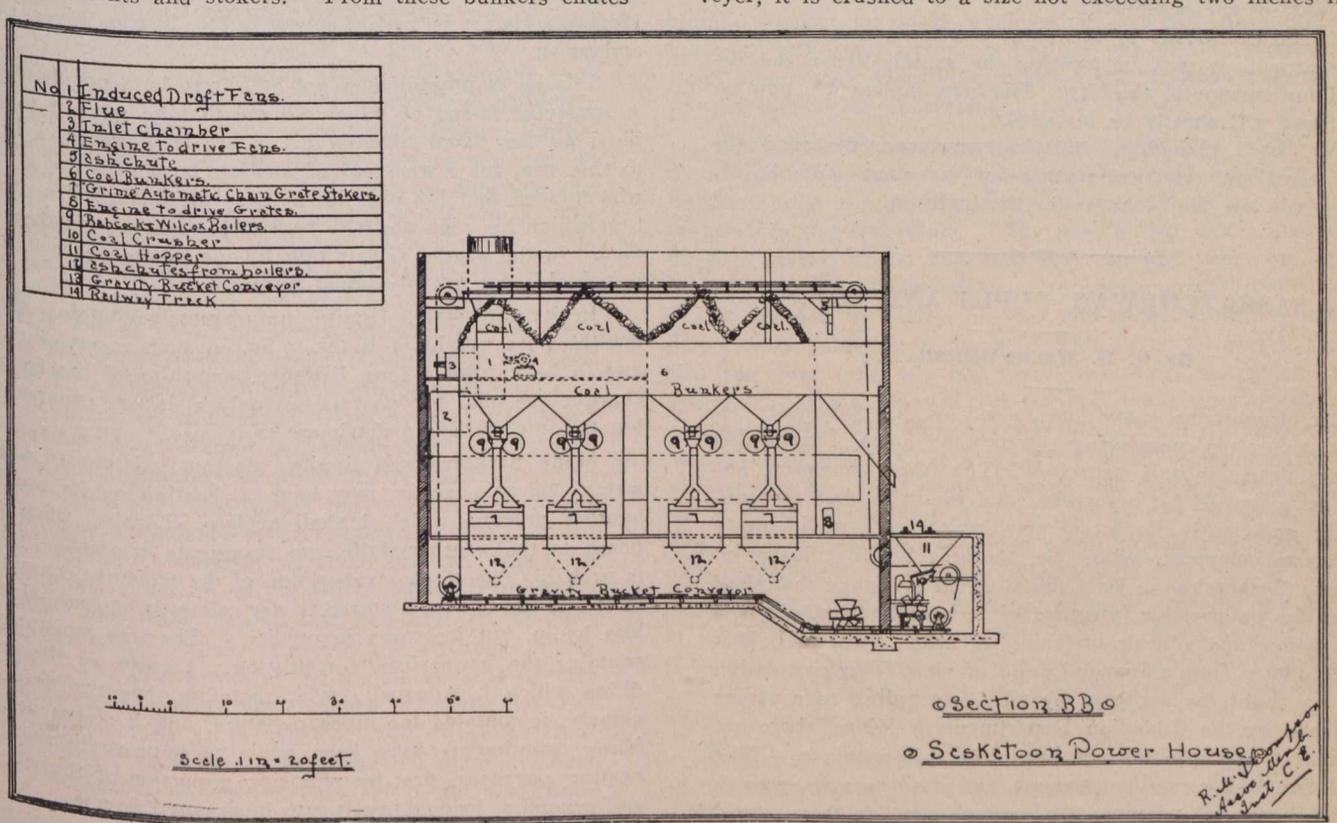


are driven by an independent engine, and feeds the coal as required under the boilers to convey the coal to the stokers.

An elaborate system of coal handling appliances is being installed. The first provision in this connection is the erec-



tion of a set of steel coal and ash bunkers, which extend the full width of the building, and are placed immediately above the boiler fronts and stokers. From these bunkers chutes



extend down to the hoppers of the stokers, and a steady flow of coal from above supplies the stokers at all times. The overhead bunkers are kept filled by a gravity bucket con-

veyer, which makes a continuous circuit from the coal hopper outside the building through and under the floor to the back of the building, thence upward and over the coal bunkers back to the hopper. Trips are located at intervals over the bunkers, and any or all of the bunkers can be filled at the will of the operator. Before the coal enters the conveyer, it is crushed to a size not exceeding two inches in a crusher located under the hopper outside of the building. Cars containing coal will be shunted on the track which passes over the hopper, and the coal dumped into same. The

coal ashes are handled in the same manner as the coal by the conveyer, and are elevated into bunkers at the front of the building, from whence they are loaded into cars or wagons by means of chutes.

By this system it will be readily seen that the work is entirely automatic, all manual labor being eliminated in firing the boilers.

The economizers are another distinctive step in the matter of economy in power production. They are set in the rear of the boilers, and all the feed water for the boilers passes through them. In the ordinary method of firing boilers, all the intensely heated gas produced by the combustion of fuel on the grates passes up the smoke stack and is entirely lost. By the use of economizers, the gas and heat is conducted from under the boilers through flues to the economizer chamber, where they are drawn by the induced draft through the economizer section, thereby heating—without further cost—the boiler feed water to a temperature of about 212 degs. F. This water, introduced into the boilers at so high a temperature materially reduces the quantity of coals required to convert the water into steam. The induced draft takes the place of a smoke stack, and the fans are automatically controlled by the steam pressure.

Engine Room.—The engine room is supplied with a traveling crane to facilitate the handling and erection of the heavy machinery. The equipment consists of a 1,684 horse-power Robb-Armstrong Cross compound engine, directly connected to a Canadian General Electric generator of corresponding power and efficiency. The exciter is operated by a direct connected engine, and will give better control of the generator than the belt-driven type.

The new switchboard is of the most modern construction, and besides various other features, has a Tirrell regulator which will keep the voltage steady. When this plant is in full operation, the large engine and generator from the old power plant will be installed in the new building, and used as a part of the equipment.

Large extensions to the plant are being considered for the year with a view of meeting the rapidly expanding demand for current in the city. Five new boilers are now on order and will shortly be installed.

Mr. A. G. Sangster, electrical engineer, designed the mechanical and electrical features of the plant. Mr. R. M. Thompson was the architect for the building.

SASKATCHEWAN FUELS AND GAS.*

By R. O. Wynne-Roberts.

Mr. Cleminsha asked me to act as his substitute to-night, and after rummaging through my notes, I consented to take duties in this capacity. The time, however, has been very limited for researches and inquiries, but the subject is sufficiently important to discuss in a rudimentary manner to commence with. So, to-night I will endeavor to talk on "Saskatchewan Fuel and Gas" in language that shall be, as far as possible, stripped of technical terms. It is a good policy and a desirable thing to utilize local fuel, if it is economical from a financial point of view. This postulation will, no doubt, be accepted by all. According to a report published by the Canadian Department of Mines, there are about 15,000,000,000 tons of lignite in this province. The population to-day is about 500,000, and if every man, woman and child was to consume, say, 10 tons per day there would be enough to last for 6,000 years. I express this fact so as to give you an idea of the quantity that is in this province, because the figure 15,000,000,000 is too great to be appreciated.

There is very little, if any, coal to be found in Saskatchewan, and probably a little peat. There is wood in the northern parts, and a huge pile of straw.

In this province straws of various grains are now lying in great piles about the country, and it has often been suggested that it would be available for conversion into briquets.

Before proceeding further, it is necessary, perhaps, to explain a few terms that will be used. When coal is thrown upon a fire a portion immediately flashes into flame and passes off in the form of vapor and gas. This portion is commonly called volatile matter. The solid fuel remaining is termed coke—it consists largely of carbon, but also contains some material that will not burn. This unburnable portion is the ash, clinker, or refuse that is removed from the grate or ashpit. These three parts of a fuel—volatile matter, carbon and ash—are the most important factors in determining the character of the product in the manufacture of gas, and in its use for heating boilers, etc.

When the coal is converted into gas there are constituents which are combustible and others which are not. For instance, hydrogen, carbon-monoxide, marsh gas, and ethylene are valuable gases, whereas nitrogen, carbon di-oxide and oxygen are not so. It is, therefore, possible to judge the value of any gas by the proportion of these gases.

The Canadian standard of comparison of coals is called the split volatile ratio; it is based on the formula

$$\text{Split volatile ratio} = \frac{\text{Fixed carbon } \tfrac{1}{2} \text{ volatile matter}}{\text{Moisture } \tfrac{1}{2} \text{ volatile matter}}$$

According to this standard lignite appears to be less valuable as we trace it from near the Rocky Mountains eastward. Near Edmonton the split volatile ratio is 2.46, at Medicine Hat it is 1.96, Estevan 1.80, Souris River 1.42, and so on.

Lignite at present does not appear to be a popular fuel. A respected friend of mine told me that he gave it to his pigs, as they liked to chew it. There is, however, a limit to this use, for I was told of another farmer in the States who noticed that his pigs liked it, so he pulverized a quantity, which his pigs ate with regrettable results, for they all died. In the course of this talk I hope to show that lignite is valuable for other rational purposes.

In its raw state, lignite unfortunately contains about one-third its weight of water. So, in such cases, when it has to be carried a long distance, one-third of the freight charges are paid for what is not only a useless commodity, but this moisture is a detriment to its use.

Many Saskatchewan lignites do not contain so much water, and this, again, may have a bearing on its use for another process, which I shall explain. Lignite, when exposed to the weather, falls into fragments or slack. This is probably due to the evaporation of the moisture contained in it. If the lignite is stored in dry cellars it not only slakes less badly, but improves in quality. The less moisture it contains the better it is for heating. Lignite, in the condition which it is usually sold, therefore, has two defects, namely, it contains too much moisture, and it slakes badly. Many experiments have been made to improve lignite for heating purposes, first by removing a portion of the water, and secondly, by making it into blocks or briquets.

In Germany, for instance, lignite, or brown coal, has been made into briquets with great success. It has been found that when this fuel contains about 30 per cent. of moisture and a suitable amount of tarry mixture, it will make

* Paper before Regina Society of Arts and Science, March 8th, 1912.

excellent briquets without the use of additional binding composition. So moisture has some advantage in this respect, but in the process of manufacture two-thirds of the water is squeezed out, so it has only 10 per cent., which is about equal to ordinary coal. In Germany a large proportion of the people use lignite briquets as their principal domestic fuel and the industry has grown to be immense. In the United States of America experiments have been carried on by the government, and it has been proved that briquets can be made out of the poorest fuel, but each kind requires to be treated in a particular way. North Dakota lignite possesses similar qualities as Saskatchewan fuel, perhaps it is a little superior. Experiments have been carried on to ascertain what can be made of lignites.

The main reason why lignites are not found to answer in ordinary stoves, or under steam boilers, is because the grates are not designed for that purpose. Lignite, besides containing water, has a low percentage of fixed carbon, and a high proportion of volatile matter. So, when it is used in ordinary grates, it is found to be too flashy, and the draught is often too feeble.

In the first place, we will see what has been achieved by using lignite for steam boiler heating. There are a number of 250 horse-power boilers, sterling water tube type, installed in connection with the Williston irrigation scheme, and one of these boilers was set aside for practical experiments with lignite as fuel. A special furnace of a semi-producer type was built, lignite was fed onto the grate and there converted into gas. The gas then passed through a combustion chamber, where a quantity of hot air was mixed with it, and most of the gaseous combustible was burned. The gas then worked about the tubes and heated the water, on its way out it also heated the air tubes, where the air was heated for the furnace. The fire grate had rooking bars and a quantity of cold air was admitted under the grate bars to keep them cool and to prevent clinker from fusing onto them. There are many interesting points which could be referred to, but I am omitting them. Continuous tests were made, and it was found that the combination of boilers and furnace gave good results with North Dakota lignite. Steam could be made with fuel efficiency of 55 per cent. to 58 per cent. of the heat in the coal, and no difficulty was experienced in obtaining the full capacity of the boiler. The results obtained compared very favorably with those in average plant when the heat available to the boiler is considered.

Another way of using lignites is by making them into briquets. The development of briquet manufacture has been very great during the last few years. On the important coal fields of South Wales, in England, Germany, and the United States, waste fuel, amounting to millions of tons, has been utilized in this manner, with profit to the capitalists and to the communities. The United States Bureau of Mines carried out a large number of experiments. They installed a German machine, designed to make briquets solely by means of high pressure of 14,000 to 28,000 pounds per square inch. This press may be described as a square pipe, into which the crushed lignite is placed and a plunger forces it through. The pipe tapers at the middle and the lignite, as it was forced through, was reduced in size and was polished and smoothed by the heated sides. Lignites from Dakota and other States were experimented upon. Some samples were found to be incapable of being made into satisfactory briquets without some binding material, whilst others proved to be all that could be desired. The conclusions arrived at by the authorities were, that lignite ignited readily, made a hot fire, and burned freely until it was consumed. Little shaking or poking of the fire was necessary to obtain maximum efficiency. The loss of unburned fuel through the grate was from 6 to 8 per cent., which was not excessive, and could be reduced by using suitable grates. In these experiments the lignite was crushed into ⅜ in. diameter or smaller. Dakota lignite was found to be tougher than the rest. It was then dried and afterwards mixed and run into the pressing machine.

These briquets were tested to see how they would stand knocking about and exposure to the weather.

It is stated that lignite briquets can be made for $1.50 per ton; this does not include the cost of the fuel. Among the advantages to be obtained, it is stated that lignite briquets give about 50 per cent. more heat than the raw material; they will stand handling, and will resist weathering much better than the raw fuel. There would be a saving of about 20 per cent. on the freight charges.

Lignite can be made into gas. There are two ways of doing this, namely, by means of the ordinary gas-works plant, and also by means of producers.

Prof. Babcock, of the North Dakota University, carried out interesting experiments in connection with making gas. He had a small plant consisting of a retort bench, condensers, scrubbers, washers, purifiers and holder. These were constructed for the special purpose of seeing what could be done with lignite.

In an ordinary gas-works, the roal is placed in a fire-clay retort, which it like a pipe with one end closed up and the other connected to a pipe to take away the gas. When the retort is sufficiently full a lid is fastened on and no air is admitted. The retort is built in brickwork over a furnace which is heated to a temperature of about 2,200 deg. Fahr. The coal is burned in the hermetically sealed pipe and the smoke has to force its way up through the ascension pipe to the various parts of the work. This, of course, is a very simple description of a gas-making process; it is much more scientific and technical, but for our present purposes I am eliminating everything which might tend to make the process difficult to understand.

When Prof. Babcock was experimenting with lignite he found that it was not necessary to maintain such a high heat, he found 1,200 to 1,400 deg. Fahr. to be ample, so less fuel is required to fire the retort. The smoke that is discharged consists of tar, vapor, and gas. The tar and vapor are removed by means of condensers, scrubbers and washers. The gas is purified by means of lime and other materials, and then it was passed into the holder for use. It was found that the unpurified gas had about two-thirds the value of good coal gas, but when it was purified it was three-quarters as good. Tar and ammonia was also obtained and about half a ton of coke. The gas burned in an ordinary burner without smoking, and could be used like ordinary coal gas, but a greater quantity had to be used to get the same result. One ton of lignite yielded about 11,000 cubic feet of gas, which is about the same as with good gas coal.

The coke obtained, however, was not suitable for use in its ordinary condition, so Mr. Babcock made briquets of it by mixing pitch with it and passing the mixture through a machine. These briquets gave results equal to anthracite which I consider excellent.

With gas producers, air is admitted, so the gas is not of the same quality as when it is made in ordinary gas-works plant. In the suction producer, after a fire has been kindled and the engine started the suction of the engine causes enough gas to be generated as is required, but as lignite has not yet been used to any great extent I will not dwell on this class of producer longer.

The pressure producer, as its name implies, is not dependent on the engine for draught, but air is forced in. These producers are simply cylinders lined with fire brick, into which air and steam is admitted in suitable quantities, and after the gas has been passed through scrubbers and washers to take out the tar, it is passed into a holder for use as and when required.

Many experiments have been made with lignite for gas-making with this type of producer. A 250 horse-power gas producer of this type was installed by the United States Bureau of Mines, and it will be interesting to note what was done. A 235 barke horse-power gas engine was worked and this was connected by belting to a 200 kw. electric generator.

North Dakota, Texas, California, and other lignites were tried and a large number of ordinary coals. I shall take the results obtained with Pennsylvania coals for the purpose of comparison. With Dakota lignite they experienced no difficulty in keeping up full load, and they found that the gas had a calorific value equal to about one-fourth of ordinary coal-gas, that is, it had 145 to 164 B.t.u. per cubic foot. Texas lignite was very satisfactory, and they found that the heat value was greater than that obtained from ordinary coal.

The quantity of lignite used per electric horse-power was as follows:

North Dakota lignite	1.70 to 2.20 lbs.
Texas lignite	1.39 to 1.99 "
California lignite	2.06 "
Pennsylvania coal	1.01 to 1.50 "

The quantity of gas consumed per electric horse-power was:—

Dakota lignite	77.8 to 87.2 cubic feet
Texas lignite	81.3 to 84.8 " "
California lignite	87.7 " "
Pennsylvania coal	81.5 to 103.4 " "

The calorific value of the gas was:—

Dakota	6470 to 7830 B.t.u. per. lb. of dry fuel
Texas	7130 to 8100 " " " "
Pennsylvania	8310 to 13540 " " " "

Generally speaking, lignite used by means of gas producers gave 2½ times the power if used with steam boilers and engines. Furthermore, the experiments showed that low-grade North Dakota lignite developed as much power when converted into gas as did the best Virginia bituminous coal when utilized under steam boilers.

Expressing the results in another way, the efficiency of the entire plant, based on the electric horse-power, made commercially available and the fuel consumed was:—

Dakota lignite	9.2 to 12.7%
Texas lignite	9.9 to 11.9%
Ohio coal	11.1 to 14.3%
Pennsylvania coal	10.8 to 15.0%

So, it will be seen that North Dakota lignite, which is a near relative of Saskatchewan lignite, gave exceedingly good results when converted into producer gas.

There is another type of producer, namely, the down-draft, but this will not permit me continuing the discussion. I may state, however, that the air is admitted at the top and not at the bottom, as in the other producers, and this is for the purpose of burning the tar.

On the basis of the tests made, it will be interesting to note the difference in the various gases made by producers and ordinary gas plant.

Good bituminous coal will yield about 11,000 cubic feet of gas, and almost 1,500 pounds of coke, besides tar and ammonia; the calorific value of the gas is about 650 B.t.u. per cubic foot.

Ordinary bituminous coal converted into producer gas will yield about 120,000 cubic feet, some tar and ammonia, and the calorific value of the gas is about 150 B.t.u. per cubic foot.

Lignite will yield about 11,000 cubic feet of gas, some tar and ammania, and half a ton of coke, which can be made into briquets. The calorific value of the gas is about 500 B.t.u.

Lignite converted into producer gas will yield about 70,000 cubic feet, some tar and ammonia. The calorific value of the gas is about 160 B.t.u. per cubic foot.

Some authorities are sanguine enough to state that in the near future producer gas will be supplied for all purposes at such a rate that might seem incredible. Mr. D. B. Dowling, of the Canadian Geological Survey, in a paper read before the Canadian Mining Institute, wrote: "A town in the west supplied with lignite at from $3.00 to $4.00 per ton should have a producer gas plant to use lignite—heat the houses with gas at ten cents per 1,000, use the gas engine for electric lighting and water supply and run all the factories by the same means of producing power." I am not at present in a position to express opinions on this phase of the subject, but that lignite can be used for various purposes cannot be gainsaid. Producer gas will require larger mains to carry it and larger fittings to consume it than with ordinary coal gas, but when this matter is carefully gone into it may be possible to find compensatory factors.

In conclusion, what will be the advantages of using lignite in the various forms mentioned to-night?

Cheap gas would constitute an excellent attraction to manufacturers; it would also be a great convenience to our womenfolk. Lignite briquets would be cheaper than any other form of fuel, and would be found satisfactory if proper grates were used. Lignite gas would reduce the smoke nuisance. It would be handy for various industrial operations—annealing, japanning, soldering, brazing, drying, evaporating, for stoves, boilers, bakers' ovens, etc. Producer gas is being largely used for brick, lime and cement kilns; gas can be so easily distributed from any centre and to any part. Twelve per cent. of the producers in the United States are operated with lignite. As natural gas cannot be duplicated by any known process, we should make the best possible use of our natural resources of fuel.

Producer gas can be made from wood, sawdust, tan-bark, straw, hay, corn-cobs, and corn-stalks, and even leather scraps, but of course these fuels, with the exception of wood and sawdust, are not yet in extensive use.

The quantity of lignite mined in Saskatchewan appears to increase with the population; for instance in

	Population.	Tons lignite mined.
1891.....	40,520	20,000
1901.....	90,564	44,900
1906.....	257,763	170,582
1911.....	500,000	200,000 (about)

I wish it to be clearly understood that the remarks made to-night are exceedingly rudimentary. The subject is so full of technicalities that it is difficult to give expression to the essential facts without introducing terms which would require more time to explain than is available this evening. I hope, however, that what has been said will create a desire on behalf of the public for more and fuller information and details. I understand that the government proposes to make a full investigation into this most important matter, and it can be safely said that there is ample room for original experiments and tests.

The Canadian Engineer

ESTABLISHED 1893.

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CONTENTS OF THIS ISSUE.

HARBORS ON THE PACIFIC.

The opening of the Panama Canal will herald the dawn of a new era for the west coast of the American continent. A great impetus will be given to the development of the mineral and agricultural resources; in the increased facilities available for marketing products at the great trading places of Europe. The United States recognized the necessity of providing means of transportation for the rapidly developing Western States additional to the transcontinental railway systems in operation now. The completion of the Panama Canal will be the initial realization of the satisfaction of the demand for a shortened and cheaper route to the eastern United States and the European markets.

The United States, appreciating the consequent necessity for adequate shipping facilities as a result of the completion of the canal, are now spending millions of dollars in deepening, enlarging and constructing their harbors on the Pacific coast, so that when the new waterway is ready immediate benefits may be received from its use.

The Canadian Government have been slow to perceive the necessity of immediate action, if Western Canada is to share in the new markets opened by the canal. We are glad to see that they are awakening, however. The report of the Government engineer, Mr. L. Coste, on Victoria harbor has just been published. An abstract of the report will be found in this issue of *The Canadian Engineer*. Mr. Coste recommends a very extensive programme for the development of Victoria harbor, a programme which, if followed, will place the city in a most enviable position for handling its share of the vast traffic which will develop in our Canadian West.

The Government must take steps to follow up the report with prompt action. Every day this work is delayed means increased strength to the American harbors on the Pacific coast. Once the lines of traffic have been laid, it becomes increasingly difficult to change them. To develop our Western provinces and to receive the maximum benefit from the new avenues of transportation, we must spare no exertion. Our harbors on the Pacific coast demand immediate attention if our share of the new prosperity is to be received.

COLUMN DESIGN.

The subject of column design is a very important one, not only from the point of view of safety, but also in the necessity for securing maximum efficiency in labor and material for the manufacturer. In this issue of *The Canadian Engineer* appears an article, entitled "Notes on Column Design." In our opinion the plea of the writer for uniformity in column formulæ is well justified. An examination of the formulæ in common use shows that the majority of designers are not so far apart as is generally supposed. The most commonly employed formula at the present time is that which has been made popular by the American Railway Engineering Association. This conforms tolerably closely to the actual results of tests, and with the extensively used formula of the New York Building Code. The former, and certain formulæ giving similar values, have been justly criticized on the ground of their severity for columns having high values of slenderness ratio.

The remark of the writer concerning the necessity for careful provision for extra amount of flexure in long columns while pertinent, should not be followed to the

extreme. Experimental investigations have shown that the allowable stress on steel columns depends quite as much on the make-up of the section as on the slenderness ratio, and that a short column will not necessarily carry a greater load in pounds per square inch than a column of considerably greater slenderness ratio. It might be remarked that a careful study of actual full-size column tests, made by the engineer members of the Citizens' Committee on the revision of the Toronto Building By-law, showed that a formula very closely approximating that of the New York Building Code fitted the results of tests better than any other, and a working formula was, therefore, proposed which does not differ materially from that formula.

While the practice as followed by the writer, of distinguishing the dead loads and live loads in column design has had very extensive following, it is both inconvenient and liable to lead to trouble. Modern specifications almost universally proportion for dead load and live load by the same formula, making proper allowance for the trying character of the live load by means of an impact formula. The actual simplification of design thus effected is of some importance.

In structural practice on this side of the water, sliding factors of safety are not popular. There is no very good reason why the proper factor of safety for all values of the slenderness ratio cannot be contained in the working formula, and such is the almost universal practice at the present time.

The above comments on this paper are not made in a critical spirit, for the work done and the conclusions arrived at deserve a good deal of attention at the hands of engineers. There is no question that a standard formula for column design (that of the American Railway Engineering Association, or a similar one) would be of great benefit to the designing engineer and the manufacturer. We are glad that the writer has presented his thoughts so clearly in this excellent paper, and we hope that some discussion will arise as a result.

THE RAILWAYS IN BRITISH COLUMBIA.

A vast prospect opens up in British Columbia as the result of the programme outlined in the Provincial Legislature for railway development. Legislation recently enacted provides for the closing link in the new route between the Kootenay and the coast by granting a cash bonus of $10,000 per mile for the continuation of the Kettle River line from Coldwater Junction to Hope. This joins up with the present boundary branch of the Canadian Pacific Railway to Coldwater by the line now under construction from Midway westward and from Penticton eastward. This new route will provide a far shorter and better location than the main line, with the advantage of easier grades.

The Provincial Government also announce the projected acquisition by the Canadian Pacific Railway of the former Great Northern right-of-way in the Kootenay Lake basin of the Slocan. The Canadian Pacific Railway will take over the right-of-way from the syndicate of Kaslo citizens, which took it, with Government backing, from the Great Northern last year. Under the new management the line will be re-built to standard gauge and joined to the Canadian Pacific Railway's Slocan system.

The above announcements, when crystallized in action, will have a great effect in developing the latent resources of British Columbia, as well as in the case of the short route to the coast, introducing the traveller to the developed eastern British Columbia instead of as at present to picturesque mountain scenery as a part of a lengthy journey. The improved shipping facilities should immediately increase the silver-lead and zinc shipments from the Slocan district.

There is no doubt that better railway facilities in British Columbia, combined with the improvement of the harbors and the opening of the Panama Canal, will cause a tremendous influx of capital with the consequent development of the rich resources of the province.

THE FAMINE IN CHINA.

There is a bad famine in China and immediate relief is necessary. Canada, we know will be among the first nations to give much needed assistance. A national movement is being inaugurated and money, wheat and flour will be dispatched to the responsible international committee in China, who will see to its proper distribution. The Canadian railways have promised to help, the leading Canadian milling companies will, if required, grind wheat at cost for shipment to China. Prominent citizens throughout the country will co-operate, and we must have the help and financial assistance of the Dominion Government. Talk is frequent regarding the bonds which exist between nations. Here is an opportunity for us to prove that the talk has a practical and sympathetic phase. From the humane viewpoint, there should be no hesitancy in sending a ship load of wheat, flour, and funds—a national gift from Canada to the famine-stricken Chinese.

Aside from the duty, which is apparent, there are many other good reasons for such action. First, we need the friendship of every nation we can secure. The Oriental labor problem has yet to be solved, and it will be easier to negotiate with an ally. Again, there must be removed from the average Chinese mind the impression that there is only an "America." We should tell the Chinese as a nation that on the North American continent is the great Dominion of Canada, rich in natural resources, and whenever occasion arises, wealthy in practical sympathy.

The suggested action by Canada would have another important bearing. Despite what is said by many diplomats, the Far Eastern situation in its relation to Great Britain and the Empire is by no means removed from the danger zone. The contribution to China, by the principal of the overseas empires should prove of considerable assistance in the future conduct of Empire diplomacy. Then there is the awakening of China to the imperative necessity of the application of modern science to national life. The floods are the cause of the present famine. Floods have proved a national disaster in China time and again. Engineering skill would mitigate, if not abolish altogether, this devastation. Engineering skill would improve the present unsanitary conditions existing in many parts of China and which, with the floods, are responsible for large loss of life. Canadian engineers can take their share of that work in China.

Here then is a worthy appeal to the people of Canada.. Immediate action is necessary. With that object in view, organization and national committees are being formed, the membership of which will probably be made known in a few hours.

EDITORIAL COMMENT.

The annual report of the Temiskaming and Northern Ontario Railway has recently been presented to the Ontario Legislature, and shows a gratifying increase in the total net earnings for the year. The net earnings have increased from $436,130.31 for 1910 to $593,152.69 for 1911, or an increase of about five per cent. The operating expenses have decreased in percentage from 73.2 to 66.4. An appendix to the report is a report from Engineer Ellis, who states that the mouth of the Moose River, on the James Bay, provides the only possible site for a harbor. He adds the opinion that the cost of making the roadstead available for vessels of reasonable draught might not be prohibitive.

* * * *

An inkling of the country's railroad needs is gathered from the statement of Vice-President Bury, of the Canadian Pacific Railway, that the company may spend, shortly, $60,000,000 on an entirely new line of railway from the prairies to the Pacific coast. It was Mr. Bury who recently emphasized the importance of mixed farming in Western Canada as a part solution of the crop movement problem. The growing of wheat, however, will for many years keep ahead of the cult of mixed farming. We cannot tell the Western grower to stop wheat production until railroad mileage, waterways and terminal facilities overtake him. Material and labor, rather than money, appear to be the railroads' trouble. This makes important the work of immigration. In turn, we must remember that railroad labor to-day may not have the same employment to-morrow. While there is need for caution in new tranportation plans, the double tracking of the Canadian Pacific Railway from Winnipeg to the Pacific coast appears to be a necessity. According to Mr. Bury's various calculations, based on the development of all the railways in Western Canada and a proportionate growth of the country, only 40 per cent. of the crop will be moved by the close of navigation this year. This is a problem upon which our governments and tranportation authorities may well concentrate effort.

LETTERS TO THE EDITOR.

Water Powers of Canada.

Sir,—In your issue of March 7th I note an appreciatory editorial respecting the report on Water Powers by L. Denis and A. V. White, recently issued by the Commission of Conservation.

You say: "There is one feature of the conservation question, however, which is lost sight of, and that is the absolute necessity of securing the highest possible economy of water in all water power developments," etc.

Our report not only shows the wasteful use of head, as illustrated by conditions at Niagara Falls, but, in addition, points out the necessity for providing for the possible use of all the power that may be made available at any particular water power site.

This is brought out on page 12 as follows:—

"The regulations respecting waters which are to be set aside for the development of power should be so framed as to require that the preliminary installation of dams and other main works necessary for the control of the waters be made with reference to the possible future development of the full water-power that may be available. For example, suppose a certain waterfall is capable of yielding 10,000 horse-power. If development rights are let to A. for 2,000 horse-power, to B. for 1,000 horse-power, and to C. for, say, 1,000 horse-power., and A., B. and C. are allowed to design and construct their respective works irrespective of each other, or of the possible development of the remaining 6,000 horse-power, then it will probably become quite impracticable to get anything like the remaining 6,000 horse-power because of the damage that would be caused to the plants of A., B. and C. On the other hand, if preliminary works were constructed with a view to utilizing any amount of power up to the full 10,000 horse-power, as occasion demanded, no such contingency as has been supposed could well arise."

James White,
Secretary Commission of Conservation.

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Lethbridge Sewage Disposal Works.

The Editor:

Sir,—We have read the very interesting account of the new works in course of completion at the above, designed by Mr. Aird Murray, and described in your issue of February 1st, and as makers of the sprinklers and other fittings for the filters and tanks, we would like to add a few lines regarding these sprinklers, which we think would be of interest to your readers.

The three percolating filters are to be worked by our Patent Airlock "Cresset" Revolving Distributor with Canadian Patent Roof Support. The stationary centre column is extended to form what might be described as the tent pole, which extends to the apex of the roof, where the girders converge and are bolted to the lugs on the centre cap. The body of the sprinkler is so built that, by removing adjustable wedges, the double flanged piece in the column can be taken out; this action releases the weight on the ball bearings, so that they may be got at, cleaned and replaced without dismantling the whole of the sprinkler and consequently the roof.

Another valuable advantage which the "Cresset" has over all other makes is its lack of friction when in work owing to the airlock seal. This seal enables the apparatus to revolve with so small a head as 9-inch, and deliver almost any variation in volume required.

We are issuing a new pamphlet, wherein the mechanism of this apparatus is specified, and shall be pleased to send same to any of your readers on application. Yours obediently,

Adams-Hydraulics, Limited.

An interesting bill has been introduced by the Attorney-General of Saskatchewan. The measure provides for the appointment of a Fire Commissioner, whose foremost duty shall be to investigate the origin and circumstances in general connected with every fire which is believed to have been caused by incendiarism or negligence. He may issue subpœnas for the attendance of witnesses at such investigations. Deputies will be appointed throughout the province to furnish the Fire Commissioner with reports on every fire occurring in the various municipalities, where the damage is in excess of $100. They shall also advise him of any suspicious circumstances, and he will then be in a position to institute an investigation. This is most desirable legislation. Manitoba already has a fire commissioner, and Saskatchewan will likely be the next province. Ontario has discussed the matter for many years, but seems little nearer an actual appointment. With an annual fire waste in Canada of more than $20,000,000, every province can well afford to employ a fire marshal or commissioner.

THE PRINCIPLES OF SPECIFICATION AND AGREEMENT WRITING.

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

Fifth Article.

GENERAL CLAUSES.—Continued.

The general clauses of the specifications differ from the specific clauses in that they refer to the general office and field relations of the parties rather than to particular operations or details. Where specific regulations are inserted in the general clauses they refer to matters which do not directly enter into the construction of the work but are preliminary or relative to the project. Provisions of this sort would concern such matters as instructions to bidders, security or payment to the Contractor.

There is some difference of opinion as to which of the general provisions of the contract should be incorporated in the specifications under the head of "General Clauses" and which should be reserved for the agreement. It is the writer's opinion that the division should be made on the basis of the uses to which the written contract will be put. The engineering staff, with the exception of the chief engineer or engineer in full charge of the project for the Owner, seldom requires to consult those stipulations concerning the legal or business responsibilities assumed by the Contractor, but any assistant engineer or inspector may require to inform himself respecting any feature of the construction of the work, the payments to be made for it, the direction of field operations, or, in fine, any provision defining the duties and authority of the Contractor or the representatives of the Owner on the work. For this reason, it would appear that all those clauses which concern the normal working of the contract, including such incidents as charges, extras or defective work should go in the specifications while clauses referring to legal or business responsibilities or to abnormal happenings, such as forfeiture of the contract or settlement of disputes, and with which only the original contracting parties and the chief engineer would have to deal, should be placed in the agreement. The specifications then become purely a code of working rules for those who may have to do with the actual prosecution of the work or design or construction, while the agreement becomes a document to which reference need be made only in case of serious disputes, unusual situations or the final settlement.

Of such great variety are the matters treated in the "General Clauses" of the specifications that it is impracticable to mention here more than a part of those which frequently find a place in specifications. The subjects which might advisedly be covered in the "General Clauses" of the specifications forming a part of a typical construction contract, and following the relationship between the specifications and the agreement outlined above, would be as follows:

(1) Definition of Terms.
(2) Contractor's Undertaking.
(3) Plans and Specifications.
(4) Character of Work.
(5) Inspection.
(6) Conduct of Work.
(7) Alterations.
(8) Extra Work.
(9) Duration of Contract.
(10) Powers of the Engineer.
(11) Estimates and Payments.
(12) Security.
(13) Instructions to Bidders.

(1) **Definition of Terms.**—The terms which require to be defined in the "General Clauses" of the specifications are principally those referring to the contracting parties or their representatives, technical terms presumably having been defined in the specific clauses. Thus, the word "Contractor" might be interpreted by an inspector to mean either the general contractor or a subcontractor, unless the particular one meant is explained in the specifications. "Corporation" might, unless limited in its application, refer to a contracting municipal corporation or to the private corporation with which it contracts. If there were more than one municipal corporation involved in the contract, it might refer to any one of them. "Company," "Board," "Commissioners" or any such bodies having mention in the specifications should for the convenience of those whose duty it is to enforce the contract be defined in the specifications and not merely in the agreement, which, indeed, they may never have occasion to examine. So many engineers are associated with a work of any magnitude that the word "Engineer" should be clearly defined. It might mean the Owner's engineer, any consulting engineer who might be retained for special services, a resident engineer or the Contractor's engineer. Definiteness is, therefore, imperative in this matter. "Inspector" should be defined so that, for example, any municipal councillor who chooses cannot hand out instructions to a Contractor under the pretext of being a special inspector.

(2) **Contractor's Undertaking.** — This description of what is to be undertaken by the Contractor does not refer, except perhaps indirectly, to the extent or character of the work which is to be finally delivered up to the Owner, but rather to those things which the Contractor must furnish in order that work of the kind required by the Owner may be secured. He must provide all material, labor, tools and appliances necessary to the completion of the work in accordance with the intention of the contract. It is also advisable to state that the provision of all these things is to be covered by the prices named by the Contractor in his tender, and that no further remuneration may be claimed under this head.

(3) **Plans and Specifications.**—The necessary general provisions relating to plans and specifications may be grouped roughly under the divisions of interpretation, conformity on the part of the Contractor, responsibility for accuracy and feasibility.

The engineer, as the author of the plans and specifications, should have the right of interpreting them, for he should know, better than anyone else, precisely what was meant. To him should be referred for rulings all questions of conflicting and erroneous statements, whether of graphical or written character. In decisions of this sort, it is obvious that the judgments of the engineer should be in strict conformity with the true spirit, meaning and intention of the contract as a whole, and it is the universal custom to specify that this broad view of the contract shall prevail. Errors and omissions in plans or specifications should therefore not be allowed to justify the Contractor in furnishing less than was clearly contemplated in the contract, and he should be called upon to perform all work which may reasonably be inferred as necessary for the complete fulfilment of the spirit of the contract, although certain requirements may, through oversight, not have been stated. In making such a ruling it would manifestly be dishonest for the

engineer to cover up his own carelessness or ignorance by requiring the provision of things which could not be read into the contract by any fair-minded person.

Strict adherence to plans and specifications and to the interpretations placed upon them by the engineer should be required in the contract. This is, of course, presupposed in the undertaking of the work by the Contractor, but it is nevertheless not amiss to point out in the general clauses of the specifications that he will be held rigidly to the written requirements and that he should in no case count upon the leniency of the engineer in releasing him from an onerous obligation.

Responsibility for accuracy of plans and specifications lies, in general, with the party who made them. If the work is done in accordance with the detailed instructions of the engineer and these are found to be erroneous, the Contractor is not liable, unless perhaps he had entered into the absurd agreement to guarantee the engineer's plans and specifications. If the Contractor prepares the detail plans, he, in this case, must assume the responsibility. Approval of these plans by the engineer does not release him, and it is generally so stated in the specifications.

The feasibility of a proposed scheme is in effect guaranteed by the party who proposes it. If the engineer requires a cofferdam to be constructed in a certain manner and it fails, his principal, the Owner, must bear the expense of the failure. If, on the other hand, the Contractor had put forward the proposal, even though the engineer had allowed the work to proceed without protest, the Contractor is responsible. Sometimes, also, the engineer accepts an entire scheme proposed by a Contractor, such as the finishing of new or special materials, machinery or devices, and since the Contractor is by reason of his special experience better acquainted than the engineer with the nature and performance of what he proposes to supply, the former may, by the specifications, be required to guarantee the workability of that part of the construction or equipment provided by him.

(4) **Character of Work.**—Apart from the description in the specific clauses of the specification of the kind of work required in each class, it is well to cover the character of all work in a general way, and in addition to establish the conditions which must be instituted and maintained by the Contractor as an essential of good work. He should be required not only to deliver up to the Owner in the completed structure the best materials and workmanship customarily obtainable, but he should be called upon to provide labor, tools and appliances of a character necessary for the performance of work of this class required. It should further be stipulated that all defective work must be removed and made good at the expense of the Contractor before final approval is granted. The possible refusal of the Contractor to do this should be anticipated by a provision that the Owner may remove such work himself and deduct the cost from any moneys due the Contractor.

(5) **Inspection.**—The fullest privileges of inspection must be retained by the Owner if entire confidence is to be placed in the work. To this end the Contractor should be required to furnish to the selection of the inspector samples of cement, sand, gravel, steel, and all other materials requiring laboratory examination. Sometimes, as in the inspection of structural steel at the mills, the contractor is called upon to provide the necessary testing machines as well. In field inspection, the right of opening up work which has been covered should be secured to the Owner, or his engineer, but if investigation shows such work to have been in accordance with the contract, the Owner should be required to pay for the cost of the opening up. No materials should be allowed in the work which have not had the final approval of the inspector before use. Cement, for example, might be thoroughly satisfactory as tested at the mills or as disclosed by samples taken from the cars, but due to careless handling or storage might be seriously impaired by the time it was incorporated in the work. It is a safe rule to specify, in addition, that all condemned material shall be immediately removed from the site of the work. If allowed to remain, it is surprising how readily it finds its way into the structure.

Many times in the experience of every engineer there arises the embarrasing situation where imperfect work has been approved by an inspector, or while, perhaps, not definitely approved, has been allowed to be put in without protest. In such circumstances the Contractor very naturally takes the position that the work has been done to the satisfaction of the engineer, or to that of his representative, and, therefore, ought not to be replaced. Such an attitude on the part of the Contractor is indefensible, for the reason that conformity with the contract is the standard of acceptance, and if it can be shown at any time before final approval of the work and the taking over of it by the Owner, that the work is not in accordance with the contract, the Owner may require the Contractor to make such alterations as may put it in a condition to satisfy the demands of that instrument. Approval of defective work through oversight or failure to point out faulty construction during its execution does not relieve the Contractor of the responsibility of providing at the close of the work precisely what the Owner called for in the contract.

(6) **Conduct of Work.**—Although, broadly speaking, the engineer is interested only in the character and acceptability of the completed work, he should retain sufficient powers over the Contractor's operations to not only ensure safety, speed and freedom from disputes during construction, but also to require reasonable assurance that the methods of the Contractor will result in ultimate success. At the outset, full protection of the public from accident by means of fences, barriers, covered passageways and lights should be demanded, and if reasonable safeguards for the Contractors own employés are not required, they at least should be required for the employés of other Contractors and for the representatives of the Owner. In addition, the stakes, hubs and marks placed by the engineer or his assistants should be the objects of protection. Work should be allowed to commence only at such places and times as may be mentioned in instructions from the engineer, and the order of prosecution of the work should be under his control. Only in this way would it be possible to have one Contractor conform to the needs of another and to the exigencies of the whole constructional scheme. Direction of the Contractor's forces should be in the hands of a competent and responsible foreman, satisfactory to the engineer. Whatever the character of the foreman may be, however, he should be constituted the official representative of the Contractor in the absence of the latter, and, therefore, qualified to receive instructions from the engineer. Otherwise, an unwilling Contractor might make it exceedingly difficult to deliver disconcerting instructions. In order that completion on time may be facilitated and the engineer's arrangements as a whole safeguarded, he should have the right to order an increase of the Contractor's force if thought necessary, and if the character of the Contractor's employés is objectionable and not suitable for the performance of the class of work required by the contract, the engineer

should be in a position to order their replacement by acceptable men. Order at all times should be obtainable upon direction of the engineer, and the Contractor should be required to so conduct himself and his employees that the interests of other Contractors will not be prejudicially affected.

But while these powers of direction should be secured to the engineer, it is possible to go too far in this respect. Beyond a certain degree of control the Contractor ceases to be an independent Contractor at all, and becomes merely the agent of the Owner. The latter then becomes responsible for the acts of the Contractor, who is under these conditions nothing more than the Owner's "other self." A typical clause of a specification, quoted by Mr. Daniel J. Hauer in the Journal of the American Society of Engineering Contractors for December, 1910, which confers on the engineer powers transforming the Contractor into the agent of the Owner is as follows:—

> "The engineer shall have entire charge of all forces employed under this contract, and shall direct their work and disposition, and shall order such forces increased or diminished as he shall deem expedient."

(7) **Alterations.**—The right to make such alterations or modifications in the plans or specifications as may appear desirable should be conferred on the engineer by the contract. It does not follow that these changes should be executed by the Contractor without extra charge, however, or that they should be considered as covered by the original contract. The limit of magnitude of alterations permissible without involving a modification of the contract should, therefore, be specified.

Where the changes are slight and do not necessitate a very much longer time for the execution of the work as a whole than was originally contemplated, it should be possible for the engineer to order changes, granting to the Contractor, where he thinks proper, extra remuneration or extension of time. If the changes are only of a trifling nature, not involving increased cost or additional time for execution, it should be permissible for the engineer to secure them without any extras or extension of time. In no case should the Contractor be allowed to make a claim for anticipated profits in case of a reduction in the amount of work.

In case extensive alterations are necessary, such, for example, as the relocation of a line of railway through new country, the Contractor should be entitled to demand a change in the contract or a supplementary contract to cover the new conditions. Likewise, if projected changes involve a change in the value of the work of over a certain percentage of the original tender price, the old contract should be altered. Large changes in quantities sometimes affect the unit prices for which work may be done to such an extent that a new contract would be the only fair method of dealing with the situation.

(8) **Extra Work.**—Any excess of the quantity of work as actually executed over the work as defined in the plans and specifications is called extra work. Such work is usually paid for at certain prices stipulated by the Contractor in his tender or fixed by the engineer in the specifications or notice to bidders. In case the work is reduced in quantity it is customary to specify that the Contractor's remuneration shall be diminished in accordance with the reduction in quantities and the unit prices for extras, or perhaps these prices reduced by 10 or 15 per cent.

Perhaps no single consideration pertaining to construction contracts is more provocative of disputes and litigation than the question of extras. The Contractor who has bid too low endeavors to the utmost of his ability to establish claims for extras in the effort to extricate himself from imminent financial loss. As a sort of safeguard against a possible error in his tender the Contractor will, if permitted, name high unit prices for extras, which, while not taken into account in comparing the tenders, may stand him in good stead if he is successful in establishing extras. The practice of the engineer fixing the extras is thus calculated to materially reduce the cost of the work.

In addition to this precaution, the engineer needs to exercise great care in framing all the clauses of the specifications which have any bearing on the question of extras. As a necessary condition to the consideration of any claim for extras, the Contractor should be required to show the written authority of the engineer. It should be distinctly understood in this connection that assent to alterations by the engineer does not constitute a sanction for extras. Some engineers, with good reason, require claims for extras to be presented monthly, so that the question may be investigated while the matter is fresh in mind, and perhaps before the work is rendered wholly inaccessible. Remuneration for extras must be determined by the engineer on the basis of the measured quantities and the prices fixed in the contract. The engineer should not be allowed to fix the prices of extras, since such procedure is illegal. Any work not foreseen in the list of extras inserted in the contract should be covered by Force and Material Account. In this way the Contractor is assured of the cost plus a fair profit, and the engineer may in a measure control the cost by requiring accurate account of the time of workmen and quantities of materials put into such special work.

(9) **Duration of Contract.**—In most contracts time is declared to be of the essence of the agreement, which signifies that there must be a prescribed time for commencement, a time for completion, and perhaps also a specified rate of progress. Without the latter it is difficult for the Owner to cancel the contract on the ground of slowness in the prosecution of the work, since this would only be possible by proving that the Contractor could not by any human means finish on time—manifestly a difficult thing to do. The effect of unusually adverse weather conditions, alterations and delays on the time of completion should be definitely covered. Slight alterations, not entailing extra work, should not entitle the Contractor to an exension of time unless the engineer judges such to be warranted. Where the Owner suspends or delays the work, it may be only common justice to not only grant an extension of time equal to the delay, but some extra allowance or compensation for the loss attending the tie-up of the Contractor's plant and organization during the delay, and for the interference with subsequent work to be undertaken by the Contractor.

(10) **Powers of the Engineer.**—If the Owner is to be assured of reasonable progress and despatch in the work, there must be one individual in supreme control, and that person the engineer. Questions of a purely business character might be satisfactorily settled by others, but all matters involving technical details should be subject to the final decision of the engineer in charge, who, for convenience, is usually the engineer who prepared the plans and specifications. Only an engineer, or his representatives, should, for example, be allowed to interpret the plans and specifications, or to pass on questions of measurement, classification or quality, or to make alterations or order extras. No one but an engineer should be given the power of general direction

of the work with certain rights over even the forces of the Contractor.

Upon the award of the contract the engineer ceases to be merely the professional adviser of the Owner, and takes upon himself new and onerous duties. He must then not only direct the work, but interpret and enforce the contract and become to a large extent the sole arbitrator of most of the disputes which are likely to arise between the two contracting parties. The anomaly of the engineer occupying this judicial position while being in the pay of one of the parties to the contract has frequently been pointed out, but no one has yet devised a better arrangement. Probably no better evidence of its practicability and of the tact and success with which the engineer has on the whole filled this dual and manifestly difficult position is needed than the fact that the practice of giving large judicial powers to the engineer still continues to be almost universal. Of course, if an engineer were to adopt the attitude of uncompromising partisanship on all matters, or seek to conceal his own errors and omissions under cover of his authority as engineer, great hardship might result to the Contractor, but if he is honorable and firm enough to be fair at all costs there is no reason why his interpretatioon of the contract should not be satisfactory to both parties.

(11) **Estimates and Payments.**—As a guidance to the engineering staff in general, it is desirable to incorporate in the specifications the provisions respecting estimates and payments. Usually, progress estimates of an approximate character are granted to the Contractor every month, and upon presentation of this to the proper authorities he is entitled to receive payment for the value of the work done during the previous month, less a certain drawback. The drawback, which runs from 10 to 20 per cent., constitutes a deposit to secure the Owner against loss due to defective work or other breaches of the contract. The percentage should not be large, and is preferably less than 20 per cent., since the tying-up of a large amount of the Contractor's money results in higher bids than would otherwise obtain. After a certain sum, depending on the size and character of the work, has been held back, it is unnecessary and undesirable to continue the deduction of the percentage, and the amounts due the Contractor on progress estimates should then be paid in full as they fall due. The final estimate is usually deferred till about one month after the work has been completed to the satisfaction of the engineer, during which time liens and other claims against the Contractor may be filed. Having then deducted all sums due the Owner or to creditors of the Contractor whose claims had been formally registered, the Owner makes the final payment in accordance with the estimate of the engineer.

(12) **Security.**—To ensure that the Contractor will formally enter into a contract if the work is awarded to him, it is customary to require either a deposit cheque or a guarantee from a surety company or a private individual. The amount of the cheque is usually about 5 per cent. of the tender price on contracts up to one thousand dollars and 2½ per cent. on contracts over that amount. If the bidder be unsuccessful, his cheque should be returned forthwith, but if successful, it is retained until he has formally entered into a contract with the Owner. While the deposit cheque is most commonly required, a guarantee is much less objectionable from the Contractor's point of view, as it obviates the tying-up of his money, which, if he had many bids outstanding at any one time, might be very extensive.

On important work, and generally on work of a public character, the Contractor is required to submit a bond for the faithful performance of the contract. This is preferably supplied by a surety company rather than an individual, since the status and solvency of the latter is sometimes difficult to prove. In any event, the bond should be drawn in such a way as to allow slight changes in the contract without releasing the surety.

(13) **Instructions to Bidders.**—The information which is incorporated in the "Notice to Bidders" should also be inserted in the specifications, and generally in somewhat greater detail. It is excellent practice to require all bids to be made on standard forms of tender supplied by the engineer. In this way irregular bids, errors and omissions are frequently avoided. Matters to which the attention of the bidder should be directed by this section of the specifications are the sealing and marking of bids; delivery to a specified address by a certain time; portions of the work open to tender of any one bidder; provision of the prescribed security; reservation of right to reject any or all bids; and items for which prices are to be quoted in the tender.

MUNICIPAL WORK IN BASSANO, ALTA.

By-laws providing for an expenditure of two hundred thousand dollars upon waterworks, sewers, concrete walks, street grading and city hall are to be submitted to the ratepayers of Bassano, Alta., immediately. Such was the decision of the Bassano town council at a recent meeting.

With a view to aiding the town in the floating of their debentures, owners of subdivision property adjoining the present town limits voluntarily requested the council to extend the borders of the town, by taking in their property. This will be done immediately, and with the result that Bassano's assessment will immediately jump close to the two-million-dollar mark.

The source of water supply will be the Bow River, at a point 3½ miles southwest of Bassano, and in the vicinity of the C.P.R. irrigation dam, a large stand-pipe to be erected near the intake. The total cost of the water system, according to the present estimate, will be $83,391.10, while the cost of the sewer system will be in the neighborhood of $60,000. In the latter estimate provision has been made for disposal works to be located about two miles to the east of the town.

The main outfall sewer is to be constructed with a capacity large enough to serve a town of ten to fifteen thousand people.

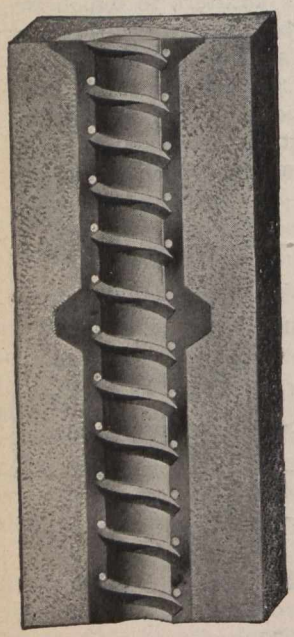
The by-law for the new $25,000 city hall, together with the $25,000 by-law for concrete sidewalks and street grading will be submitted at the same time as the water and sewer by-laws, and not later than April 6th. Immediately upon ratification by the ratepayers, work will be started and rushed to completion. The citizens feel confident that both water and sewer system will be completed and in operation early this fall.

REINFORCED CONCRETE TIES.

A substitute for the wooden railway tie has been long looked for. The Universal Concrete Tie Company, Whitney-Central Building, New Orleans, have furnished us with the following information concerning their new reinforced concrete tie. This will no doubt be of interest to everyone who is in touch with the tie question.

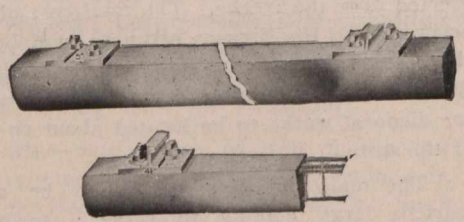
This company, which has now organized and opened its principal offices in New Orleans, is the outcome of fifteen years of strenuous labors on the part of the inventor of the well-known reinforced concrete tie and fastening or spiking device bearing his name. It is a coincidence that these ties should have been tried out and after more than five years of practical use under heaviest traffic conditions, been cordially recommended by the roads using them, and that a company has been formed to introduce them at the time when the eyes of the railroad world are seeking light on this subject. At their last meeting, the American Railway Engineering and Maintenance of Way Association apointed a special committee to investigate and make concise recommendations for next year's work, on a substitute for wooden ties. The necessity for a substitute for wood ties is conceded.

LATERAL SECTION OF REINFORCED SOCKET IMBEDDED IN CONCRETE TIE



The fundamental objection to the concrete tie is its want of resiliency. This criticism, however, is overcome in the construction and use of this reinforced concrete tie, which cushions the load effectively. This is proven by four to six years use of these ties under heavy traffic conditions on various trunk lines.

These ties are built upon the same principle as the best concrete construction, being reinforced by heavy corrugated steel bars, so tied together as to form a truss unit. They are moulded in specially designed moulds, and thoroughly matured before used, and with proper care in selecting and mixing the ingredients, permanency is assured. The rounded edges of the base of these ties, minimizes the weight and eliminates breakage of unprotected edges in handling, while the "V" shaped centres of base insure solidity in track, overcomes the vibration of motion, prevents sliding or slewing of track, and entirely eliminates centre binding, so common in all other ties.



These ties can be made at points along the track where needed, thus obviating the handling except on push cars, and by common labor of the section, when not otherwise employed. This must always be under proper supervision.

The weight of ties varies according to size, i.e., from 375 lbs. for ordinary roadbeds, to 450 lbs. for heaviest traffic conditions under trunk lines, while in terminals and grade crossings larger are used. Owing to their greater bed and face area, 2,600 of these ties will replace 3,000 wood ties to the mile under maximum traffic conditions.

The company recommend the 9 ft. 10 in. face tie for all terminal construction where traffic conditions demand permanency, and where, as in tunnels and causeways, the cost of changes always reaches extravagant figures and handicaps traffic. The hardwood cushions 2 in. by 14 in. by the width of the tie, are readily interchangeable by one man sitting on end of tie, and without interference with traffic, simply removing the two screw spikes which pass through holes in block or cushion, into reinforced babbit metal sockets previously imbedded in ties when moulded.

One company which has been using these ties for nearly six years states that the cushions, though regularly examined, are perfectly sound though "checked," and that spiking devices have never needed tightening and are holding rails firmly.

Experience under varying traffic conditions has proven that rails on these ties remain true to gauge, and that the track cannot spread since spiking device does not work loose.

This spiking device consists of a screw spike of varying lengths and diameter, according to its uses, which enters a reinforced non-corrosive socket imbedded into the concrete. This is suitable likewise for all kinds of cement construction, such as buildings, viaducts, street railways, etc.

THE CONFLAGRATION HAZARD.

With the idea of making impossible the repetition of such terrible catastrophes as those which have recently overtaken Baltimore, San Francisco, Bangor, Chelsea, and other unfortunate places, considerable attention has been given toward the development of fire breaks or stops which would make virtually impossible the repetition of such a disaster. Among the ideas which have met with expert approval might be mentioned the erection of solid lines of heavy fireproof buildings, roughly in the form of a Maltese cross, thus dividing the total area into sections separated by these massive bulwarks. This scheme, however, does not provide against the carrying of embers by a high wind to a long distance in advance of a conflagration.

The only apparent complete solution of the situation lies in equipping the principal buildings, certainly within the congested area, in such a manner that it will be virtually impossible for fire to obtain hold upon them, and thus advance another step in its progress of destruction. There are two general methods by which this may be done, but for most perfect protection they should be jointly adopted.

For fighting a fire on the inside of a building it is absolutely essential for best results that the building be equipped with an approved form of automatic sprinkler which, opening as soon as the temperature caused by the fire reaches a certain predetermined point, will flood that fire and thus automatically put it out. The secondary protection, which would come into play only when a conflagration is in progress or threatened, is a system of open sprinklers on the outside of the building, located one above each window or other exposed opening, and operated by means of a valve at some distance, turning water into the pipes and surrounding the building with a veritable curtain of water through which the fire cannot pass.

A splendid instance of this duplicate form of protection was in evidence at the Baltimore fire in the premises of the O'Neill Department Store. This building was equipped both inside and out as above described, the outside sprinklers covering no less than 98 windows in the six stories. It was directly in the path of the fire and was attacked by flames

which practically enveloped it, leaping more than 15 feet above the elevated sprinkler tank, the top of which is 30 feet above the roof. The cover of this tank was destroyed, while the tank and the timbers on which it rested were so badly damaged as to necessitate replacement. They were saved from total destruction, however, by blocking the overflow pipe and keeping water running in the filling pipe, thus overflowing the tank and keeping it wet. The cornice of the building was on fire a number of times, but four Grinnell automatic sprinklers in the attic prevented the fire from entering. The freight elevator caught fire, but two sprinklers at the top checked it here. The open sprinklers over the windows were put in operation fifteen minutes before the flames attacked the building, and such was the value of the screen thus formed that the store was open for business again two days after the fire. Thus the sprinkler saved not only the building and contents, but other buildings which, protected by this screen, were shielded from the direct force of the flames.

An interesting sidelight on this lies in the fact that a modern 11-story "fireproof" building directly across the street, equally exposed but not protected by sprinklers, was completely gutted.

NEW STEAMER FOR VANCOUVER.

A new twin-screw steamer the "Chelohsin" has been built to the order of the Union Steamship Company, of Vancouver, by the Dublin Dockyard Company, Dublin, and is described in a recent issue of Engineering. She is intended for the owners' passenger and light-freight service in the protected waters of British Columbia.

The dimensions of the vessel are 175 ft. long between perpendiculars, with a beam of no less than 35 ft., which was necessitated by the vessel's great height, there being four decks devoted to passenger accommodation, etc. She has been built under survey of the British Board of Trade and the British Corporation, and is specially strengthened with plating, doubled forward, to resist the impact of floating timber, and, for the same reason, aft, the propeller shafts are outwardly protected by bossing the shell, and the propellers are of strong section cast steel. A specially heavy belting surrounds the vessel, and the anchors are drawn up into recessed hawse-pipes forward so as to be under the flush of the shell plating, thus preventing damage to other vessels coming alongside. The hull has also been built of very stiff construction, all the four decks being completely plated with steel, and the whole bound together by a system of pillaring, the efficacy of which was found at the trials, which took place in rough weather, for there was then a total absence of the annoying vibration associated with high speed engines.

The first-class passenger accommodation is very comfortable, nearly all the state-rooms having only two berths on the awning and shade-decks. They are finished in oak, and in some of them both hot and cold water are laid on. Fourteen of the state-rooms have, in addition to the two open berths, a folding cabinet-bed on the American principle. The dining-room is situated on the main deck, with a companion-way to the awning-deck. It is square in shape and will accommodate 60 passengers, the tables being arranged for small parties of four, six, or larger numbers. The pantry and the galley are adjacent.

The ladies' saloon is on the awning-deck aft, attached to it being a tea-room and a reading-room, and also a ladies' retiring-room with toilet arrangements. There is also what is called a conversation-room on the awning-deck immediately forward of the range of state-rooms. It is spacious and has large sliding windows all round, through which the scenery, which is in many places very fine, may be viewed. This room also forms the principal entrance hall. The smoking-room is on the shade-deck forward of the funnel casing, and in this again the windows are of the sliding type. In front of the smoking-room is the chart-room, and in front of that the wheel-house. The second-class accommodation and that for the deck passengers are situated on the lower decks forward. The comfort and the convenience of the passengers has been well considered, there being a hot-water system, steam-heating system, and a complete electrical installation.

The propelling machinery has been supplied by Messrs. MacColl & Company, of Belfast, and consists of two sets of balanced-crank triple-expansion engines, supplied with steam at 185 lb. pressure per sq. in. from two specially large boilers, designed for burning inferior coal. The auxiliary machinery comprises centrifugal, circulating, feed, bilge, and sanitary pumps, evaporator, ash-ejector, etc.

Before leaving Belfast, the vessel ran her trials on the new measured mile in Belfast Lough, and obtained a speed of 14.29 knots in service conditions, and fully 13 knots with 300 tons of dead-weight on board, both speeds being in excess of that guaranteed, although the weather was boisterous at the time. The vessel was built to the specification of Mr. James Maxton, consulting engineer, Belfast, under whose supervision the trials were carried out.

The Chelohsin has made an excellent maiden-voyage, the long passage from Belfast to Vancouver being made in 72 days; and the vessel has not suffered in the least from her ocean trip. To economize coal on the voyage, steam was generated by one boiler only.

BUILD THE GEORGIAN BAY CANAL.

The following resolution was passed by the Ontario Associated Boards of Trade recently:—

"That the reports of engineers on the surveying and estimating for the Georgian Bay Canal show that the section from Georgia Bay to Lake Nipissing, through the French River, is comparatively easy of construction and not of excessive cost:

"That the making navigable of the French River would throw open to water competition in rates all that section of Northern Ontario tributary to Lake Nipissing, and would give the Temiskaming and Northern Ontario Railway, which serves the farming sections of the Temiskaming district, the lake port considered so desirable to the successful operation of that railway;

"That the Canadian Pacific and Canadian Northern Railways, serving what might be called the western portion of the clay belt, the farming section of the Sturgeon Falls district, centring as they do with the Grand Trunk Railway and T. and N.O. Railways at North Bay, would have the advantage of a lake port at North Bay and that this would work to the advantage of all lines of private enterprise that might be entered into in the north country;

"That the construction of the canal would develop the water powers of the French River, which are now held back from development by the Dominion Government because of the possible construction of the Georgian Bay Canal, and, therefore, would make available electrical energy to be used in manufacturing, mining or any enterprise in which power is used;

"Therefore, that the making navigable of this river is a most important factor in the upbuilding and development of all the eastern portion of Northern Ontario."

Metallurgical Comment

T. R. LOUDON, B.A.Sc.

Correspondence and Discussion Invited

RE-ROLLED RAIL BARS FOR CONCRETE REINFORCING.

Quite recently in the pages of one of our contemporaries, there appeared a discussion on the question of the advisability of using for the purpose of reinforcing concrete, bars that have been re-rolled from old rails. Some of the statements made in this discussion were, to say the least, rather sweeping and could hardly have been made with a full knowledge of facts.

At the outset, it is to be clearly understood that **the following is not a discussion as to the relative merits of low and high carbon steel for reinforcing concrete.** It is merely intended to point out a few facts that have come under the writer's observation and which it will be seen must necessarily have a great effect on the question as to the desirability of re-rolled rail bars.

Before discussing the re-rolling of rails, the writer would take exception to the following statement that appeared in the referred to articles and which is apparently given as a reason why re-rolled rail bars are as well made as other bars rolled from billets:

"It is a matter of common rumor, if not common knowledge, that the scabbed, piped and otherwise defective billets are used for rolling into reinforcing bars; also, in many cases, the crop ends from the ingot, rejected as not being good enough for a rail, are so rolled."

Such a statement, if true, would warrant a deep searching investigation—if true; but, the reader will see that the matter is one of "common rumor if not one of common knowledge." To the man who is accustomed to think, "common rumor" is a very dangerous and untrustworthy source of information. To the practical man, however, portions of the statement contain a refutation of their truth. It is a matter of practical knowledge that to roll steel containing a "pipe" means that the final metal will contain this same cavity in compressed and elongated form. The surfaces of the cavity do not weld together under rolling for the very good reason that they are generally badly oxidized. One can readily imagine the form of concrete bar resulting from this "piped" billet or from the rail crop end which is rejected because it contains the "pipe" of the ingot from which it is cut. It cannot be said with absolute certainty that no "piped" billets are ever rolled into concrete bars, just as it cannot be said that no "piped" rails are ever put out in service even after the greatest precautions; but, what is more to the point, it can be said that **great precautions are taken to prevent such a thing happening.**

To come back to the re-rolling question, it must be admitted that the proper re-rolling of a rail into a smaller rail section does give an extremely good and serviceable rail **provided the original rail was free from defects.** Re-rolling is not going to cover up those defects. On the contrary, it has been the writer's experience that the re-rolling in diagonal passes tends to uncover such defects as hidden "pipes," seams, etc.; so that the final inspection very easily eliminates the undesirable rails. This fact is used as an argument that the same thing will happen in re-rolling a rail into bar sections. To a very limited extent, this may be true. As far as the sound steel itself is concerned, the re-rolling certainly tends to give it a higher elastic limit and ultimate strength; so that, provided an engineer favors the use of "high elastic limit" steel, one apperently gets perfection in this product. But we must stop to consider that if the rail has a defect to begin with, say a small undiscernible open seam, this flaw will not be readily detected in the final bar. It is comparatively easy to inspect re-rolled rail sections; but, one would have to go over each foot of a re-rolled rail bar with extreme care in order to detect some of the fine seams that the writer has seen in these bars as resulting from a defect in the original rail. Supposing, however, for the sake of argument, that it is admitted that all the original rails are free from defects, there still exists a fact that must be recognized if one uses the re-rolled product.

In the table below the writer gives some analyses from actual rails that were selected at random from a pile of rails that had been re-rolled:

	Rail No. 1	No. 2	No. 3	No. 4
Carbon	.29	.31	.05	.51

The wide range in carbon content of these rails is at once apparent. The tests of the re-rolled product showed the consequent variation in strength that one would expect. But, it may be said that this variation is abnormal; rails are manufactured to-day under a very definite chemical specification. Quite true; but, if one will take the trouble to look up these specifications, such as those of the American Society Testing Materials, it will be found that in Bessemer rails there is a range of from .35 to .55 carbon for rails varying in size from 50 to 100 lb. section (the carbon content being given for the various sizes of rails); and, in open hearth rails, the range for the same rail sections is from .46 to .75 carbon. As rails used for re-rolling are of all sizes, it would seem to follow that one would get bars with varying strengths; **certainly the bars would not be all alike as far as carbon is concerned.** To such an argument as this, the answer might be that re-rolling mills sort the rails into piles according to section, etc.; but, it is seen that even if this is done, the rails may some of them be Bessemer and others Open Hearth, and a glance at specifications shows that, say for 80 lb. rails, Open Hearth shall be between .52 and .65, and Bessemer between .4 and .5 carbon, which gives a range of from .4 to .65 in 80 lb. rails piled without taking into account whether they were Open Hearth or Bessemer rails. Such argument might go on indefinitely. It is fact with which we are concerned.

It will be noticed that in the given analyses, one of the rails showed merely .05 carbon. In fact, this was an old wrought iron rail. The point is that these old rails (not necessarily wrought iron) are finding their way to the re-rolling mills, and with them there is absolutely no definite guarantee of carbon content, so that the final product is necessarily a variety. It is beside the question to say that the steel in rails is all of good tested quality; that these old rails are very good steel, etc. The steel is of good tested quality for rails, but, it does not necessarily follow that it will give an even quality of steel for bars.

If engineers wish to use steel whose carbon content is likely to vary widely, all well and good. They do so knowing that the steel they are using may have a wide range of strength. **This fact must be recognized and**

given its due place, even if, as someone has suggested, "Oh well, most of the steel is good; but, now and again soft or very hard bars creep in."

STEEL WHEELS.*

Chas. C. Bacon, Jr.

The wheel committee of the Master Car Builders' Association was instructed by the executive committee, last June, to consider the designs and specifications for steel wheels and to report at the convention to be held this coming June. The wheel committee held a meeting about two months ago at which were present, by invitation, representatives of the solid steel wheel manufacturers. Upon learning that the subject of specifications covering solid steel wheels had been under consideration for upwards of two years by a special committee of the American Society for Testing Materials, the M. C. B. committee very promptly determined to accept an invitation which was extended to have representation on that committee. This latter committee is well qualified to handle this important item intelligently, being composed of representatives of the manufacturers and of the railways which have had the longest and most extensive experience with solid steel wheels. It is but right

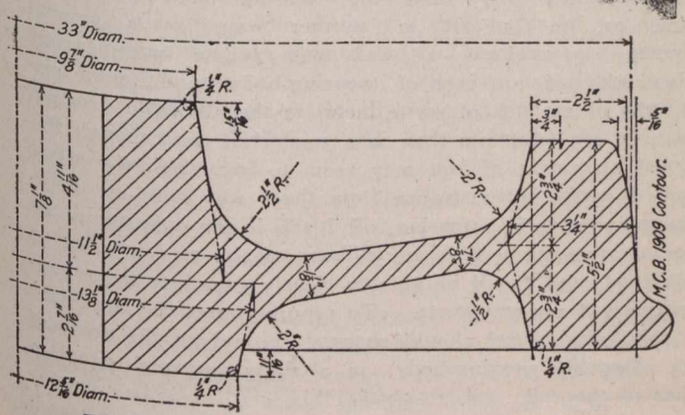


Fig. 1.—Typical Design of Solid Steel Engine Truck Wheel.

and proper that the question of design be thrown open to all, so that there may be full expression of opinion, and so that the manufacturers and the railways will reach agreements, or standards, at the earliest possible moment. The object of this paper is to place before you a list of twenty-one designs of solid steel wheels which long experience and careful study would seem to indicate are adequate standards in connection with more than ninety per cent. of the requirements of the railways of the United States to-day, and which would soon cover the other ten per cent. if railways would give attention to some points in connection with coordinate equipment; also to further place before you certain reasons why a study of the subject has convinced me that a total of eleven of these designs are all that are desirable or required.

A 33-in. steel engine truck wheel is shown in Fig. 1, which is representative of the other designs for different diameters of this type of wheel. Fig. 2 shows the design for a 33-in. tender, passenger car and freight car wheel. The salient point of difference between these two general classes is that wheels for engine trucks require inside hub faces of large diameter to provide adequate bearing surface. A total of eleven designs which I think are all that are desirable are, for engine trucks, 28½ in., 30 in., 33 in., and 36 in. For freight cars, tenders and passenger train cars, 28 in., 30 in., 33 in. (two designs) 36 in. (two designs) and 38 in.

One of the reasons for increasing the number of designs of wheels for engine trucks above the four above noted is that of the diameter of the inside face of the hub. It has long been considered by prominent roads, which have placed may thousands of solid steel wheels in engine truck service, that this dimension should properly be 12 5/16 in., but recently several large companies have called for engine truck wheels with inside hub faces of either 13 in. or 14 in.; in fact, one large system has issued a sheet setting forth that this dimension shall be either 11 in., 12 in., 13 in., 13½ in., or 14 in., under certain conditions. Ninety-five per cent. of the solid steel wheels which are in engine truck service in the United States to-day have 12 5/16 in. diameter of inside hub face. This dimension is standard with the roads which have had the longest and most extensive experience with solid steel wheels of this type and I am told that it has proved to be a proper and satisfactory dimension. The cost of manufacturing solid steel wheels, and therefore the price to the railways, is largely a question of the number of wheels produced per type, and this being the case it seems most important—particularly as regards engine truck

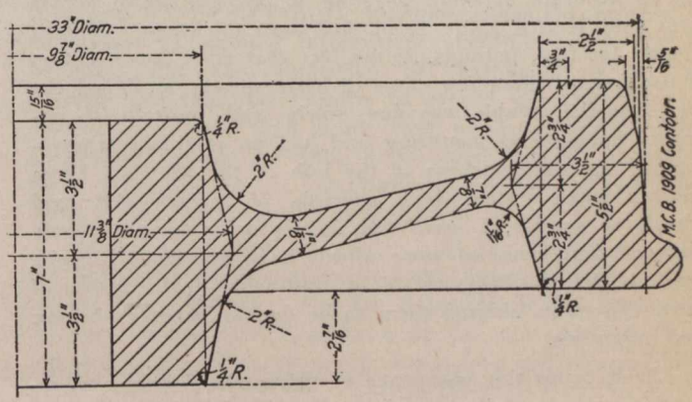


Fig. 2.—Steel Wheel for Tenders, Freight and Passenger Cars.

wheels of which the total number required is not sufficiently large to enable manufacturers, even under the best of conditions, to reduce the cost of production to the same level as that of the other classes of which larger quantities are used—that specific attention and study should be given to this dimension of inside hub face diameter, so that a standard can be adopted for the best interests of all concerned.

For a 6 in. x 11 in. axle the hub diameter is increased from 9⅞ in. to 11 in., to provide proper hub wall thickness and this brings up a point which I wish to make one of the principal features of my paper, i.e., what is the proper hub wall thickness for solid steel wheels?

A hub diameter of 9⅞ in. has long been recognized as all that is required in mounting solid steel wheels on 4¼ in. x 8 in., or 5 in. x 9 in., or 5½ in. x 10 in. axles, i.e., up to and including 7 in. diameter wheel-seats, for even in connection with the 5½ in. x 10 in. axle, and allowing for the eccentricity provided for in the specifications, a 9⅞ in. hub diameter means a minimum hub wall thickness of 1¼ in. on a 7 in. diameter wheel-seat. During the past few months, and under the leadership of one of our large systems, which, however, is basing its statements and acts on experience with comparatively few solid steel wheels, there

* Abstract of a paper read at the meeting of the Western Railway Club.

has been quite a move on the part of some roads, none of those which have had long and extensive experience in the matter, however, to use wheels with 11 in. hub diameter on 5½ in. x 10 in. axles, and even on 5 in. x 9 in. axles, on the groud that 1¼ in. is not sufficient for a minimum hub wall thickness and tended to "loose wheels." From a manufacturer's standpoint I have no reason to take exception to this move. A heavier wheel means a higher price, and so long as a railway wishes to pay for excess metal I do not know that it is within a manufacturer's province to object But as one of the engineers who has had to do with the solid steel wheel subject from its infancy, and who is more or less responsible for the dimensions, I wish to assume just as definite and positive an attitude on this point as words will permit me to express.

I have long been in touch with this particular point and have had considerable personal experience in the boring and mounting of wheels, and since this question was raised recently I have made a further study of it and consulted with representatives of those roads which are qualified by long and extensive experience to speak definitely and intelligently on the subject. I find that one large system, having over 200,000 solid steel wheels in service, has had less than a dozen loose wheels in the past six or seven years, despite the fact that 1¼ in. minimum hub wall thickness has been the adopted practice, and that in the early days of the solid steel wheel industry, when manufacture was not as accurate in some ways as at present, many wheels went into service with 1⅛ in. hub wall thickness. Of still greater interest, perhaps, is the fact that close investigation of each one of these few cases of loose wheels developed the fact that the trouble was due, solely and entirely, to improper boring and mounting and had no reference whatsoever to the wall thickess of the hub of the wheel. From another large system, with upwards of 90,000 solid steel wheels in service, I learn that in six or seven years only three or four cases of loose wheels have developed, despite the hub wall thickness of 1¼ in. minimum; investigation of these few cases showed them to be due to improper boring and mounting.

Such being the experience of those whose long and extensive use of solid steel wheels certainly qualifies them to know whereof they speak, I look upon it as a piece of undue assumption when a road with a limited experience, both in time and in quantity, sets out to be aggressive along a line with which it is unfamiliar. A hub wall thickness of 1¼ in. is all that is required with properly designed and manufactured solid steel wheels mounted on axles with wheel-seats up to and including 7 in. diameter; those who are troubled by loose wheels under such conditions must look to their own shop practice, to their boring-mills, their axle-lathes, and their wheel-presses.

Some roads in wishing for something larger than a 5½ in. x 10 in. axle have, for reasons of their own, doubtless, neglected to adopt the M. C. B. standard, 6 in. x 11 in., and have gone to the use of sort of an "in-between," 6 in. x 10 in., which renders it necessary to add these two extra designs of wheels. As I am discussing wheels I do not like to encroach on another subject, but it seems to me that as much axle trouble is caused by over-heating as by lack of section, and that conditions are not much improved by increasing the section without proportionate increase in bearing. In other words, is there any great advantage in a 6 in. x 10 in. axle over a 5½ in. x 10 in., the adoption of the 6 in. x 11 in. axle, instead of a mere "in-between"? I refer to this as merely another one of those features which has its effect on the cost of manufacture, and therefore the price to the railways of solid steel wheels.

Another point is brought up by the suggestion that, though shown as standard designs, I would like to eliminate the 30½ in. engine truck wheel, 33½ in. engine truck wheel, and two of the wheels used for cars, solely because they mean the use of solid steel wheels with a 3 in. rim thickness. Experience tends to prove that a 2½ in. rim thickness in connection with solid steel wheels makes for emciency and economy, and that the use of 3 in. thickness is to be avoided. In the first place, one must consider the rim of a solid steel wheel as being of two general parts, the allowable wearing-body, being that depth which can be properly used in service, and the minimum allowable rim thickness, which necessitates removal from service. For example, in a rim thickness of 2½ in., it may be said that there is 1½ in. of allowable wearing-body, with 1 in. thickness remaining which calls for removal from service under M. C. B. Rules. It must be borne in mind that this 1½ in. of allowable wearing-body cannot be entirely used in road service. From time to time while the wheel is in service certain deformations of contour will occur, after varying mileages and with correspondingly varying depths of metal worn from tread, which necessitate removal of the wheel from service for re-machining to restore the contour.

Long experience, with general averages on numerous roads and under varying conditions, indicates that the allowable wearing-body in a rim 2½ in. thick will split-up far more economically than the wearing-body in a 3-in. rim, or, to put it in another way, as a general average proposition a road will secure more actual sixteenths of an inch of wearing-body, and fewer sixteenths of an inch of waste metal in the allowable wearing-body of a 2½ in. rim than in a 3 in. rim. And though this broad statement of fact may seem to over-shoot the mark, and to evoke remonstrance from those who have not given the point specific attention, all I ask is the opportunity for co-operative study with any railway official of conditions on his road, and I will be able to clearly demonstrate the correctness of my statement. To properly meet the conditions a solid steel wheel should possess, throughout the depth of its allowable wearing-body, an attrition-resistance equal to that of the rail, and, to obtain this, certain limits must be recognized in rim thickness from a manufacturing standpoint. Not alone must a high degree of attrition-resistance be obtained initially, but it should be maintained, as uniformly as possible, throughout the allowable wearing-body: this quality is largely secured by the work, and the depth of penetration of the work, which is put upon the rim. There is no process of manufacture of solid steel wheels known to-day which will produce as good and serviceable a wheel with a 3 in. rim thickness as with a 2½ in. rim thickness. Based on the records of a good many thousand wheels which have been worn out in service, the mileage-life of a solid steel wheel with 2½ in. rim thickness is greater than one with 3 in. rim thickness, all other things being equal.

I have always been, and I am to-day, a strong and persistent opponent of the use of the term "shelling" in connection with solid steel wheels. There has been too much of a tendency to call all defects shelling, owing to either convenience or lack of familiarity with the subject, whereas proper analysis would have classed the defect under one of three or four other and more specific headings, which would have enabled the manufacturer to handle the matter far more intelligently and in a manner decidedly more for the benefit of the railway. Shellig may be the easiest thing to think of, or to say, but it is absolutely non-specific under normal conditions in connection with solid steel wheels, and in 99 cases in a 100 means nothing at all. The chilled por-

tion in the rim of a cast iron wheel extends at right-angles to the chill-block, and only to a certain depth, this depth being dependent on the quality of the iron, etc. The effect is a slight depth of metal with strong resistance, backed with ordinary gray iron of far less resistance, bordering, comparatively speaking, upon sponginess. When this strong surface metal had been worn so thin as to be unable to support the service-load which was on it, it would, having but a comparative sponginess or cushion beneath, mash-up and fall away in a manner which left the appearance of the outside of an oyster shell, and hence the term "shelling."

I have always opposed the use of the term "shelling" as applied to solid steel wheels, for I have believed, and my belief has been based on specific study, that no such condition should exist in properly designed and made solid steel wheels. But I must now go on record as saying that if some railway officials persist in using wheels with a 3 in. rim thickness, or over, and can succeed in inducing manufacturers to supply such types, then I must, though most regretfully, add the item of shelling to the liabilities of solid steel wheels, for close observation of many wheels of this type, not confined to any one manufacturer's product, convinces me that in a properly made solid steel wheel with a 2½ in. rim thickness there is good opportunity for knowing what you are getting, whereas with a 3 in. rim thickness you cannot be sure of anything, except that there will be a considerable percentage of dissatisfaction and trouble in the results. Let those who doubt the correctness of my position in this matter take note of the fact that the roads which have had the longest and most extensive experience with solid steel wheels have nearly all given up the use of wheels with a 3 in. rim thickness and have adopted the 2½ in. thickness as standard.

For years I have been an advocate of the idea of producing wheels so true to dimensions that the machine work was reduced to a minimum. I am still a firm believer in the theory, but only to the extent to which it can be carried in justice to the quality of the material produced. Machine work increases the cost of production, and it may often remove metal of particular service value, yet if the effort to produce material on which machine work is unnecessary opens the door to a product which lacks uniformity, lacks many of the other virtues which it should possess, and borders on the dangerous, then extreme caution should be used in order that a "penny wise, pound foolish" policy be avoided. It may be all right to produce some of the commodities of life on the basis of tonnage, or general average, but in dealing with wheels let us not forget that we are dealing with units, each and every one of which should possess integrity; otherwise, much time will be spent in settling claims for low mileage, in providing for adjustments covering defective material, and, worse yet, in explaining how wrecks occurred. Uniformity in manufacture is perhaps the feature most to be desired in connection with solid steel wheels. But uniformity of quality should be held as paramount to uniformity of mere dimensions.

The production of proper solid steel wheels does not entail the mere forming of a bulk of steel into the shape of a wheel. It carries with it far greater requirements and responsibilities. Proper production means not alone mere shaping, but, and particularly, the working into shape along such lines as tend to preserve and develop the virtues of the material for the service in which the finished product is to be used, and the doing of this in such a way as to assure uniformity and quality as between wheels which are subsequently mated in service. Irregularity of dimensions can be easily overcome by a few pennies' worth of machine work, but lack of uniformity in quality is incurable and is sure to assume more or less serious, if not actually dangerous, forms when the wheels go into service.

Manufacturers of solid steel wheels are particularly accommodating when engaged in close competition for an order, and it is for that reason that wheels of all sorts and sizes can be obtained. But clear-headed railway officials certainly realize that the production of small quantities of an endless variety of designs means a higher cost than when a minimum number of designs permits of proportionately larger quantities, and that cost is always reflected in price. They certainly realize that in the heat of close competition a sales department will frequently offer odd designs which may or may not have been thoroughly demonstrated as unifying the possibilities of proper manufacture and the requirements of service, and they surely appreciate how standardization of wheel designs is an end to which we all should strive.

ELECTRO-METALLURGY OF TIN.

In speaking of recent experiments upon the electro-metallurgy of tin, le Journal du Four Electrique (January, 1912), reaches the conclusion that the solution of the problem has been found as regards general lines of work, and that it remains only to study the minor questions of detail. The statement is made that the yield of tin ores is much increased by electric-furnace treatment, that the process is continuous as against intermittent smelting in the reverberatory, that the formation of "hardhead" is reduced greatly, and that the quantity of carbon necessary for reduction is no more than 14 per cent. in the electric furnace, as against 20 to 25 per cent. in the reverberatory. The floor space necessary for the installation is smaller, and the consumption of the electrodes is negligible.

Some calculations are given as to the energy required for the reduction of cassiterite; the basis of these calculations is as follows: For the reduction of 118 grams of tin from stannic oxide, 145,300 gram cal. are required. The reaction, $C+O_2=Co_2$, gives out 96,960 cal., and the reaction, $2C+O_2=2CO$, 58,000 cal. It is necessary. then, in order to set free 118 grams of tin that we should have, for the first reaction, 145,300—96,960 cal., or 409,661 kg.-cal. per kilogram of tin set free, and since 1 kw.-hr. equals 864 kg.-cal.. it is necessary per ton of tin to have 474 kw.-hr. of energy. This figure becomes 855 kw.-hr. if we apply the equations $2C+O_2=CO$. As in practice, each of these reactions gives about 50 per cent. of the reduction, it is necessary to count on the average as the consumption of energy required, which is 665 kw.-hr. per ton of tin. The temperature in the smelting zone is estimated at 1,400 or 1,500° C., and the calorific balance of the furnace is then as follows: For the reaction, 665 kw.-hr.; for heating the slag, 130; for the specific heat, 45; losses by radiation, 130; losses through hot gases, 130 kw.-hr.; a total of 1,140 kw.-hr. per ton of tin.

The experiments were made in the furnace like that of Harmet for the reduction of iron ores, constructed of magnesite brick. A product was obtained containing about 99 per cent. tin, little iron, and free from arsenic. At the beginning of the campaign, which usually lasted from 10 to 12 days, the furnace was heated for a day with wood and coke in order to dry the bricks and then charged with about 14 kg. of anthracite coal per 100 kg. of ore, this proportion, however, depending on the nature of the latter. A current was then passed of about 1,000 amp. at 60 v., these figures changing to 40 v. and 2,500 amp. when the reaction commenced. A half-hour afterward the slag commences to

form and its aspect alone suffices to show whether the charge is of the proper composition or not. Experiments have also been made to recover the tin from the furnace slags by an electrolytic method. These were fused with soda and the mass afterward dissolved in water and electrolyzed with plates of iron as a cathode. Excellent deposits of tin were obtained, but the yield was not high.

ONTARIO HYDRO-ELECTRIC LEGISLATION.

The following powers are conferred on the Hydro-Electric Commission by a bill introduced in the Ontario House to amend the Power Commission Act:—

To take over existing power transmission lines and to improve water powers, by assisting municipalities and others in the storage of water, making of sluices, etc.;

To expropriate a local distributing plant where a municapility has voted to enter into a contract with the commission for a supply of power;

To regulate installation of electrical equipment and installation of wires in all buildings including private houses;

To require the appointment by municipalities of inspectors to see that such regulations are carried out;

To order the removal and alteration of any works that are a menace to the public safety or endanger life;

To control absolutely light and power rates charged by municipalities whether those municipalities take power from the Commission or not;

To control the rates of any company or individual taking power from the Commission;

To prescribe a uniform system of bookkeeping on the part of power municipalities;

To direct the disposal of surpluses earned by municipal power plants supplied by the Commission. (In many cases these surpluses are now devoted to the building of sidewalks, street sweeping, etc.);

To order all wires under its jurisdiction underground in cities and towns;

With the co-operation of the Dominion Railway Commission to order underground all wires strung on streets where the municipalities construct tunnels or conduits to carry such wires;

To impose a penalty of $100 per day for any disobedience of any such order.

CEMENT PRODUCTION LAST YEAR.

Complete statistics have been received from the manufacturers of cement covering their production and shipments during the year 1911. These returns show that the total quantity of cement made during the year, including both Portland and slag cement was 5,677,539 barrels as compared with 4,396,282 barrels in 1910, an increase of 1,281,257 barrels, or 29 per cent.

The total quantity of Canadian Portland cement sold during the year was 5,635,950 barrels as compared with 4,753,975 barrels in 1910, an increase of 881,975 barrels, or 18.5 per cent.

The total consumption of Portland cement in 1911 including Canadian and imported cement and neglecting an export of Canadian cement, valued at $4,067 was 6,297,866 barrels as compared with 5,103,285 barrels in 1910, or an increase of 1,194,581 barrels, or 23.4 per cent.

Detailed statistics of production during the past three years are shown as follows:—

	1909. Barrels.	1910. Barrels.	1911. Barrels.
Portland cement sold	4,067,709	4,753,975	5,635,950
" manufactured	4,146,708	4,396,282	5,677,539
Stock on hand Jan. 1.....	1,098,239	1,189,731	844,741
" Dec 31 ...	1,177,238	832,038	903,590
Value of cement sold	$5,345,802	$6,412,215	$7,571,299
Wages paid	1,266,128	1,409,715	2,103,838
Men employed	2,498	2,220	3,010

The average price per barrel at the works in both 1910 and 1911 was $1.34, as compared with an average price of $1.31 in 1909 and $1.39 in 1908.

The imports of Portland cement during the twelve months ending December 31, 1911, were 2,316,707 cwt., valued at $834,879. This is equivalent to 661,916 barrels of 350 pounds at an average price per barrel of $1.26. The imports in 1910 were 349,310 barrels, valued at $468,046 or an average price per barrel of $1.34.

The imports from Great Britain during 1910 were 190,506 barrels, valued at $210,839; from the United States 441,317 barrels, valued at $575,768; from Belgium 2,683 barrels, valued at $2,019; from Hong Kong 22,059 barrels, valued at $38,292; and from other countries 5,351 barrels, valued at $7,962.

Following is an estimate of the Canadian consumption of Portland cement for the past five years:—

Calendar Years.	Canadian. Barrels.	Per cent.	Imported. Barrels.	Per cent.	Total. Barrels.
1907	2,436,093	78	672,630	22	3,108,723
1908	2,665,289	85	469,049	15	3,134,338
1909	4,067,709	97	142,194	3	4,209,903
1910	4,753,975	93	349,310	7	5,103,285
1911	5,635,950	89.5	661,916	10.5	6,297,866

TABLE SHOWING THE ANNUAL VALUE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC SINCE 1900.

(Compiled by Mines Branch, Province of Quebec.)

Year.	Value.
1900	$2,546,076
1901	2,997,731
1902	2,985,463
1903	2,772,762
1904	3,023,568
1905	3,750,300
1906	5,019,932
1907	5,391,368
1908	5,458,998
1909	5,552,062
1910	7,323,281
1911	8,567,143

In our issue of the 7th inst., through a mechanical error, we regret that the illustration of the new Watts Stadia hand level and of the Improved Abney level appeared upside down. We feel certain that our readers recognize that this was a typographical error and hope that they were not puzzled by what seemed to be an apparently peculiar construction of the instruments made by this well-known, reliable firm.

In addition to the instruments above mentioned, E. R. Watts & Son are offering at very reasonable prices a new pattern surveying compass and also a C.E. dumpy level having several special features.

HAMILTON'S HARBOR.

The development of Hamilton harbor is probable. A delegation from the city waited on the Prime Minister and the Minister of Works, at Ottawa, requesting various improvements. The importance to the shipping business at Hamilton was emphasized by Mayor Lees, and the certainty that this business would increase in the near future. He stated that Hamilton's shipping business was now second only to that of Montreal among the inland ports of Canada. To the present, improvements to the harbor had largely been made by the city or by private firms which had to carry out work to provide themselves with shipping facilities. The Federal Government had given some aid and the time had come when there should be more. Hamilton was a great manufacturing centre, and destined to become greater. What was now required was a two thousand foot extension of the revetment wall, widening of the entrance to the harbor and dredging along the south shore of the harbor. It is estimated that the improvements asked for will involve an expenditure of $400,000.

ENGINEERING NOTES.

In the course of an address given before the Engineering Society of the North Western University recently, Mr. H. G. Tyrell stated that most of the bridges in the United States are considered merely as objects of utility. Europe is much farther advanced on this score, for its bridge builders see in a bridge something that can be made to harmonize with beautiful surroundings or to beautify ugly ones. That such artistic forethought will add immeasurably to the beauty of the country is evident from the fact that we have now 80,000 iron bridges, not to mention thousands of wooden ones of every description.

Montreal, Que.—Principal Peterson, of McGill University, is reported to have stated at the closing exercises of the Technical School, that Canada is thirty years behind the world in technical education. He added that the governments at Quebec and Ottawa would have to come to the assistance of the people of Canada if they are to regain their place in technical and commercial education.

Province of Manitoba.—The financial statement of the province shows a balance of $492,426 as a surplus. The estimates for the present year call for an expenditure of $5,056,245, and of this amount $2,207,000 is for public buildings.

Ottawa, Ont.—Chief Engineer Armstrong, of the Hudson Bay Railroad, with headquarters in Winnipeg, has been notified by Hon. Frank Cochrane, Minister of Railways, to send out at once a party of engineers to the Hudson Bay, one party to go to Port Nelson and one to Fort Churchill. They will remain at the ports for a couple of months taking observations and making surveys as to the suitability of the ports for terminals.

The German government are considering the state ownership of petroleum, spirits, potash and matches.

Galt, Ont.—The municipal authorities of this progressive little town have turned their attention in a very serious manner to the question of municipal milk supply. An inspector was appointed and visited the source of the supply in many instances. In such cases as conditions were found to be below standard he displayed the progressive spirit that has been evident on other occasions, and distributed instructive literature to the owners of cattle dealing with the proper care of cows and dairy matters. The result showed that the effort produced better milk and less hard feeling than the older method of dealing with the offenders through the police court.

Fort William, Ont.—Mr. Farquharson, manager of the municipal electric light plant of this city, recently gave out some interesting facts regarding the meter and flat rate system of current sales. He stated that in Fort William there are now in use 1,648 meters. The meter is the strongest factor for holding down of the peak load, which without meters would have been close to 2,500 h.p. during 1911, and with no extra revenue. While we have flat rates on light that entitles the consumers to attach any load, either cooking utensil or heater, there will always be a large percentage of peak load consumed on prodigal use of light and stolen power, other than what is paid for. That there are a great many electric heaters in use by flat rate was noticed during the peak period, and whenever a cold spell would stop, aproximately 75 h.p. would drop off from the peak load. The people now do not object to meters as formerly, as they are beginning to understand that the meter is the only intelligent and economical way to purchase current.

The municipal electric light department of Fort William, Ont., earned a net surplus of $17,255.92 during the year 1911. The total working expense of distribution and operation per horse power purchased has been, interest and sinking fund included, $51.23, as against $50.70 in 1910, and $47.04 in 1909. Against this the earnings per horse-power in 1911 were $61.93, in 1910 $59.18 and $51.35 in 1909.

Montreal, P.Q.—The Ives foundry was the scene of a trial of the Uno-Rail system of car operation recently. The truck of this car is built so that the main load rests on the top rail, which is V shaped, and has two side rails of the same shape, for the purpose of preventing any derailment. One of the main features is the little space that it takes up, requiring a right of way of only eight feet. The facilities of climbing heavy hills are by means of the Roch rail and gear, which allows the truck to follow the contours of the ground very closely. The line can be built so as to cross, over or under railways, and across rivers and canals.

Work on the new high level bridge is well under way in Ottawa, Ont. The present swing bridge has been moved from the old stone pier sixty feet and has been placed upon a wooden pier, the stone piers being removed by blasting. To support the pier on the Driveway side of the bridge an immense concrete retaining wall will be built and upon this a great number of men are now working. The space between the bank and the wall will be filled in with earth and stone which has been taken from the bottom of the canal. This wall will be 200 feet long and will be finished before the water enters the canal in May.

The British Admiralty has now had complete plans drawn up for a specially built navy hospital ship, which is to be ready in June, 1913. The estimated cost is $500,000.

PERSONAL.

Mr. H. C. Tyrrell gave a lecture before the Engineering Society of the North Western University on March 12th last.

Mr. Angus Smith, city engineer of the city of Victoria, B.C., has tendered his resignation to the Board of Control.

Mr. Myer J. Sturn is making an inspection of the schools in the city of Regina regarding the matter of ventilation.

Mr. Francis P. Smith, M. Am. Soc. C.E., chemical and consulting paving engineer, New York City, on March 8th delivered an illustrated lecture on "Mixing Plants for Bituminous Pavements" before the graduate students in highway engineering at Columbia University.

OBITUARY.

A well-known civil engineer in the person of **Charles Thompson Harvey** has passed away. Mr. Harvey died in New York on March 13th last. He became prominent partly through the active part taken in the Sault Ste. Marie ship canal, and the first elevated railway to be constructed in New York. He was 83 years of age.

PERMANENT MANUFACTURERS' EXHIBIT OF RAILWAY SUPPLIES AND EQUIPMENT.

From March 16th to 23rd, inclusive, there is being held in the Karpen Building 900 South Michigan Boulevard, Chicago, Ill., an exhibit of railway supplies and appurtenances of interest to persons dealing in these materials. The exhibit occupies the entire twelfth floor of this building. The exhibition hall contains twenty thousand square feet of floor space. Arrangements have been made for the supply of steam, electricity and compressed air for the operation of working models. Every effort has been made to have the exhibit as complete and diversified as possible.

MEETINGS.

The Dominion Land Surveyors' Association held their annual banquet in Ottawa recently. The chair was occupied by the president, Mr. Thomas Fawcett. Among the guests were Senator C. P. B. Casgrain, D.L.S.; Mr. P. B. Symes, Dr. E. Deville, Dr. W. F. King, Dr. O. J. Klotz, and Mr. C. A. Magrath.

COMING MEETINGS.

CANADIAN INSTITUTE.—198 College Street, Toronto. Saturday Evening Lectures, 8 p.m. March 23rd, "Waste Land Problems," by Dean Fernow, Toronto University. March 30th, "Spectral Lines—their Arrangement and Constitution," by Prof. J. C. McLennan, Toronto University. April 13th,—"Lantern Experiments on Reaction in Non-homogeneous Systems," by Prof. Kenrick, Toronto University.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, W. F. TYE: Secretary. Professor C. H. McLeod.

VICTORIA BRANCH—Chairman, F. C. Gamble; Secretary-Treasurer, R. W. Macintyre

QUEBEC BRANCH—Chairman, P. E. Parent; Secretary, S. S. Oliver. Meetings held twice a month at room 40, City Hall.

TORONTO BRANCH—96 King Street West, Toronto. Chairman, T. C. Irving: Acting Secretary, T. R. Loudon, University of Toronto. Meets last Thursday of the month at Engineers' Club.

MANITOBA BRANCH—Secretary E. Brydone Jack. Meets every first and third Friday of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—Chairman, Geo. H. Webster: Secretary, H. K. Dutcher, 319 Pender Street West, Vancouver. Meets in Engineering Department. University.

OTTAWA BRANCH—
177 Sparks St. Ottawa. Chairman, S. J. Chapleau, Ottawa; Secretary, H. Victor Brayley, N.T. Ry., Cory Bldg. Meetings at which papers are read, 1st and 3rd Wednesdays of fall and winter months; on other Wednesday nights in month there are informal or business meetings,

MUNICIPAL ASSOCIATIONS

ONTARIO MUNICIPAL ASSOCIATION.—President, Chas. Hopewell, Mayor, Ottawa; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

THE UNION OF CANADIAN MUNICIPALTIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Lighthall, K.C., Ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Councillor Siddall, Port Elgin; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. S. MacMillan, Warden, Antigonish, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Bec, Lemberg; Secretary, Mr. Heal, Moose Jaw.

UNION OF BRITISH COLUMBIA MUNICIPALITIES.—President, Mayor Planta, Nanaimo, B.C.; Hon. Secretary-Treasurer, Mr. H. Bose, Surrey Centre, B.C.

CANADIAN TECHNICAL SOCIETIES

ALBERTA ASSOCIATION OF ARCHITECTS.—President, G. M. Lang Secretary, L. M. Gotch, Calgary, Alta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—President, J. L. R. Parsons, Regina; Secretary-Treasurer, M. B. Weeks, Regina.

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—President, N. McMurchy; Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.

BUILDERS' CANADIAN NATIONAL ASSOCIATION.—President, E. T. Nesbitt; Secretary-Treasurer, J. H. Lauer, Montreal, Que.

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Secretary-Treasurer, Wm. Snaith, 57 Adelaide Street, Toronto, Ont.

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto

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

CANADIAN FORESTRY ASSOCIATION—President, John Hendry, Vancouver. Secretary, James Lawler, Canadian Building, Ottawa.

CANADIAN GAS ASSOCIATION.—President, Arthur Hewit, General Manager Consumers' Gas Company, Toronto; J. Keillor, Secretary-Treasurer, Hamilton, Ont.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. A. E. Barlow, Montreal; Secretary. H. Mortimer Lamb, Windsor Hotel, Montreal.

CANADIAN PEAT SOCIETY.—President, J. McWilliam, M.D., London, Ont.; Secretary-Treasurer, Arthur J. Forward, B.A., 22 Castle Building, Ottawa, Ont.

THE CANADIAN PUBLIC HEALTH ASSOCIATION.—President, Dr. Charles A. Hodgetts, Ottawa; General Secretary, Major Lorne Drum, Ottawa.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 70 Bond Street, Toronto.

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

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

DOMINION LAND SURVEYORS.—President, Mr. R. A. Belanger, Ottawa; Secretary-Treasurer, E. M. Dennis, Dept. of the Interior, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, J. Chalmers; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, J. E. Ritchie; Corresponding Secretary, C. V. Ross.

ENGINEERS' CLUB OF MONTREAL.—Secretary, C. M. Strange, 9 Beaver Hall Square, Montreal.

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

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

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

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE.—Secretary R. C. Harris, City Hall, Toronto.

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

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C. B.; Secretary, A. A. Hayward.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. N. MacKenzie; Secretary, A. R. McCleave, Assistant Road Commissioner's Office, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, Major. T. L. Kennedy; Hon. Secretary-Treasurer, J. E. Farewell, Whitby; Secretary-Treasurer, G. S. Henry, Oriole.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, T. B. Speight, Toronto; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

THE PEAT ASSOCIATION OF CANADA.—Secretary, Wm. J. W. Booth, New Drawer, 2263, Main P.O., Montreal.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.—Secretary, J. E. Ganier, No. 5. Beaver Hall Square, Montreal.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5. Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Louis B. Stewart, Toronto; Secretary, J. R. Collins, Toronto.

SOCIETY OF CHEMICAL INDUSTRY.—Dr. A. McGill, Ottawa, President; Alfred Burton, Toronto, Secretary.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, J. P. McRae; Secretary, H. F. Cole.

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

WESTERN CANADA RAILWAY CLUB.—President, R. R. Nield; Secretary, W. H. Rosevear, 115 Phœnix Block, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

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.

PLANS AND SPECIFICATIONS ON FILE.

The following Plans (P.) and Specifications (S.) are on file for reference only unless otherwise noted at the office of The Canadian Engineer, 62 Church Street, Toronto:—

Bids close		Noted in issue of
3-18	Concrete reservoir (2,000,000 gallons' capacity), Moose Jaw, Sask.....(P. & S.)	2-22
3-18	Centrifugal pumps, motors, etc., Moose Jaw, Sask. .....(P. & S.)	2-22
3-18	Valves and Fittings, Moose Jaw, Sask. .....(P. & S.)	2-22
3-18	96,000 ft. of 18-in. Steel Pipe, Moose Jaw, Sask. .....(S.)	2-22
3-15	Pavements, Welland, Ont. .....(P. & S.)	2-29
3-25	Prime mover equipment, electric lighting equipment, etc., Moose Jaw, Sask.....(S.)	3-7
4-8	Paving, Port Arthur, Ont. .....(S.)	3-21
4-11	Grading, sanitary sewers, cement walks, etc., Lethbridge, Alta.....(P. & S.)	3-14

(Lethbridge plans and specifications are on file at The Canadian Engineer Office, 820 Union Bank Building, Winnipeg.)

TENDERS PENDING.

In Addition to Those in this Issue.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Calgary, Alta., designs for aqueduct	May 1.	Feb. 22.	70
Calgary, Alta., electric machinery	Mar. 20.	Feb. 8.	68
Calgary, Alta., steel highway bridges	Apr. 15.	Mar. 14.	68
Carp, Ont., church	Mar. 21.	Feb. 7.	59
Cheticamp, N.S., dredging	Mar. 20.	Feb. 7.	60
Fredericton, N.B., concrete substructure and approaches to bridges	Apr. 1.	Feb. 29.	59
Fredericton, N.B., culvert, McKenzie Hollow	Apr. 3.	Feb. 7.	89
Fredericton, N.B., culvert, Pokiok Embankment	Mar. 25.	Feb. 7.	59
Halifax, N.S., garbage incinerator	Mar. 27.	Mar. 14.	59
Hamilton, Ont., canning factories, etc.	Mar. 23.	Mar. 14.	59
Lethbridge, Alta., grading, sanitary sewers, etc.	Apr. 11.	Mar. 14.	70
Lorneville, N.B., extension to breakwater	Apr. 1.	Feb. 7.	60
Merid, Sask., road grader and scrapers	Mar. 24.	Feb. 7.	60
Moose Jaw, Sask., turbo-generating set; generator	Mar. 30.	Feb. 7.	60
Moose Jaw, Sask., prime mover equipments, etc.	Mar. 29.	Feb. 7.	68
Oakville, Ont., sewage disposal works	Apr. 1.	Mar. 14.	68
Point Grey, B.C., plans for			
Port Arthur, Ont., paving	Apr. 8.	Mar. 14.	68
University	July 31.	Feb. 7.	60
Prince Albert, Sask., sewer and waterworks	Mar. 29.	Mar. 14.	72
Saskatoon, Sask., pavement	Apr. 5.	Mar. 14.	68
Saskatoon, Sask., electrical equipment	Mar. 22.	Feb. 29.	68
Saskatoon, Sask., labor on storm sewers	Mar. 29.	Feb. 29.	72
Saskatoon, Sask., sewer and water construction	Mar. 29.	Feb. 29.	72
St. Jerome, Que., hydro-electric installation		Feb. 7.	68
Toronto, Ont., electrical equipment	Mar. 26.	Feb. 7.	68
Toronto, Ont., work on T. & N.O. Rly.	Mar. 20.	Feb. 7.	60
Toronto, Ont., Registry and Land Titles Office additions, North Bay, Ont.	Mar. 26.	Mar. 14.	60
Toronto, Ont., water meters	Mar. 26.	Mar. 14.	72
Toronto, Ont., Garrison Creek extension	Mar. 26.	Mar. 14.	68
Toronto, Ont., high level interceptor	Mar. 26.	Mar. 14.	70
Vancouver, B.C., water pipe	Mar. 20.	Feb. 29.	60
Winnipeg, Man., drawings for Parliament Buildings	Mar. 31.	Jan. 25.	70
Winnipeg, Man., cables	Mar. 25.	Feb. 15.	60
Winnipeg, Man., asphalt	Mar. 20.	Mar. 14.	68
Winnipeg, Man., well turbine pumps	Apr. 1.	Mar. 14.	60

TENDERS.

Brampton, Ont.—Tenders will be received up to 6 p.m. March 26th, 1912, for the construction and supply of the following:—

(a) Concrete reservoir.

(b) Two turbine pumps and motors.

Plans, etc., can be obtained at the Municipal Office of the Town, and from the Engineer. J. G. Roberts, Chairman, Brampton Waterworks Commission. Wm. Treadgold, Engineer.

Edmonton, Alta.—Tenders will be received up to noon of April 1st, 1912, for the tile and marble work in connection with the Parliament Buildings, Edmonton. Plan, etc., at the Structural Engineer's office, new Parliament Bldgs., Edmonton, or at the branch office of the Dept. of Public Works, Calgary. John Stocks, Deputy Minister of Public Works, Edmonton.

Edmonton, Alta.—Tenders will be received until April 1, 1912, for the supply of approximately 300,000 bricks for the Court House, Calgary. Specifications, etc., at the office of the Structural Engineer, New Parliament Buildings, Edmonton, and at the branch office of the Dept. of Public Works, Calgary. John Stocks, Dep. Minister of Public Works, Edmonton.

Hollywood, Man.—Tenders will be received until March 27th, 1912, for the erection of a solid brick school with full sized cement basement, in the village of Langruth, Man. Plans and specifications may be seen at the Municipal Office, Portage la Prairie, or at Langruth, Man. Address, G. G. Moorehead, Sec.-Treas., Hollywood, Man.

Moose Jaw, Sask.—Tenders will be received by the City Commissioners until March 29th, 1912, for the installation of approximately three miles of 8 and 10-inch sewer mains and 6-inch water mains. Plans, etc., at the office of J. Antonisen, City Engineer, Moose Jaw.

Moose Jaw, Sask.—Tenders will be received by the City Commissioners up to noon of March 25th, 1912, for the supply and delivery of 500 feet 2½-inch, 3-ply cotton, rubber-lined fire hose.

Moose Jaw, Sask.—Tenders will be received by the City Commissioners, Moose Jaw, until April 13th, 1912, for one year's supply (approximately 7,000 tons) of steam coal. Particulars with J. D. Peters, Electrical Supt.

Manotick, Ont.—The commissioners of Manotick Police Village are prepared to receive tenders for the construction of about 10,000 square feet of concrete walk. Tenders will be open until 23rd of March. Particulars will be furnished by the secretary, R. Gamble.

Niagara Falls, Ont.—Tenders will be received until April 1st, 1912, for the construction of approximately 75,000 sq. yards of pavement, in wire-cut paving block, vitrified brick, westrumite, bitulithic, asphalt block or concrete. Specifications at the office of the City Engineer, Niagara Falls, Ont. W. J. Seymour, City Clerk. (See advertisement in Canadian Engineer).

North Toronto, Ont.—Tenders will be received until March 25th, 1912, for concrete sidewalks and bridges. Wm. C. Norman, Clerk, North Toronto, Ont. (See advertisement in Canadian Engineer).

North Bay, Ont.—Tenders will be received until March 25th, 1912, for the erection and completion of an eight-room Public school, including heating and plumbing. Plans, etc., at the office of the architect, H. W. Angus, McCool Block, North Bay. Tenders to be received by E. H. Young, Secretary Public School Board, North Bay.

Ottawa, Ont.—Tenders will be received until April 15th, 1912, for the construction of an extension to the north breakwater and dredging, at Goderich, Huron County, Ont. Plans, specifications, etc., can be obtained at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto; H. J. Lamb, Esq., District Engineer, Windsor, Ont.; Postmaster at Goderich, Ont., and at the office of R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received up to noon of April 1st, 1912, for the charter to this department of one or two steamers for Fishery Protection Service on the Pacific Coast. Vessels should meet following requirements: Length between 140 feet and 200 feet; gross tonnage between 300 tons and 400 tons; maximum speed not less than 10 knots. Copies of the conditions of the charter may be obtained on application to the Naval Store Officers, H.M.C. Dockyard, Esquimalt, B.C. G. J. Desbarats, Dep. Min. of the Naval Service, Dept of Naval Service, Ottawa.

Ottawa, Ont.—Tenders will be received until April 15th, 1912, for the construction of an extension to the north breakwater and dredging, at Goderich, Huron County, Ont. Plans, specifications, etc., can be obtained at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto; H. J. Lamb, Esq., District Engineer, Windsor, Ont.; Postmaster at Goderich, Ont., and at the office of R. C. Desrochers, Secretary Department of Public Works, Ottawa. (See advt. in Can. Eng.)

Ottawa, Ont.—Tenders will be received until the 20th of April, 1912, for the construction of a wooden lighthouse and dwelling combined on a concrete pier and protection work on Holland Island, Chatham Sound, B.C., and also for the construction of a reinforced concrete tower, double dwelling and a fog alarm building, at Point Atkinson, in the province of British Columbia. Plans, etc., at the office of the agency of the Department, Victoria, B.C.; Post Offices, Vancouver and Prince Rupert, B.C., and office of A. Johnston, Deputy Minister of Marine and Fisheries, Dept. of Marine and Fisheries, Ottawa.

Ottawa, Ont.—Tenders, bulk and separate, addressed to chairman of the Board of Control, will be received until March 26th, 1912, for the several works required in the erection and completion of a machinery hall in Lansdowne Park. Plans and specifications at the office of Architect Noffoke, 37 Central Chambers, Ottawa. John Henderson, City Clerk, City Hall, Ottawa.

Ottawa, Ont.—Tenders will be received by the Dept. of Public Works, Ottawa, until April 9th, 1912, for additions and alterations to the Fuel Testing Building, Ottawa. Plans, etc., can be obtained at this Department.

Prince Albert, Sask.—Plans for a large three-story police station, prepared by A. G. Creighton, architect, have been passed by the city council, and tenders are being called for the erection of the structure, by the police commission.

Prince Rupert, B.C.—Tenders for the supply of approximately 3,800 ft. of steel pipe, 18 inches in diameter, delivered on the wharf, Prince Rupert, will be received until March 25th, 1912. Full particulars may be obtained from Wm. Mahlon Davis, City Engineer. Ernest A. Woods, City Clerk.

Red Deer, Alta.—Tenders for all work except excavating and concrete walls and steel work to ground floor level and plumbing and heating for the Alberta Ladies' College, Red Deer, will be received until April 1st, 1912. Plans and specifications at the offices of C. A. Julian Sharman, architect, Red Deer; Barnes and Gibbs, architects, Edmonton; the Builders' Exchange, Calgary, and the Builders' Exchange, Winnipeg. J. Malcolm, Esq., Chairman Building Committee, Alberta Ladies' College, Red Deer.

Sudbury, Ont.—Tenders will be received until April 17th, 1912, for the following works:—

Contract "A"—Main Sewer, 8,555 ft. 20-in., 18-in., and 15-in.
" "B"—Sanitary Sewers and Force Mains.
" "S"—Sewer Pipes and Junctions.

Plans and specifications at the office of the Town Clerk, Sudbury, or at office of the Engineers, Mail Building, Toronto. Chipman & Power, Engineers.

St. Thomas, Ont.—Tenders will be received until noon on Friday, March 29th, for Port Stanley waterworks. For full particulars address Messrs. Jas. A. Bell & Sons, engineers, St. Thomas, Ont. (See advt. in Canadian Engineer).

Sydney Mines, C.B.—Tenders will be received until March 30th, 1912, inclusive, for building an "Annex" to "Harbor-View Hospital," Sydney Mines. Plans, etc., at the general office of the N.S.S. & C. Co., and at the Town Engineer's office, Sydney Mines; also office of Herbert E. Gates, Esq., Architect, Halifax. Edmund McDonald, Secretary to Trustees, H. V. Hospital, Sydney Mines.

Toronto, Ont.—Tenders will be received until March 26th, 1912, for the excavating, laying and joining a 24-inch cast-iron water main on Sumach Street from Queen Street to Wellesley Street. Specifications, etc., at the office of the City Engineer, Toronto. G. R. Geary, (Mayor), Chairman, Board of Control, City Hall, Toronto.

Toronto, Ont.—Tenders will be received until March 26th, 1912, for the construction of the following sewers:—Benson avenue, Christie to 114 ft. 6 in. W. of Arlington; Rushton road, Benson to St. Clair; Ilford avenue, Arlington avenue to east end; Shaw street, Tyrell to St. Clair. Specifications and forms of tender at the office of the City Engineer. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto.

Toronto, Ont.—Tenders will be received until April 9th, 1912, for the construction of storm overflow sewer, Main Garrison Creek, Section 1. Specifications, etc., at the office of the City Engineer. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto. (See advt. in Can. Eng.)

Vancouver, B.C.—Tenders will be received until March 25th, for the supply and delivery of 1 twelve-ton road roller, either single cylinder or compound steam or gasoline. D. G. Tate, City Clerk, Vancouver, B.C.

Westmount, Que.—Tenders will be received until March 28th, 1912, for intercepting sewer, also paving, Western Avenue. Specifications, etc., at the office of the City Surveyor, Arch. Currie, Westmount, Que. (See advertisement in Canadian Engineer).

Welland, Ont.—Mr. Robt. Cooper, County Clerk of the above, will receive tenders for road machinery comprising:

2 steam rollers, 10 tons each.
2 rock crushers (portable).
2 bins for stone storage (portable).
2 revolving screens.
2 chain elevators.
2 road graders.
2 sprinkling wagons.
1 traction engine, 18 h.p.
2 pick plows.
2 wheel scrapers.

Tenders to be in by noon, April 2nd next.

Welland, Ont.—Tenders will be received up to noon of April 2nd, 1912, for the following stone for building roads under the County Good Roads System:—Crushed stone, per ton, and rubble stone, per cord, f.o.b. cars quarry, and delivered in car lots at different points of the county of Welland. (Signed) Robert Cooper, County Clerk, Welland, Ontario.

A CORRECTION.

In our advance news service sheet of March 18th last a request from Messrs. McDougal and Forster was made. The address of this firm is Edmonton, Alta.

CONTRACTS AWARDED.

Province of British Columbia.—Sub-contracts for the construction of the main line of the Grand Trunk Pacific eastward to Burns Lake near Fraser Lake, have just been awarded by Messrs. Foley, Welch & Stewart, general contractors, as follows:—Aldermere East, John Bostrom, eight miles; Freeburg & Stone, ten miles; Hugh McLeod, four miles; Sheady & Smith, seventeen miles; John Albi, ten miles. Bulkley Summit, westward, Duncan Ross, ten miles. Bulkley Summit, eastward, John McLeod, five miles; A. L. McHugh, ten miles; Dan Stewart, ten miles; D. A. Rankin & Company, fourteen miles along Burns Lake and eastward.

Guelph, Ont.—The directors of the Guelph Radial Railway have awarded the following contracts:—Steel rails, Drummond & McColl, Montreal; ties, Contractors' Supply Company, Toronto; wire, Dawson & Company, Montreal.

Kamloops, B.C.—Of the ten tenders received for the construction of a covered concrete reservoir, capacity 1,500,000 gallons, that of the Graff Construction Company, Vancouver, was accepted, their price being $32,729.89.

Lindsay, Ont.—A report from this town states that The Toronto Construction Company have been awarded the contract for the construction of the new Canadian Pacific Lake Front line, a distance of 178 miles.

Montreal, Que.—The contract for the covering of 2,200 ft. of Little St. Pierre River with concrete and sides shored by wooden planking, has been awarded to Messrs. Haney, Quinlan & Robertson, for $75,500.

Montreal, Que.—A theatre for the Canadian Amusement Company, Orpheum Bldg., will be built by Contractor C. E. Deakin, 11 St. Sacrament St. The steel work will be done by the Dominion Bridge Co., Lachine. Estimated cost, $100,000.

Ottawa, Ont.—Messrs. McDougals, Limited, have received the contract for the supply and delivery of valves required by the corporation of the city of Ottawa, for $4,659.36.

Ottawa, Ont.—The Montreal Bridge Company have been awarded the contract calling for the erection of the park stand at Connaught Park.

Ottawa, Ont.—The construction committee of the Connaught Park Jockey Club have awarded the contract for the steel work in connection with the grand stand at Connaught Park to the Dominion Bridge Company, of Montreal.

Prince Albert, Sask.—The National Iron Works Co. have received the contract of supplying cast-iron water pipe required by the city during the year 1912. Contract price, $43.40 per ton.

Saskatoon, Sask.—The successful bidders for the supply of waterworks materials for Saskatoon, ars as follows:—

For cast-iron pipe, the Canada Iron Corporation.	$72,200.00
For valves & hydrants, Messrs. Drummond, McColl	10,700.00
For corporation brass, the H. Mueller Mfg. Co. ..	3,000.00
For lead and iron pipe and service boxes, Messrs. Jas. Robertson Co.	8,500.00

Saskatoon, Sask.—The contract for the superstructure of the new Y.M.C.A. building has been awarded to the Frid-Lewis Co., Ltd., of Winnipeg, their tender being the lowest received, $69,300.

Saskatoon, Sask.—J. H. Simmons, of Winnipeg, has secured the contract for the construction of an express building and of outward and inward freight sheds.

Swift Current, Sask.—A six-stall engine house and express building will be constructed by J. McDiarmid Co., of Winnipeg.

St. John, N.B.—Mr. Hartman, of Montreal, P.Q., has been awarded the contract to erect a new sardine factory in this city. The plant is for the Canadian Sardine Co., Ltd., of which Mr. McColl is the manager at this point.

Truro, N.S.—The contract for the construction of a brick and stone civic building to cost $45,000 has been awarded to Messrs. Rhodes, Curry & Co., of Amherst, N.S.

Toronto, Ont.—The County of Hastings, Ontario, have awarded a contract for the supply of a concrete mixer to Messrs. Wettlaufer Bros., who will supply a No. 4 heart-shaped mixer.

Toronto, Ont.—The contract for the new Canadian Pacific Lake Shore road, which will branch from the present Toronto-Montreal line at Agincourt and rejoin it at Bathurst, west of Smith's Falls, a total distance of 198 miles, has been let to Messrs. Deeks & Hinds. The value of the contract is about $10,000,000. The construction work includes a number of tunnels, the longest being 850 feet.

Vancouver, B.C.—Contracts for the construction of additions to the Florence Nightingale and Cecil Rhodes schools were awarded to Robert McLean & Co. The tender on the former was $56,300 and the latter $53,000.

Vancouver, B.C.—The tender for hauling the Seymour Creek pipe has been awarded to Mr. F. C. Lane, at the price of $3.90 per ton.

Vancouver, B.C.—The Terminal City Iron Works were awarded the contract for the supply of hydrants for this city. Their prices were $41.50 for 200 ordinary hydrants, and $76.50 for hydrants with crane attachments. The Robertson Godson Company in competition tendered $40 and $68 for the same.

Vancouver, B.C.—The Terminal City Iron Works will supply 200 hydrants (without cranes) for Water Works Distribution System Extensions, at $42.50; and the Robertson-Godson Company, 40 hydrants (crane attachment) at $68.

Victoria, B.C.—The contract for the erection of the new high school has been awarded to Messrs. Dinsdale and Malcolm of this city, their price being $344,000. The various bids received were as follows: On the original specifications and as an alternative, Norton-Griffiths Steel Construction Co., $358,000-$337,000; Messrs. Dinsdale & Malcolm, $344,000-$329,000; Thomas Catterall, $368,000-$348,073; Messrs. Bayne & Horie, $355,000-$337,800.

Victoria, B.C.—Messrs. Dinsdale & Malcolm have been awarded the contract for the new high school building, their tender of $344,000 being the lowest of four submitted.

RAILWAYS—STEAM AND ELECTRIC.

Collingwood, Ont.—A report states that a party of surveyors has completed a line of projected railway to this town. The plan shows a point named Baxter on or near the Toronto-Sudbury section of the C.P.R. as the start.

Coquitlam, B.C.—The Coquitlam Terminal Company are building a two-mile belt to serve factories and other buildings along the industrial sites of the Pitt River. It is to connect with the spur of the Canadian Pacific Railway on the north side of the main right-of-way.

Guelph, Ont.—At the annual meeting of the directors of the Guelph Radial Railway Company the following officers were elected:—J. W. Lyon, president; W. E. Buckingham, vice-president; C. E. Howitt, treasurer; J. U. Pequegnat, secretary. The company will do considerable construction work during the coming season.

Hull, P.Q.—The municipal council have advised that the Canadian Pacific Railway authorities be requested to build a station in proportion to the size and imporantce of the city.

Moose Jaw, Sask.—The plans of the entrance for the Grand Trunk Pacific Railway to this city, show that the railway will enter the city at Eighteenth Avenue, from which it will pass through Hillcrest in blocks 40, 39, 38, 37, 36 and 46. It then goes west through the Ross estate, crossing Main Street directly north of the exhibition grounds, goes west through several blocks in Lynbrook Heights, and passes out of the city through Victoria Heights.

Midland, Ont.—The Midland Terminal Railway has changed its name to the Midland-Simcoe Railway Company and has had its charter extended for three years.

Ottawa, Ont.—The name of the Ottawa, Smith's Falls and Kingston Railway has been changed to the Ottawa, Rideau Lake and Kingston Railway Company.

Port Colborne, Ont.—On March 27th the ratepayers will be asked to vote on a by-law fixing the assessment on all Grand Trunk property in that town at $16,000 for a period of twenty years, and also giving the company permission to close two streets and to move two others.

Saskatoon, Sask.—A bridge on the line of the Canadian Northern Railway was recently damaged by the breaking of one span. A number of passengers were killed in the fall and burning of the Pullman car.

Stratford, Ont.—The committee dealing with questions relative to the street railway will make application to the municipal council asking that body to prepare and present a by-law calling for the raising of $30,000 for this utility.

Sudbury, Ont.—Mr. Chas. McCrea has made application to the legislature for the incorporation of the Sudbury Copper Cliff Railway, capital $250,000. The lines of this road are not to exceed twelve miles distance from Sudbury.

Toronto, Ont.—A report states that a company are preparing to start a motor bus line in this city at an early date. They expect to have 50 cars to start with.

LIGHT, HEAT AND POWER.

Niagara Falls, Ont.—The city has approached the Provincial Government, and the Queen Victoria Park Commission, to secure permission for the erection of a new power house and pumping station. The plans call for four generators, water-wheels, pumps, penstocks, etc., to be placed at the bottom of a shaft. The total projected development is about 4,000 horse-power, near the site of the present pumping station. Mayor C. C. Cole, and Water Commissioner R. P. Slater, are looking after the city's interests. Mr. John Kennedy, Montreal, is the consulting engineer.

Ottawa, Ont.—The charter granted to the Orillia Power Company embodied the proposal of Hon. Adam Beck, calling for the surplus of all power plants to be used in the extension of the plant making the surplus.

Quebec, P.Q.—At a meeting of the Dorchester Electric Company preliminary details of the new concern were finally arranged, and it was announced that the new concern would be generating power by Sept. 15 next. The board of directors, as elected, consists of Ald. James Robinson, of Montreal, president; the Hon. N. Garneau, of Quebec, vice-president; Dr. W. D. Hart, G. E. Tanguay, T. N. King, J. S. Bosse, F. G. Lyman and G. Proteau.

St. Thomas, Ont.—A report states that the London Electric Company has offered to illuminate the streets for $3,000 per year less than the estimate of Hydro-Electric Commission.

Toronto, Ont.—The hydro-electric commission will undertake the farm power experiments, initiated about a year ago, during the coming spring.

Vancouver, B.C.—The British Columbia Electric Railway Company will erect a sub-station at the junction of Earle road and its Westminster interurban right-of-way, to cost $100,000.

GARBAGE, SEWAGE AND WATER.

Berlin, Ont.—The municipal authorities have had their plans approved by H. G. Hodgkins, C.E., of Syracuse, N.Y., who has advised them that the water supply, if expediently used, will serve the city for the next ten years.

Lethbridge, Alta.—Mayor Hatch is interested in a proposal to construct a new filtration plant in this city. The system at present in use allows the water to become polluted, as shown by chemical and bacteriological examinations.

North Toronto, Ont.—The town solicitor will prepare a by-law for the ratepayers calling for the expenditure of $60,000 to provide a pumping plant to supply the town with water from Lake Ontario. The project to obtain a supply from certain springs at Lemmonville has been blocked by the Private Bills Commitee of the Provincial Legislature.

Sarnia, Ont.—The provincial medical health officer has recommended that the future water supply of the above municipality be obtained from Lake Huron. There has been a great deal of annoyance of late, owing to the present condition of the river intake and the bacteriological state of the water.

Sydney, C.B., N.S.—The business of the Dominion Iron and Steel Company was interrupted recently by the breaking of a large water main. The break took place in the main pipe between the blast furnace and the bessemer plant, and at a depth of 28 feet, which rendered its repairs most difficult.

BUILDINGS AND INDUSTRIAL WORKS.

Battleford, Sask.—The Battleford Curling Club expect to erect a large rink for their own use.

Calgary, Alta.—A by-law to raise the sum of $20,000 will be discussed at a meeting of the aldermen. The money is to provide an asphalt plant for the city.

Calgary, Alta.—The rough preliminaries in connection with the plans for a new police station have been completed and competitive plans will be called in a few days. The station will have accommodation for one hundred prisoners and cost about $125,000.

Edmonton, Alta.—Mr. J. H. Gariepy will erect a six-story building on the south side of Jasper Avenue, between Fifth and Sixth Streets. The estimated cost of the work is $250,000.

Fonthill, Ont.—The Dominion Canners Co. are preparing for the erection of a large cannery at this point. The plant is to be finished this year.

Fort William, Ont.—The Board of Education will call tenders for an addition to the Collegiate Institute. It is estimated that the work will cost $20,000.

Ladner, B.C.—Plans are being prepared for a new municipal hall. A by-law calling for the erection of this building will be presented to the ratepayers at an early date.

Montreal, P.Q.—A company taking the name of the Centre-Freeze Ice Company has been formed in this city to manufacture ice from sterilized water. Mr. L. O. Geoffrion, of the Montreal Harbor Board, is interested in the matter.

Montreal, P.Q.—Plans for the erection of a ten-story building on the site now occupied by the Castle Blend block are prepared. The sale of the property was concluded by Mr. John J. Louson, representing Mr. James Buchenough, who, in turn, was acting for one of the largest trust companies operating in Montreal.

Preston, Ont.—Tenders will be called for the erection of a new addition to the Public school. H. C. Edgar, Town Clerk.

Regina, Sask.—The Saskatchewan Motor Company have purchased a site on which they will commence the erection of a four-story garage.

Saskatoon, Sask.—A report states that negotiations are closed for the erection of the mills of the United Flour Mills Co., of Minneapolis, U.S.A.

Toronto, Ont.—A report is in circulation that a tall building will be erected on the site now occupied by Messrs. Rice Lewis and Company. It is said that the Standard Stock Exchange are to be the owners of the new structure.

Toronto, Ont.—The National Iron Works, Ltd., are preparing plans and specifications which, when completed, will double the present capacity of their plant. Mr. Gordon F. Perry, manager of these works, is superintending the details of these plans.

Toronto, Ont.—Work on the new St. Alban's Cathedral (Anglican) will be started at an early date.

Vancouver, B.C.—Plans for a large building are prepared. It is to be erected at 506-14 Cordova Street.

Vancouver, B.C.—A report states that the Dominion Bed Manufacturing Company may erect a branch factory in this city. There is a branch of this company in Kent, Washington, at the present time.

Vancouver, B.C.—The Dietrich Saw Works, of Galt, Ont., will establish a branch in Vancouver. A permit has been taken out for a $10,000 warehouse. It will be enlarged later.

Welland, Ont.—The Holman Sign Company will occupy the premises recently used by the Electro Steel Company. Forty men will be employed.

BRIDGES, ROADS AND PAVEMENTS.

North Toronto, Ont.—A road through the Mount Pleasant Cemetery will be constructed in the near future. An overhead bridge will be erected in connection with this over the tracks of the old Belt Line Railway The General Buying Ground Trust and the town of North Toronto will share the cost, which comes to about $15,000. Mr. E. A. James is the town engineer of the above.

Province of Saskatchewan.—The Government of this province will consider the granting of $5,000,000 for road improvement.

Victoria, B.C.—Plans for a concrete bridge to replace the present wooden structure over the Gorge Road Ravine are being considered by the council. The estimate for a 60-foot span the full width of the roadway and the reinforced concrete arch with the necessary walls is $24,371. A steel bridge with a 120-foot span, having the necessary approaches at each end, the bridge taking the full width of the roadway, will cost $32,300. The engineer, Mr. Angus Smith, recommends the former.

FIRES.

Ottawa, Ont.—The establishment of Messrs. Parsons & Company was damaged by fire to the extent of $5,000 on February 9th last.

St. Catharines, Ont.—About $6,500 damage was caused by fire to the premises and stock of the Martin Electrical Store in this city.

TRADE ENQUIRIES.

The following were among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ended February 12th, 1912. Fuller information may be obtained by communicating with the Department of Trade and Commerce, Ottawa.

The following were among the enquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ending March 4th, 1912:—

A Dundee firm of jute manufacturers wish to appoint a reliable Canadian agent.

A Scottish firm manufacturing split lentils are anxious to develop trade connections in the Canadian North-West.

A London firm manufacturing automatic packing machinery would like to hear from Canadian firms likely to be interested.

Enquiry is made by an English manufacturer for the names of parties in Canada having alkali properties to dispose of.

A London correspondent is desirous of purchasing Monel Metal, and would like to hear from Canadian manufacturers.

A West of England correspondent is open to represent Canadian firms desirous of doing business in Great Britain.

A Scottish firm manufacturing a new improved diaphragm suction pump are open to appoint Canadian agents.

From the branch for city trade enquiries, 73 Basinghall Street, London, E.C.:—

A Midlands firm manufacturing horticultural brass foundry (syringes, pumps, sprayers, etc.), invite correspondence from Canadian importers.

CURRENT NEWS.

Calgary, Alta.—Many tenders were received for the municipal paving. The prices ranged from $2.36 to $2.85 per sq. yd. for bithulithic; $3.50 to $3.75 for wood blocks; $2.05 to $2.40 for sheet asphalt; $2.12 for asphalt concrete, and .09⅜ to 10⅜ for concrete sidewalks.

Calgary, Alta.—The municipal authorities are preparing to spend the sum of $84,000 on park improvements during the coming season. The plans call for the construction of asphalt walks and driveways, the erection of band stands, electric lighting extensions and the installation of two or more fountains.

Ottawa, Ont.—Over 100 dwelling houses belonging to the C.P.R. and situated near the old St. Lawrence and Ottawa tracks on the block bounded by McTaggart, Redpath, Cumberland and Dalhousie Streets, were condemned by the medical health officer as the result of not being equipped with sanitary conveniences. The C.P.R. was instructed to install improvements, but this would have required running a sewer down the street, and to this expense the company was not prepared to go. As a result the houses will all be knocked down, the material in them being sold to the highest bidder.

Ottawa, Ont.—Railroad officials are to make a request to the federal government that steel rails from the United States be admitted into Canada duty free during the coming year, owing to the inability of Canadian makers to supply the demand.

Toronto, Ont.—An architectural competition will take place in connection with the new Technical School to be erected on Harbord Street. Plans must be in the hands of the committee of awards previous to June 15th next. Although the treatment will be left to the discretion of the designers, a few suggestions have been made. Among these it is stated that good light is important; brick material is recommended for the facades and the structure is to be five stories in height. The board of assessors has been thus named:—Dr. A. C. McKay, principal of Toronto Technical School; Mr. P. E. Nobbs, of McGill University, and Mr. Frank A. Wickson, Toronto.

Vancouver, B.C.—The Wallace Shipyards, North Vancouver, has received instructions to fit the tug Point Grey with oil-burning apparatus, and also an order from the Terminal Steamship Company to fit the sternwheeler Baramba with oil fuel apparatus.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Each week on this page may be found summaries of orders passed by the Board of Railway Commissioners, to date. This will facilitate ready reference and easy filing. Copies of these orders may be secured from The Canadian Engineer for small fee.

16094—March 6—Authorizing G.T.P.B.L. Co. to construct spur for Yellowhead Pass Coal & Coke Co., Ltd., on Alberta Coal Brch.

16095—March 7—Authoriing C.N.O. Ry. to take portion of Lot 9, Brokenfront Con. Town of Trenton, for diversion as approved by Order 12480.

16096—March 6—Authorizing Midland Rly. (G.N.R.) and G.T.P. Ry. to operate trains over crossing in Parish Lot 55, St. Boniface, Man., pending completion of interlocker.

16097—March 8—Authorizing G.T.R. to construct branch line of railway through Holmedale District in City of Brantford, Ont., and across Hydraulic Canal and the Grand River to a connection with its Brantford and Tillsonburg Branch (20th Dist.) and to close streets and highways in the city. Compensation to be paid A. J. Wilkes for land taken.

16098—March 11—Approving revised location of C.N.O. Ry. (Montreal-Port Arthur line) through Twp. of Capreol, dist. of Nipissing. Mileage 426.53 to 429.29 from Montreal.

16099—March 9—Substituting plan "A" for plan filed and approved by Order 15280 of Sept. 11th, 1911, C.N.R. spur H.B. reserve in city of Edmonton, Alberta.

16100—March 9—Authorizing Central Vermont Ry. to reconstruct bridge over Little Montreal River, between St. Lambert and Chambly, Que.

16101—March 9—Directing C.P.R. within 90 days to install electric bell at crossing known as Concession Road between Cons. 4 and 5 in Twp. of Cumberland, County Russell, Ontario.

16102—March 4—Authorizing C.P.R. to construct subway at Decarie Ave., Montreal, Que., to include diversion of Prudhomme Avenue by means of Western Avenue, $10,000 from Rly. Grade Crossing Fund, one-fifth of balance by city of Montreal.

16103—March 7—Directing G.T.R. at once to arrange that train No. 7 stop at Paris, Ont., to let off passengers from Toronto and points east thereof; complaint Board of Trade, Paris, Ontario.

16104—March 11—Authorizing C.P.R. to use and operate bridges at mileages 0.5, 94.3 and 81.4, Windsor sub-division.

16105—March 11—Authorizing C.P.R. to use and operate bridges at mileages 40.3, 42.1 and 43.8, on London sub-division.

16106—March 11—Authorizing C.N.O. Ry. to cross public road in Twp. of Trafalgar, county of Halton, Ontario.

16101—March 14—Dismissing application of United Fruit Co.'s of Berwick, N.S., on rate of apples to Winnipeg, Man.

THIS CANCELS FORMER SUMMARY OF ORDER NO. 16101.

16107—March 11—Approving by-law of Bay of Quinte Ry. authorizing Geo. H. Shaw to prepare and issue tariffs of tolls.

16108—March 7—Directing G.T.R. to before May 1st, 1912, install electric bell at crossing west of Bainsville station, Twp. of Lancaster, Ct. Glengarry, Ontario. 20 per cent. from Railway Grade Crossing Fund.

16109—16110—March 12—Authorizing C.P.R. to use and operate bridges 8.2 and 9.2 on Cranbrook S.D. and bridges 80.5 and 62.8 on its Sirdar sub-division.

16111—March 4—Authorizing G.T.R. to take lands in the Twp. of York, county of York, Ont., in connection with Toronto grade separation scheme.

16112—March 5—Relieving G.T.R. from further protection of crossing of Richmond Road, Twp. of Nepean, Carleton Ct., Ont.

16113—March 4—Approving standard station designs for Algoma.

16114—March 4—Eastern Railway Company, and for Algoma Central and H.B. Ry.