# Canadian Engineer

(Including THE CANADIAN CEMENT & CONCRETE REVIEW)

A WEEKLY JOURNAL

For CIVIL, MECHANICAL, ELECTRICAL and RAILROAD ENGINEERS and CONTRACTORS

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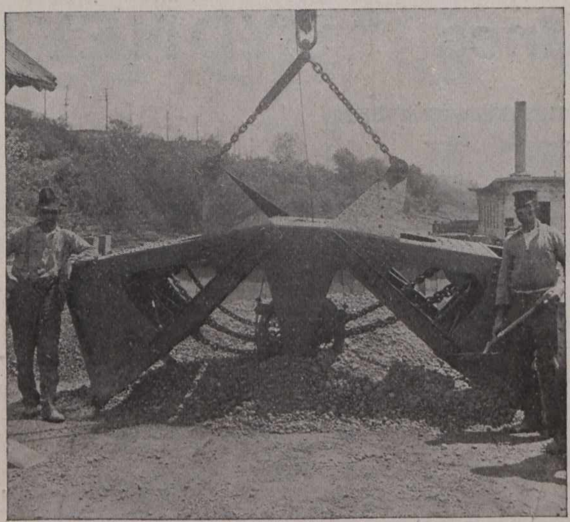

# WHERE TO BUY

## AN ENGINEERING TRADES DIRECTORY

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**Air Compressors**
Adams Hydraulics, Ltd.
Canadian Boving Co., Ltd., The.
Canadian Rand Company, Ltd.
Canadian Westinghouse Co., Ltd.
Hopkins & Co., F. H.
Mussens Limited.
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Ontario Asphalt Block Co.

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

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Mussens, Ltd.
Vining Bros. Mfg. Co.

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Inglis Co., The John.
Leonard & Sons, E.
Petrie, H. W., Ltd.
Polson Iron Works.
Robb Engineering Co.
MacKinnon, Holmes & Co.

**Books, Technical.**
John A. Hart & Co.
The Canadian Engineer.
Renouf Publishing Co.
St. Bride's Press, Ltd.
Technical Publishing Co.

**Boring Tools.**
Armstrong Bros. Tool Co.
Mussens, Limited.

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Kuhnert & Co., A.
London Concrete Machinery Co., Ltd.
Mussens, Ltd.
Peerless Brick Machine Co.

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Foundation Co., Ltd., The.
Manitoba Bridge & Iron Works, Ltd.
McNeil & Co., Wm. P.
Pennsylvania Steel Co.
Structural Steel Co., Ltd.

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Hopkins & Co., F. H.
Mussens Limited.
Wire & Cable Co.

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Mussens, Ltd.
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Jeffrey Mfg. Co.
Wire and Cable Co.

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Inglis Co., The John.
Manitoba Bridge and Iron Works, Ltd.
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Macdonnell & Co., J. D.
Mussens, Ltd.
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Rogers, Alfred.
Rogers Supply Co.
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Cement Tile Machinery Co.
Hopkins & Co., F. H.
Ideal Concrete Machinery Co., Ltd.
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London Gas Power Co., Ltd.
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Mirrlees-Watson Co., Ltd.
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Factory Products, Ltd.
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Manitoba Bridge & Iron Works, Ltd.
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Peacock Bros.
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Royce, Ltd.
Smart-Turner Machine Co., Ltd.
Structural Steel Co., Ltd.
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Foundation Co., Ltd., The.

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Dominion Bridge Co., Ltd.
Factory Products, Ltd.
Hopkins & Co., F. H.
Manitoba Bridge & Wire Works, Ltd.
Mussens Limited.
Northern Engineering Works.
Structural Steel Co., Ltd.

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Leonard & Sons, E.

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Date, John.

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Keuffel & Esser Co.
Dietzgen Co., Eugene.
Peacock Bros.

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Calgary Drafting Co.
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Bell Co., The Wallace.

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Hopkins & Co., F. H.
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Peacock Bros.
The Canadian Fairbanks Co., Ltd
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Adams Hydraulics, Ltd.
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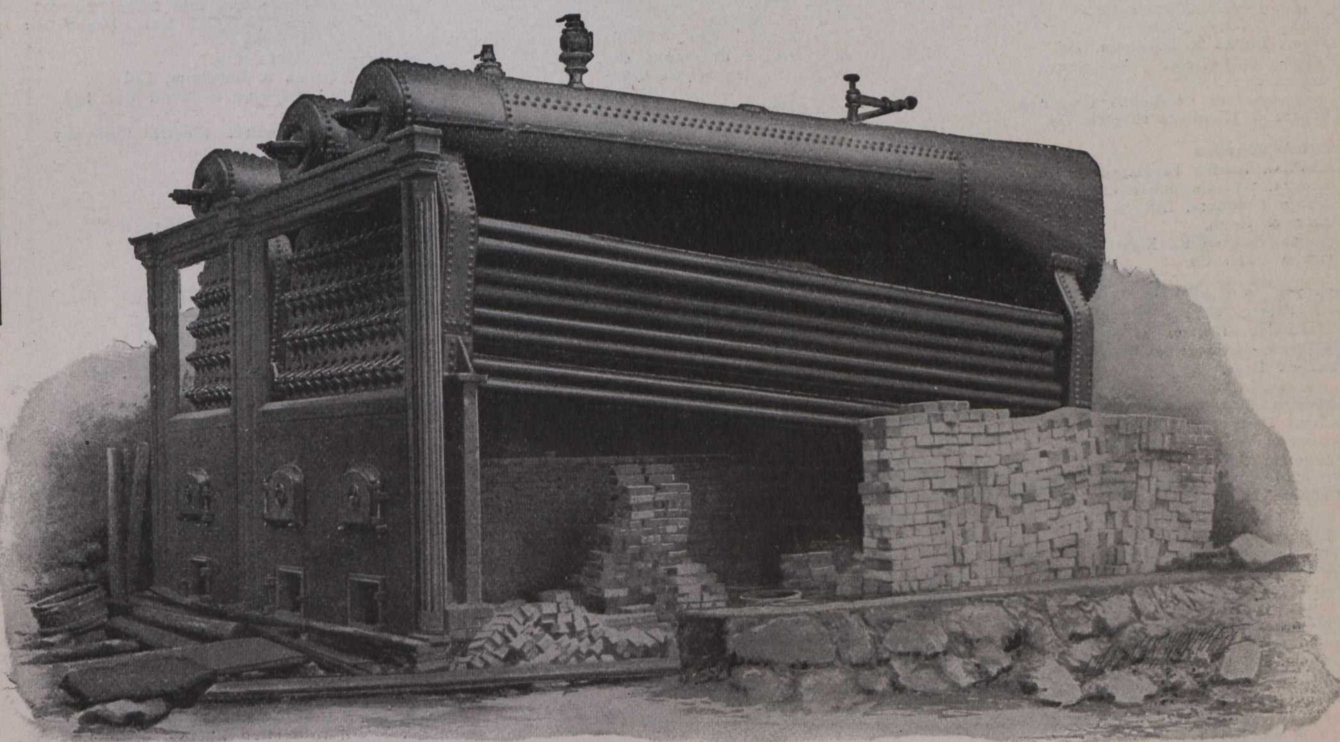

THE ERIE CITY WATER-TUBE BOILER

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**Electric Apparatus**
Bruce, Peebles & Co., Ltd., (Vandeleur and Nichols, Agents).
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Dutcher, Maxwell & Gregory.
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Fielding & Canniff.
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Galt Engineering Co., John.
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Wilson, N. D.
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Ontario Lime Association.

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Hopkins & Co., F. H.
Montreal Locomotive Works, Ltd
The Canadian Fairbanks Co., Ltd.

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Brown & Co., A. G.
Hopkins & Co., F. H.
Jeffrey Mfg. Co.

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Fleck, Alex.
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Inglis Co., The John.
Peacock Bros.
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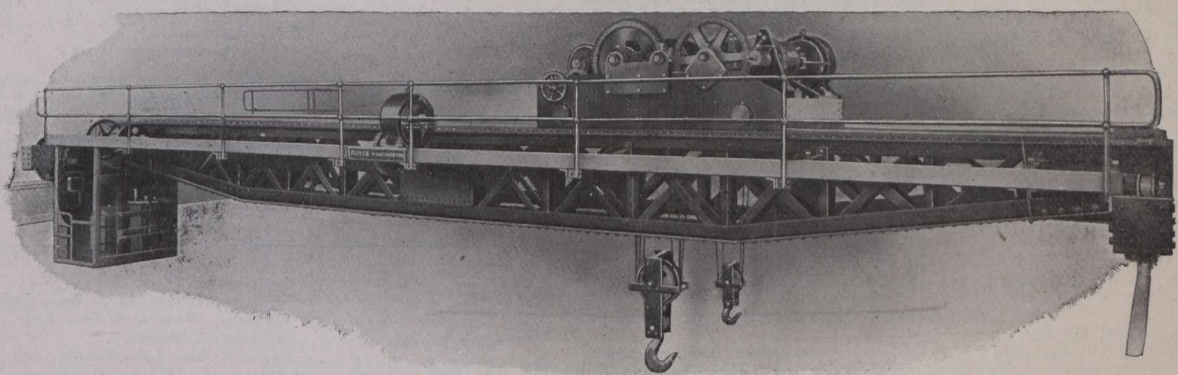
Hopkins & Co., F. H.
The Canadian Fairbanks Co., Ltd.

**Machinery Transmission**
Inglis Co., The John.

# ROYCE LIMITED,

## TRAFFORD PARK,
## MANCHESTER, ENG.



**Photograph of 20-ton "Royce" Electrical Crane.**

SPECIALISE IN ELECTRICAL **CRANES** (GOLIATH, OVERHEAD & JIB TYPES)

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(Ordinary and " Royce " Patent Free Bollard Types)

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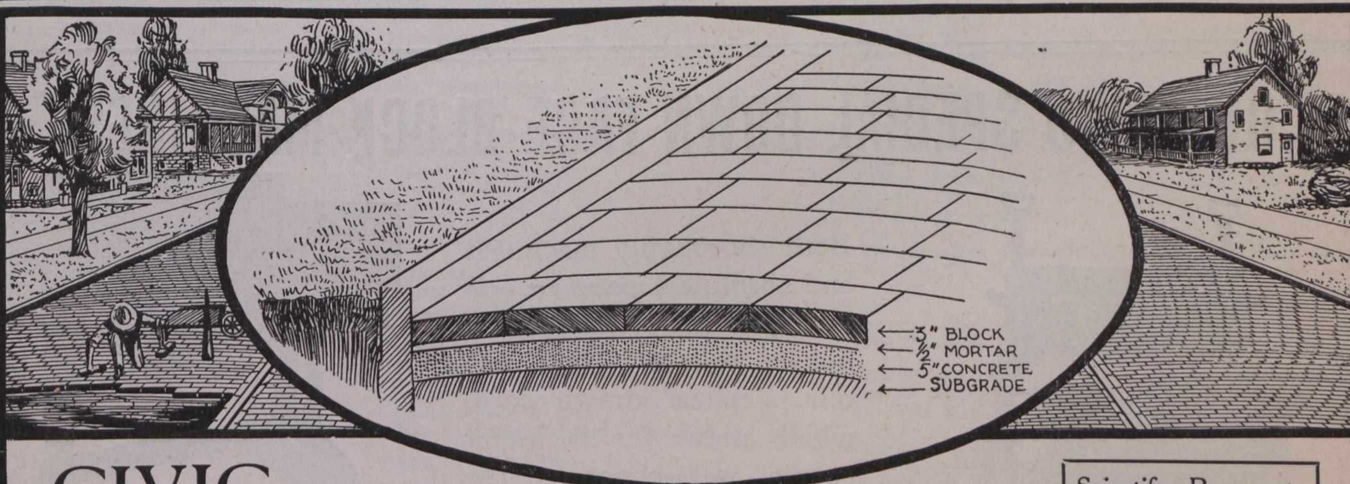


**CIVIC PRIDE** sometimes demands something a little better than the kind of thing used by the next town. People with civic pride now-a-days demand asphalt block pavements.

*Engineers contemplating laying pavements are requested to drop us a postal.*

**Scientific Pavements**

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Head Office - Windsor, Ontario.

Works at Walkerville.

(Continued from Page 8).

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Fetherstonhaugh & Co.
Fetherstonhaugh, Dennison & Co.
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**Ridout & Maybee.**
Sheehy, James J.

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Inglis Co., The John.

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**Ford Iron Co.**
Gartshore-Thompson Pipe & Foundry Co.
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Wood & Co., R. D.

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Beatty & Sons, Ltd., M.
Canadian Boving Co., Ltd., The.
Canadian Rand Co.
Canadian Fairbanks Co.
**Glenfield & Kennedy.**
Goldie & McCulloch Co., Ltd.
Hopkins & Co., F. H.
Inglis Co., The John.
**Leonard & Sons, E.**
Mirrlees, Bickerton & Day, Ltd.
**Mirrlees, Watson & Co., Ltd.**
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Petrie, H. W., Ltd., Toronto.
Peacock Bros.
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Wood & Co., R. D.

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Rail Joint Co. of Can., Ltd
**The Canadian Fairbanks Co., Ltd.**

**Rails.**
Gartshore, J. J.
Hopkins & Co., F. H.
Provincial Steel Co.

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**Railway Supplies**
Brown & Co., A. G.
Coghlin & Co., B. J.
Hopkins & Co., F. H.
Koppel Co., Arthur.
Mussens Limited.

**Railways, Industrial and Portable**
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Koppel Co., Arthur.
Manitoba Bridge & Iron Works, Ltd

**Ratchett Drills, Universal**
Mussens Limited.

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Manitoba Bridge & Iron Works, Ltd
Priddle, Arthur.

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Canadian Rand Co.
Hopkins & Co., F. H.

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Paterson Mfg. Co., Ltd.

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Hopkins & Co., F. H.
Mussens Limited.
Peacock Bros.

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The Canadian Fairbanks Co., Ltd.

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Greening Wire Co., Ltd., The B.
Hopkins & Co., F. H.
Mussens Limited.

**Rules**
Lufkin Rule Co.

**Schools, Engineering**
McGill University.
School of Mining.

**Screens.**
Greening Wire Co., Ltd., The B.
Hopkins & Co., F. H.
Mussens, Ltd.
Peacock Bros.

**Sewage Disposal**
Adams Hydraulics, Ltd.
Heenan & Froude.

**Sheet Metal Work**
Polson Iron Works.
The Canadian Fairbanks Co., Ltd.

**Shovels, Steam**
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Mussens Limited.

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Leonard & Sons, E.

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

**Standpipes**
Glenfield & Kennedy.
Inglis Co., The John.

**Steel, Speedicut, High-speed**
Allen & Co., Ltd., Edgar.
Montreal Steel Works.
Nova Scotia Steel & Coal Co.

**Steel, Structural**
Allen & Co., Ltd., Edgar.
Cleveland Bridge & Engineering Co., Ltd.
Dominion Bridge Co., Ltd.
Ford Iron Co.
Leslie & Co., Ltd., A. C.
MacKinnon, Holmes & Co.
Manitoba Bridge & Iron Works, Ltd.
Montreal Steel Works.
Mussens Limited.
Nova Scotia Steel & Coal Co.
Pennsylvania Steel Co.
Polson Iron Works.
Provincial Steel Co.
Structural Steel Co., Ltd.

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Peacock Bros.

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Inglis Co., The John.
Leonard & Sons, E.
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Peacock Bros.
Polson Iron Works.
Structural Steel Co., Ltd.
Wood & Co., R. D.

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Slack & Co., T.

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Hopkins & Co., F. H.
The Canadian Fairbanks Co., Ltd.

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Mussens Limited.
The Canadian Fairbanks Co., Ltd.

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Peacock Bros
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Toronto & Hamilton Electric Company.

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**Turbine Regulators.**
Kvaerner Brug.

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Kuhnert & Co., A.
Kvaerner Brug.
Peacock Bros.
The Canadian Fairbanks Co., Ltd.

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Mirrlees, Watson Co., Ltd.

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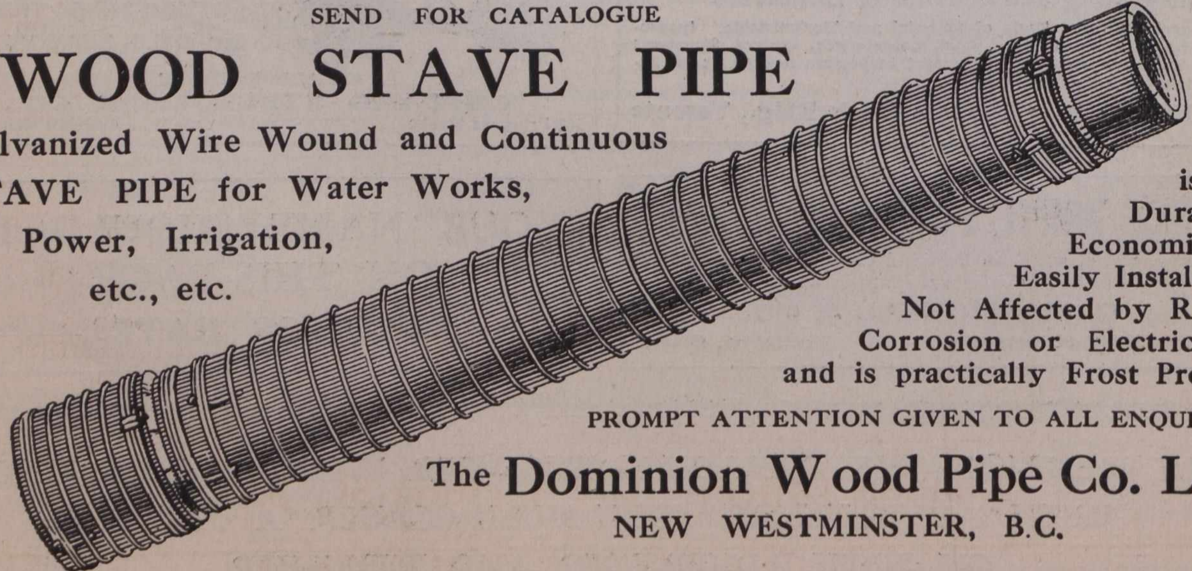

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Volume 20. Toronto, January 26, 1911 Contents of this issue on page 221



# THE CANADIAN ENGINEER

An Engineering Weekly.



## DESIGN AND CONSTRUCTION OF THE DAM AT ST. ANDREW'S RAPIDS, MANITOBA.

A. H. Harkness, B.A.Sc.*

The Red River, after an irregular course of nearly 1,000 miles almost due north, empties into the north end of Lake Winnipeg. This lake, which is of approximately the same area as Lake Ontario, and is nearly 300 miles in length from north to south, has enjoyed quite a commerce between the different ports on its shores and the town of Selkirk, twenty-five miles up the river from its mouth. Winnipeg, which is situated about twenty-five miles further up the river, has been cut off from the advantages of this commerce, due to the fact that, except during periods of high water, the river was navigable only to the town of Selkirk. A rapid fall in the river, known as the St. Andrew's Rapids, about five miles above Selkirk, formed an effective barrier to navigation. The construction of the St. Andrew's dam and lock has overcome this barrier and given the city of Winnipeg water communication with the lake and all the immense natural resources of it and its surrounding country.

The Saskatchewan River, after flowing its course from the Rocky Mountains through what will ultimately become one of the greatest agricultural regions of the world, empties into the north end of Lake Winnipeg. The people of Edmonton and of other towns along its course are at present agitating for the improvement of this river to make it navigable, and the Government has the project now under consideration. The Nelson River, which flows from Lake Winnipeg to Hudson Bay, is one of the largest rivers on the continent, and can be made navigable without great difficulty by the expenditure of a considerable sum of money from the lake to the Bay. The people of Winnipeg and Edmonton look forward to the time when these cities will have direct water communication with each other and with the sea.

The Red River, flowing from south to north, is subject to very severe ice-jams and floods in the spring of the year on account of the ice breaking up on the upper portions of the river while it is still frozen solid to a thickness of from two to three feet on the lower portions. These ice-jams naturally form at places in the river where there is little current, as at such places the ice freezes thickest and is slowest in melting. A stationary dam at the St. Andrew's Rapids would have produced such a condition near the city of Winnipeg, and might have had the effect of subjecting that city to severe floods. It would also have presented a serious obstacle to the free flow of the immense quantities of ice that come down the river with the spring freshets. It was, therefore, decided to use a movable dam, the type adopted being that known as the Camere. This is the first instance of the use of this type in America, though it has been successfully used on the Seine River in France.

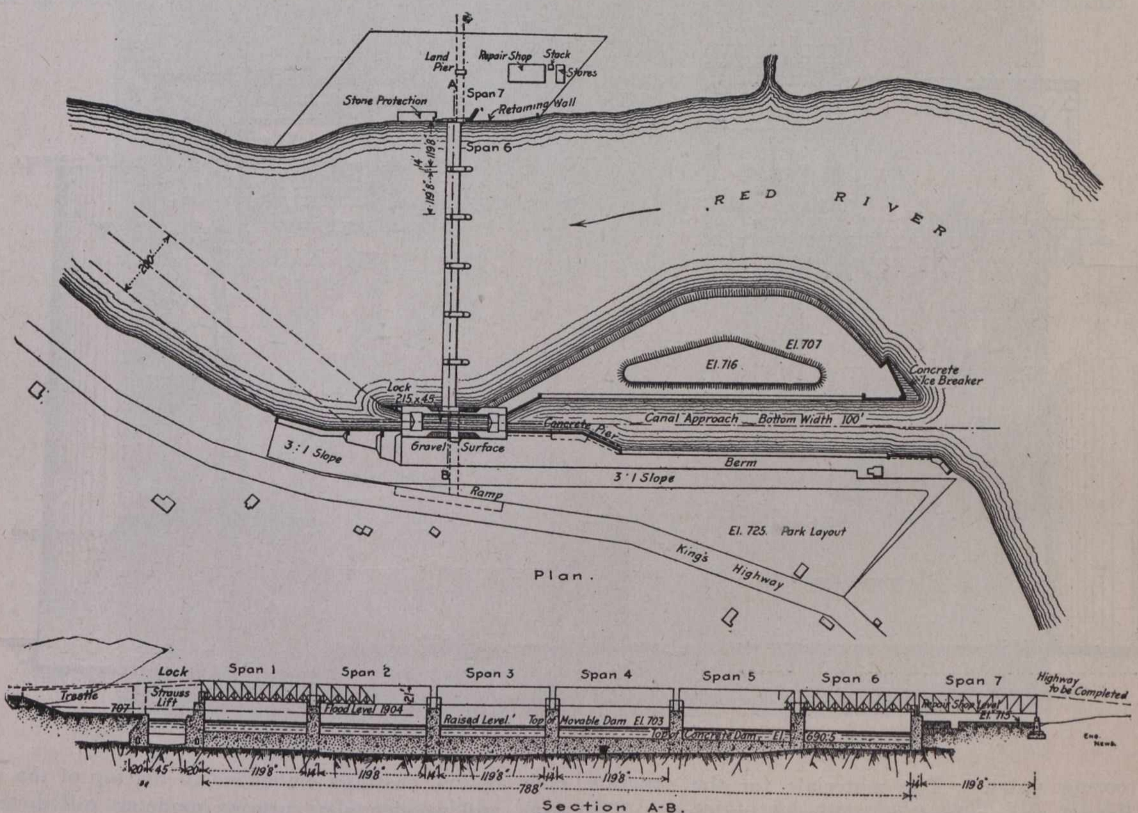



Fig. 1.

Fig. 1 is a general plan of the work as constructed. The canal and lock past the dam are located on the west side of the river. The lock provides for a lift of 17 feet at mean, or 22 feet at extreme low water level, with a minimum depth of 9 feet over the mitre sill. The total fall from the city of Winnipeg to the site of the dam was originally 16 feet. The water gradient with the dam closed is

* Structural Engineer, Confederation Life Building, Toronto, Ont.

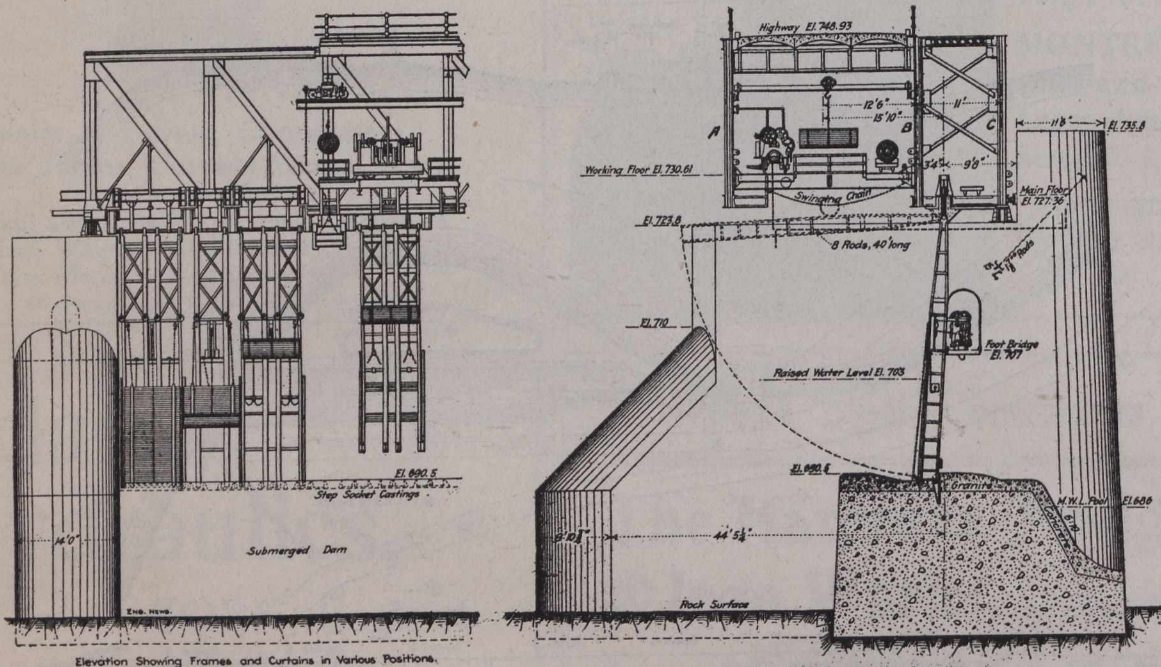
between one and two feet, so that the water level at Winnipeg is raised about three feet. A submerged dam of solid concrete extends from the outer lock wall across the river to the east bank. The crest of this dam is 4 ft. 6 in. above the mean water level (see Fig. 2), and dams the water back permanently to a depth of from six to eight feet. This is sufficient to obliterate the rapids, and makes the river navigable for shallow-draught vessels during any periods in the spring and fall of the year when the movable portion of the dam may not be in operation. The submerged dam is divided into six equal spans of 119 ft. 8 in. each by piers 14 ft. wide, which, together with the shore abutments, carry the superstructure or dam proper. The concrete work was all built on solid rock at a depth of from two to four feet below the rock bottom of the river.

The concrete work of the submerged dam and the piers was constructed in the winter under cover. The site of the dam was unwatered in sections of two spans each. Each section was covered over with a house of boards and tar paper, so built that the walls served as the forms for the concrete dam. By means of a steam boiler and coils of pipes the temperature within the enclosure was kept well above the freezing point. The materials for the concrete after being heated were mixed in a heated building. The concrete was carried out to the work by an overhead cable and deposited through openings in the roof of the enclosure.

The superstructure consists of six truss spans, carrying the curtain frames and curtains of the movable dam, and a seventh, or approach span, used for handling material to and from the trucks for removal to the repair shop. (See Fig. 1.) Each one of the six spans consists of three trusses, which may be called A, B and C (Fig. 2). Each truss is 126 ft. 8 in. in length, centre to centre of end bearings, and 21 ft. centre to centre of chords. Trusses A and B are 25 ft. apart, centre to centre, and carry a highway floor between the top chords and a working floor about 3 ft. 3 in. above the top of the bottom chords. The trusses of the seventh span are in line with trusses A and B. The concrete highway floor is continued over the seventh span, and is carried on I-beam stringers and plate-girder floor beams. The working floor extends into Span 7 for two panel lengths only. Trusses B and C are 11 ft. apart, centre to centre, and carry the main floor at the top of the bottom chord. Both the main and working floors are constructed of never-slip plates, with the rivet heads countersunk in the working floor only. The curtain frames are suspended from the main floor. All the vertical sway bracing is located between trusses B and C, so as to give clear head room over the working floor between trusses A and B (Fig. 2).

The trusses are of the Pratt type, divided into eight panels, with vertical end posts. The panels in trusses A and B are subdivided to provide points for the floor-beam connections of the working floor. The top and bottom chords of the trusses are built up of angles and plates, the main diagonals of channels and plates or channels latticed, and the posts of angles latticed. The sub-diagonals and posts are built of two angles latticed. The shoes are provided with disc bearings and with roller nests at one end of each span. On the down-stream side of truss C horizontal shoes bear against the vertical face of the upper part of the pier to resist the horizontal thrust due to the pressure of the water on the dam.

The movable portion of the dam consists of a series of frames hung from the main floor, resting at their lower ends against castings embedded in the top of the submerged dam, and wooden slat curtains made to roll down and rest against the up-stream side of the frames. The curtain frames are composed of plate-girders, each girder being 2 ft. 3 in. deep and 34 ft. 9 in. long. The girders are assembled into groups of two, forming single and of four forming double curtain frames (Fig. 2). There are six single and seven double frames in each span, making a total of seventy-eight frames in the whole dam. The double frames are assembled so that the outside girders of a frame are 7 ft. 11 in., centre to centre. The frames are hung from the bridge so that the double frames are 7 ft. 11 in. apart, centre to centre of outside girders, with a single frame hanging between. Thus each curtain, which is 7 ft. 7¾ in. long, is supported at the ends by the outside girder of the double frame, and at the two intermediate points by the centre girders of the double frame, or by the single frame. Great care was exercised in the fabrication of these frames in the shop; also in the alignment of them and of the castings against which they rest in the field, to ensure that




Elevation Showing Frames and Curtains in Various Positions.

Section through Dam in Operation.

Fig. 2.

the faces against which the curtains bear should be in one plane.

Each frame is hung by means of a shaft, which passes through the upper ends of the girders. A collar on each end of the shaft rests between two brackets projecting downwards from the main floor. The shaft is carried by clevises attached to hangers, which pass through holes in the main floor. These hangers are carried by two 10-in. channels, back to back, the ends of which rest on step castings bolted to the main floor. Vertical adjustment is provided for by wedges between the seat of the casting and the shoe on the channels.

Each curtain is composed of fifty laths of long leaf Southern pine, and a heavy casting, forming a core, about which the laths roll. This casting is heavy enough to unroll the curtain against the buoyancy of the water. The laths vary in size from 3 5-32 in. thick by 3 1-16 in. wide at the bottom to 1 21-32 in. thick by 3 1-16 in. wide at the top, and are 7 ft. 7¾ in. long. They are linked together with brass links with a clearance of 1-32 in. between laths. The top of the curtain when unrolled in position is 13 ft. 7½ in. above the top of the submerged dam. When the curtain is down in position it is suspended by chains from hooks attached to the frame above (Fig. 2). The space between the end curtain frames and the pier, which varies in the different spans from one to two inches, is sealed by a round pole four inches in diameter.

The curtain is rolled up and down by means of a continuous chain, which passes down behind and up in front of the curtain and over two pulleys, carried in a frame built into the curtain frames. This chain is operated by a travelling electric crane from a footbridge, which is cantilevered out from the curtain frames on the opposite side (Fig. 2). When the curtain is being rolled up, the chain, as it passes over the pulleys on the crane, hangs through an opening in the footbridge floor. When the curtain has been finally rolled up to position the chain is locked by levers at the pulleys in the frame The chain is then removed from the pulleys on the crane and deposited in a chain-box built into the curtain frames. It is necessary, in order that the curtains may roll up properly, to have a slow downward movement of the chain behind the curtain. Otherwise, as the chain is drawn up in front, it gathers the casting and laths up into a bunch instead of a roll.

Openings at the level of the footbridge are left through the piers to give access for the crane from one span to another. Every other pier has a pocket built to one side of the passage into which the crane may be shoved from a turntable for storage when not in use.

The footbridges are hinged so that they may be swung up against and hooked to the curtain frames for winter storage. The curtain frames are lifted to their winter position by cranes operating on a track on the working floor of the bridge. The equipment for this purpose consists of two 20 horse-power 230 volt cranes, with two sets of sprocket wheels and two chains each for lifting the double frames, and two 10 horse-power cranes of similar design with one set of wheels and one chain each for lifting the single frames. Each of the larger cranes has also a two horse-power motor attached to the truck for moving the crane. The smaller cranes may be moved by hand or hitched to the larger one. A short piece of chain, with a forged shoulder and eye on the end (Figs. 2 and 3) is attached to each single curtain frame and two similar chains to each double curtain frame at about one-third the height of the frame. To lift the frames, the chain from the crane is lowered and hooked into the eye on the chain. The frame is then raised by the crane until the shoulder on the chain is above the floor level, when it is engaged by a crotched lever, which holds it up in a nearly horizontal position. The working floor is also equipped with two four-ton, overhead, travelling, hand-power cranes and two of similar type, but designed to lift together, at the same time and speed, two loads situated at a distance of 4 ft. 9⅛ in. at right angles to the bridge of the crane. The first two are for lifting the curtains through the openings in the working floor (Fig. 3)

Fig. 3.

in case it is necessary to remove them to the repair shop for repairs. The second two cranes are used for pulling the chain from the crane over by means of the swinging chain (Fig. 2), so it can be reached from the footbridge. Trucks on a service track on the down-stream side of the working floor are used for carrying the curtains to Span 7, where they may be let down through an opening in the floor to be taken to the repair shop.

The cranes which operate on the footbridge for raising and lowering the curtains are three in number. The equipment of each crane consists of a two horse-power, 220 volt motor and controller. They may also be operated by hand, and are so operated for the control of the water during the summer. Power is brought to these cranes by a conduit under the main floor with leads down the back of the curtain frames to sockets within reach of the footbridge. Each crane is fitted with a 25-foot flexible chord.

The repair shop and power-house is a brick building situated a short distance to one side of Span 7. Access is had to it from the dam by means of a track which runs under the floor opening in Span 7. It is equipped with an engine and generators for supplying the necessary electricity for lighting the locks and operating the bridge, and with machinery for making any repairs that may be required about the dam.

There were no engineering difficulties in the erection of the steel work for the dam. The material was delivered to the site on the east side of the river by means of a siding about two miles long from the main line of the C.P.R. between Winnipeg and East Selkirk. It was unloaded by a derrick car and stored in convenient places in the yard.

The top of the submerged dam made an excellent foundation for the falsework. The falsework was put together in bents on shore and taken out and set in place by a scow fitted with a hoisting engine and derrick. Two spans only of falsework were framed up, the same falsework being used in alternate spans. Levels were taken on the falsework soon as erected, and cambre blocks were made of the correct thickness to give the trusses the necessary cambre. The bottom chords were then laid on these blocks. It was seldom necessary to make any adjustment for the cambre after the erection of the trusses, on account of the settlement of the falsework.

As the width of the top of the submerged dam was not sufficient to admit of the falsework extending out to the position of Truss A, this truss was erected within about four feet of Truss B, and, after being riveted up, was jacked out to position. The nature of the falsework and the position in which Truss A was erected are shown in Fig. 4.

The bridge was erected by means of a travelling derrick from the top of Trusses B and C (Fig. 4). To erect the first half of Span 6 the derrick was set up on falsework parallel to Span 7. The material was carried out for erection on a service track laid on the main floor between Trusses B and C.

The bottom chords of the trusses were spliced at the second joint from the end, making two short end sections and one long centre section for each truss, while the top chords were spliced at the centre. It was, therefore, necessary to lay the long centre section of the bottom chord before the first half of each span could be erected so the derrick could move forward from the previous span. As the derrick could not handle this chord at half the length of the span, a gantry was used for lifting the outer end, while the inner end was handled by the derrick. Soon as this section of the bottom chord was in place the remainder of the first half of the span was assembled, after which the derrick moved forward and erected the second half. Riveting followed the assembling as closely as possible so as to free the falsework for the next alternate span.

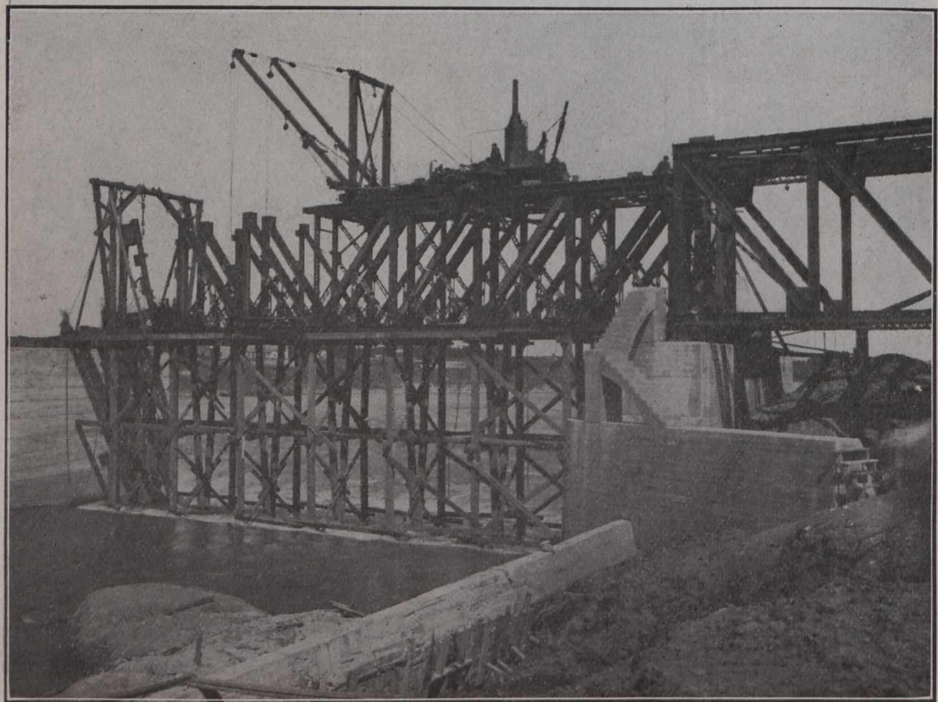


Fig. 4.

The curtain frames were erected from the same scow, with the derrick removed and replaced by a gantry, that was used for placing the falsework. The frames were skidded down to the scow from the yard on rails. The scow hauled itself out to position with its hoisting engine by means of cables to each shore. The frames were lifted by blocks made fast to the bridge above and to rings in the frames. The double frames weighed about nine tons each and the single ones about five tons. After a little experience the gang of men on the scow was able to put up seven or eight frames a day.

After the curtain frames had been erected and brought to their proper level by means of the wedges on the castings, the hinges for the footbridge were bolted on and carefully adjusted to their correct position. The holes which had been sub-punched in the frames were then reamed out to full size and the hinges riveted on. The footbridges were then lowered from the main floor through Truss C and the hinge-pins put in. They were then levelled up by means of shims, after which the rails were laid and bolted in place.

The cranes and electrical equipment had not yet been installed when it was necessary to haul the frames up for the winter. The hoisting engine was taken off the scow and put on skids on the track for the crane. The frames were then hauled up and hooked into position. Fig. 5 shows the bridge with the frames up.

roll down over this. The brush could then be cut off on each side of the girder, the curtain rolled up to allow the short pieces against the girder to escape, and then rolled down to position.

When the curtains were first put down there was a large amount of leakage through them between the laths, but after a few days the swelling of the wood and the deposit of silt against them made them almost watertight. The pole seal next the concrete piers worked well also. The deposit of silt and dirt against the curtains was not sufficient to prevent their rolling up freely last fall.

The bridge and dam were designed by H. E. Vautlet, C.E., and the lock and concrete work by A. R. Dufresne, District Engineer, of Manitoba, and E. A. Forward, who was Resident Engineer on the work.

The excavation and concrete work was done by Messrs. Quinlan & Robertson, general contractors, Montreal. The steel work and machinery for the dam was fabricated and erected by the Canada Foundry Company, Toronto.

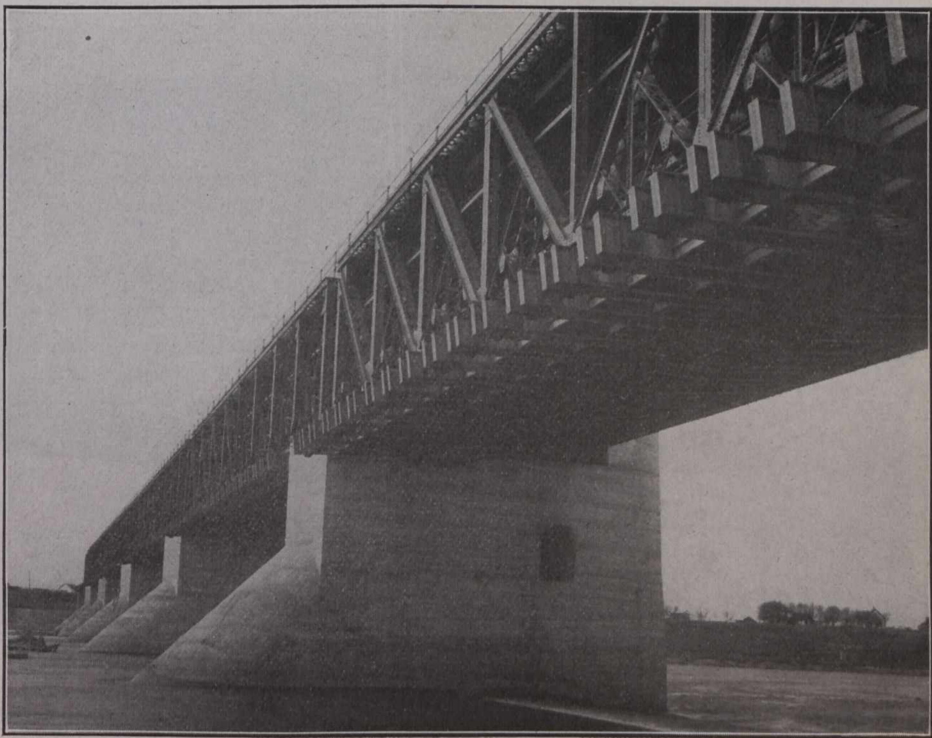


Fig. 5.

In operation no water is supposed to flow over the top of the curtains, the curtains being rolled up from the bottom just sufficient to discharge the flow of water. It has been found easy in practice to regulate the flow of the water very closely. The operation of raising and lowering the curtains for this purpose is done by hand-power, with the cranes on the footbridge.

The dam and locks have been in successful operation now for one summer. Some difficulty was experienced at first when the frames were put down in the spring on account of the large amount of drift that lodged against them and interfered with the curtains going down. A boom built across the river at an angle of about 45° removed the difficulty to a great extent by deflecting the drift to the shore, where it was removed. A certain amount of submerged drift, consisting chiefly of small, green boughs of trees, continued to lodge against the frames, but the curtains would

## NATURAL GAS TRAIN LIGHTING.

The Pintsch gas lighting system, now in use on the trains of the Canadian Pacific Railway, will, in future, be supplanted in the western division by the use of natural gas, the company having decided to ship natural gas from Medicine Hat to Calgary, using two transport cars that have been specially built for the purpose. The cars are of the flat type, equipped with stationary frames, into which are fitted horizontal steel cylinders or flasks, fifteen feet long and eight inches wide, which are capable of sustaining a pressure of 1,700 pounds to the square inch. Natural gas has been used for illuminating purposes with satisfactory results for the past year on trains running out of Medicine Hat, and with the storage problem solved, other divisions will be furnished with this illuminant, its light being superior to that of coal oil or manufactured gases.

## WINNIPEG APARTMENT HOUSES.

By H. C. Baker, Jr., Assoc. M. Can. Soc. C.E.

(Continued From Last Issue).

### Structural Features

In general, all apartment "blocks" in Winnipeg are so constructed that the exterior walls and some of the interior walls are bearing walls; i.e., besides carrying their own weight, they carry also the floor and roof loads. Floor-loading is usually 100 to 120 pounds per square foot at the first floor and 60 to 80 pounds per square foot at the other floors. Snow-loading on the roof is usually 20 to 30 pounds per square foot.

So far, no "block" yet erected is of steel frame or cage construction, having a complete framework of riveted steel members supporting the walls, floors and roof.

Two or three "blocks," such as the "Casa Loma," for instance, have steel floor framing of girders and beams supported by cast-iron columns. All connections are bolted. The floors are carried on wooden joists resting on furring strips or ledger beams, which are attached to the steel beams. A typical floor framing plan of such a building is shown below. In this particular case, as before stated, the walls and framing have been so designed that additional storeys may be added whenever the growth of the city makes it necessary. In the larger fireproof buildings the floors, beams, joists, girders and columns are of reinforced concrete throughout. The reinforcing steel consists of plain bars, twisted bars, expanded metal, Kahn bars, etc. In these fireproof buildings the stairways are of ornamental iron. The best of all floors for an apartment house is undoubtedly of reinforced concrete, in which wooden sleepers or nailing strips are laid. A layer of cinder concrete is placed over the reinforced concrete and levelled off even with the tops of the sleepers. The finished floor is of matched maple or oak nailed to the sleepers. This type of floor is fireproof, practically noiseless, and permits of the convenient laying of pipes and electrical conduits in the cinder concrete between the sleepers. It is advisable to have a gallery of some kind in conjunction with each suite in a climate where the summer season is as hot as it is in Western Canada.

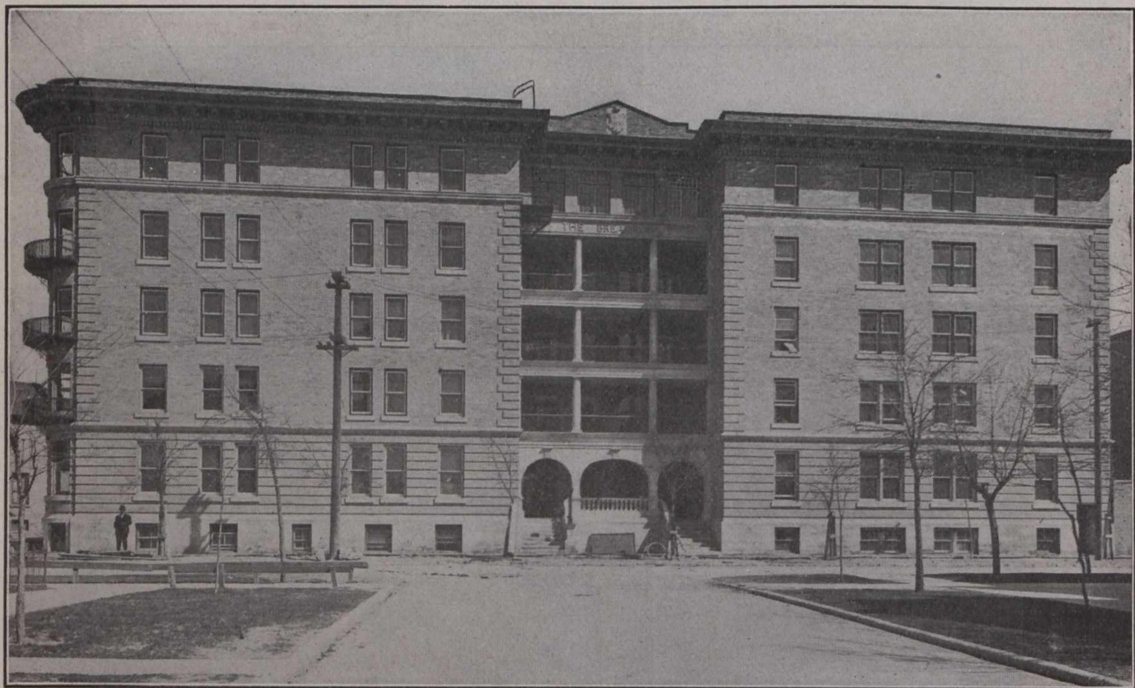
The illustrations of the "Roslyn" and "Warwick" show methods of arranging balconies.

In every modern city the design of any building, as far as the structural elements are concerned, is governed to a great extent by the building regulations or by-laws. The following extracts from the Winnipeg regulations are of interest:—

Columns.—Columns carrying iron or steel beams, which in their turn support exterior beams, must be of cast-iron, wrought-iron or rolled steel. No cross-section of any rolled column will be less than ¼ in. thick, and the greatest length must not exceed forty times the diameter or least lateral dimension. The "length" means unsupported storey height, not actual length of member. Cast-iron columns must not be less than 5 in., external diameter; metal, not less than ¾ in. thick; length not to exceed twenty times diameter; flanges, lugs, brackets, etc., not less than 1 in. thick; columns not cast with open side or back must be drilled with ⅜-in. hole in shaft or barrel by the manufacturer, so that the thickness of metal can be tested. Pipe columns must not exceed in length thirty times the diameter. All steel or iron columns must be painted with at least one coat after erection.

Girders, Beams, Joists, etc.—Wall girders, spandrel beams and other wall members must have at least 9 in. of brickwork or other fireproofing on the outside and 4 in. on the inside, except at the flanges, which may project to within two inches of the outside of brickwork.

Steel, cast-iron, or stone bearing-plates must be placed under the ends of all beams or girders resting on walls. The ends of all steel beams resting on walls shall have anchors consisting of a piece of 4 x 4-in. angle riveted to web of beam. Wooden floor beams running parallel to walls must be anchored to the walls once in every ten feet at the cross bridging, or with anchors of sufficient length to span



THE BREADALNANE.

Corner of Hargrove and Cumberland Streets. West Elevation Showing Main Entrance.

at least three joists, so that all walls shall be anchored at least every ten feet all around the building."

The usual thickness of walls for apartment houses is as shown below:—

| | Storeys. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Base-ment. | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. |
| Basement Laid... | 12 | 8 | .. | .. | .. | .. | .. |
| Two-storey ..... | 12 | 12 | 8 | .. | .. | .. | .. |
| Three-storey .... | 16 | 12 | 12 | 8 | .. | .. | .. |
| Four-storey ..... | 20 | 16 | 16 | 12 | 12 | .. | .. |
| Five-storey ...... | 20 | 16 | 16 | 16 | 12 | 12 | .. |
| Six-storey ....... | 20 | 20 | 16 | 16 | 16 | 12 | 12 |

The proper thickness of walls for buildings in any locality depends, of course, on the quality of the material used

The designing of an apartment house as regards the structural features is not difficult. Given the bearing power of the soil at the site, the building regulations, the size of building and the kind of materials, one floor and roof besides the columns need only be worked out, since all intermediate floors are usually similar in arrangement. Head work is called for only in designing the exterior in an architectural sense, arranging the suites and rooms to best advantage and providing for conveniences and labor-saving devices. One of the most important of all features in modern apartment house construction is the economical arrangement of back entrances, where all deliveries are made.

### Architectural Features.

In this city all the usual "orders" known to the ancients and many others invented by later generations are to be found. In one sense Winnipeg is only about eight or nine years old; that is to say, it is only during the past eight or nine years that modern buildings have been erected. The oldest "modern" apartment block was erected only three years ago. The increase in population has been so rapid and the number of buildings erected each year so large that all attention has been given to the existing requirements of the people rather than to an attempt to erect buildings which would be notable in an architectural sense. Many "blocks" are obviously utilitarian in exterior treatment, extreme in their simple, cube-like design, entirely without ornamentation.

The treatment of the entrance in the central court of the "Devon" is excellent and very pleasing. The exteriors of the "Roslyn," "Breadalbane" and "Warwick" present architectural features of no mean conception, and are as pleasing as any other buildings of similar type to be found in Canada. The "Breadalbane" strikes a pleasing medium, not too plain, and with no waste of material in an effort to decorate the exterior on either street. Some of the smaller "blocks," such as "Broadway Court," illustrated here, are carefully designed, in keeping with their importance and surroundings.

It is hardly to be expected that in a growing Western city, such as Winnipeg is to-day, architectural "gems" will be found. That stage of development has not yet been reached, though we are fast approaching it.

In apartment house construction in Winnipeg, as well as in many other cities, the main idea is to erect a building which will conform to the regulations, contain the largest number of suites in the least possible space and produce the greatest revenue from the least expenditure. If, after such a building has been planned and the probable ultimate cost known, there should be any money to spare, it will be expended in architectural features and interior decoration.

**THE WARWICK.**

**On Qu'Appelle corner of Carlton—opposite Central Park—north elevation showing main entrance and roof garden.**

### Building Materials.

Footings, foundation and basement walls, when not of concrete, are usually constructed of rubble masonry laid up in mortar in the usual manner. The stone used is a species of limestone, light yellow in color, brought in by rail from Stoney Mountain, about 14 miles north of Winnipeg. This material sells for $7.50 per chord on the cars at Winnipeg.

Dimension stone, such as used in belt courses, jambs, lintels, sills, quoins, cornices, etc., is brought in from the Tyndall quarries at Tyndall, Man., and sells for 80 cents to $1 per cubic foot when dressed on two faces. In some of the larger buildings the dimension stone used is imported from the United States, Eastern Canada or Europe. Artificial stone is also used to a small extent. Ordinary local brick is straw-colored, made in Balmoral or St. Boniface, both places being close to Winnipeg, and can be purchased for $11 per 1,000, delivered. The face brick most used is imported from St. Louis, Miss. There are several grades and colors. This brick sells for from $38 to $45 per 1,000 on cars at Winnipeg, duty paid. The item of customs duty on such brick coming in from the United States is considerable, being 35 per cent. on the selling price at the point of manufacture.

In the usual make-up of an apartment "block" as regards the walls, the fronts., i.e., the walls erected on streets, are faced with imported brick, backed with local brick, and ornamented with cut stone at the usual points. Interior walls, rear walls and side walls not facing streets are of local brick.

Timber for framing, stairs, etc., is yellow pine or British Columbia fir, all imported. Interior trim, doors, windows, etc., is of birch, oak or pine. Flooring is of oak or maple. The only local timber available is poplar and tamarac, which is not used to any extent in building construction except for frame residences.

### Interior Decoration.

There is not much variety to be found in the interior decoration of any of the apartments as yet. Fireplaces and hearths placed in living rooms are of hard, colored brick, with hardwood mantles. In each room the usual baseboard and picture moulding will be found. In practically all dining-rooms the walls are wainscotted with burlap of various colors, panelled with wooden strips to the plate-shelf or rail. Walls are kalsomined or papered. Doors and window casings are painted, stained or varnished. The hardware is usually good, and the plumbing, heating and electric features plain and serviceable. In some of the newer "blocks" the dining-rooms have ceilings ornamented with false beams of wood, and the wainscottings are also of wood, panelled. The lighting in some of the newest suites is done by means of inverted reflectors on the indirect plan, the light being diffused from the ceiling and walls.

### Heating and Plumbing.

Steam heat in apartment houses here is universal, and is usually of the "direct" type, having a one-pipe circuit system of piping. Various types of boilers are used, from the ordinary tubular boiler to the most up-to-date style of sectional, cast-iron boiler. The radiators are of the usual cast-iron, upright type, and the allowance of radiating surface per cubic foot of space in each room is about two square feet.

One of the principal advantages of direct steam heating for apartments is the ease with which all rooms can be heated alike, regardless of their location or the outside temperature. Compared with hot water heating, sometimes used, there is no danger from damage by freezing of water in the radiators when closed, as might happen in vacant suites in very cold weather in the case of hot water heating. At the same time, with steam heating, the size of the radiators must be such that the rooms may be warmed in the coldest weather, and, unless expensive automatic regulators are installed, there is no satisfactory way of reducing the amount of heat in mild weather except by shutting off the supply of steam or by opening the windows. This is overcome to a certain extent in the large rooms by having two or more radiators of different sizes, so that one or more need only be used at one time.

Fuel used is coal and wood. The coal is bituminous, and is brought in from several different points in Western Canada and the Western States. Average cost per ton is $6 to $11, delivered. Tamarac wood, sold at $5 to $7 per cord, is also largely used for heating. The average cost of a heating plant, complete, such as is commonly installed in Winnipeg is about 1½ to 2 cents per cubic foot in the larger buildings.

### Ventilation.

For six months of the year, during spring, summer and early fall, people live out of doors as much as possible, and when indoors most of the windows are open, so that the problem of ventilation for half the year is not a difficult one. In winter, however, with double windows and steam heat, ventilation is necessary. Mechanical ventilating plants, consisting of the usual motor-driven blowers, with air-ducts, etc., have been installed in one or two of the larger buildings. A movable slide in the outside, or storm windows, is all that is provided in most of the apartment houses as yet, however.

Where there are shafts specially constructed for the purpose of ventilating and lighting bathrooms and pantries, it is stated in the building regulations that "such shaft shall under no circumstances be roofed or covered over at the top with a roof or skylight, and every such shaft shall be provided at the bottom with an intake or duct, open to the outer air, of a size at least one-twentieth of the area of such shaft, in order to create a free circulation of air.

### Insurance.

The cost of fire insurance covering an apartment building is a very considerable item of expense. The following will show in a general way the comparative costs of fire insurance on "blocks" of different types at the rates obtaining in Winnipeg to-day:—

A two-storey frame structure of not more than 30 feet by 60 feet area of ordinary construction throughout would take the highest rate, say, 100 per cent. rate for the purpose of comparison. This same type of building, but of twice the floor area, divided in halves by a brick fire-wall, would have the same rate.

A three-storey building with brick side walls, wooden floors, roof, partition framing, stairs, etc., having an area of not more than 2,000 square feet on any floor, would have a 75 per cent. rate, showing a reduction of 25 per cent. on account of the brick exterior walls. This same type of building, but of double the floor area, divided by a suitable fire-wall, would have the same rate. In this same building, if the floor joists are carried on steel beams, supported by cast-iron columns and by the exterior walls, no fireproofing material being used to cover the metal, the 100 per cent. rate would apply.

In the case of a three-storey building of "fireproof" construction, having brick side walls, reinforced concrete floors, floor framing and columns, non-bearing partitions of plaster or metal lath or of hollow tile construction, the percentage of rate will be 71 per cent. If an elevator is placed in this type of building the rate would be increased 14 per cent.

In a building constructed with brick exterior walls, reinforced concrete floor slabs carried on steel framing, supported by the walls and by cast-iron or steel columns, unprotected by fireproof material, the rate will be 75 per cent.

In general, the rate for the buildings above described is at present 1 per cent. per $100 of insurance per year, or 2 per cent. per $100 for three years. The percentages given above, therefore, represent cents per $100 of insurance per year.

Insurance will be written up to the full value of the buildings, providing the surrounding structures do not present an extraordinary hazard and are far enough away to be without the proscribed limit.

### Fire Protection.

As all apartment houses in Winnipeg, with perhaps a half dozen exceptions, are constructed of combustible materials, it is interesting to note what precautions have been taken to protect the buildings themselves, the contents and the occupants in case of fire. The building regulations provide for certain features in design and construction which, if properly carried out, would not only prevent fires to a great extent, but would also make it easier to handle a fire should it once start. A building should be protected from fire from the outside by favorable location, and fire-walls and doors should be so placed that any interior section which might be on fire can be quickly isolated from other sections, thus confining a fire to one small part of the building. There should be plenty of space around the building, so that the fire-fighters can get at all sides without encumbrance. Inside a building the public halls and stairways should be wide, and kept clear at all times. One or more standpipes should be provided with hose-valves at each floor and at the roof. Hand grenades and other forms of chemical extinguishers should be located in a convenient place in each suite and their use explained to the tenants. Unless there are two stairways, front and rear, one stairway outside the building and one inside, available from each suite, iron fire-escapes should be provided, with a balcony at each floor. These metal fire-escapes can be made as ornamental as required.

The following extracts from the recent city building regulations, before referred to, covering fire protection are of interest:—

"Every tenement house hereafter erected shall have in the roof a fireproof bulkhead or scuttle, or the same may be covered with fireproofing materials. There shall be stairs or a fixed ladder leading thereto, and no scuttle or bulkhead door shall be locked, but may be fastened on the inside with movable bolts or hooks. Such door or roof-opening must not be less than two feet by three feet.

"At the rear of every lot containing a new tenement house, unless the rear of such lot abuts upon a public lane, there shall be a yard, open and unobstructed from the earth to the sky.

"Every part of such yard shall be directly accessible from every other part thereof.

"In every tenement house in which a steam heating system is used the boiler shall be enclosed on all sides by walls of fireproof material so as to form a boiler-room. The doors of such room, as also the floor and ceiling, shall be fireproof.

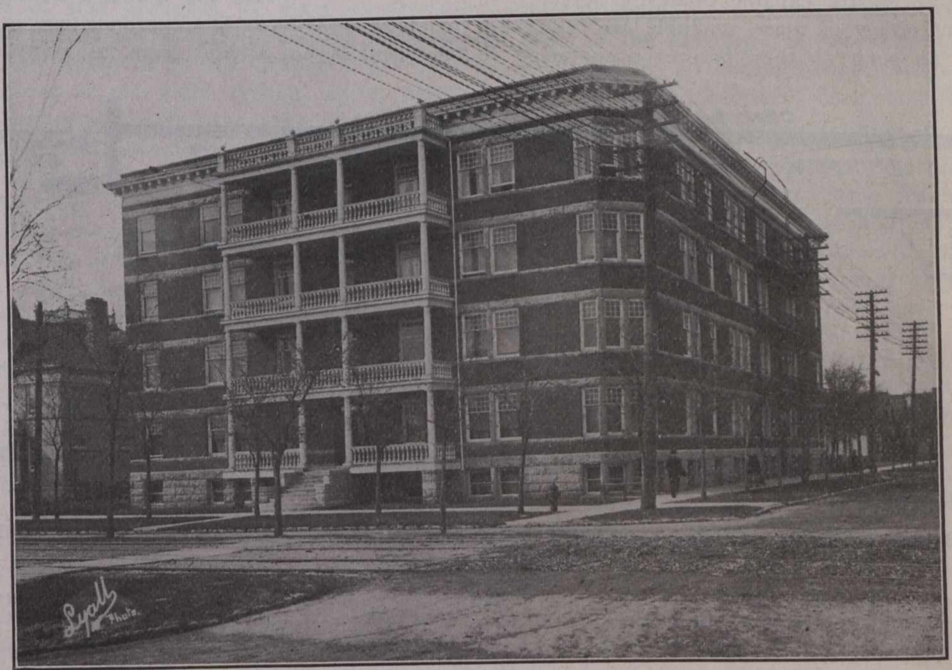
"No apartment building of non-fireproof construction shall have an area exceeding two thousand square feet on any floor, unless divided by interior division walls of fireproof construction extending from the basement floor to the roof.

"There shall be one flight of stairs, at least three feet wide in the clear, extending from the entrance floor to the top floor, for every 2,000 square feet of floor area above the entrance storey.

"Where wood flooring is used in a fireproof tenement house, the space immediately under such wood flooring and between the wood nailing-strips shall be filled with cement concrete or some other approved incombustible material.

"In all non-fireproof tenement houses all hall partitions shall rest directly over each other, and shall extend through the wooden floor beams and rest on the plates of the partition below, and the studding between the uprights to the depth of the floor beams shall be filled in solid with approved incombustible materials.

"In all walls where wooden furring is used, all the courses of brick from the underside of the floor beams to the top of the same shall project a distance of at least two inches beyond the inside face of the wall, so as to provide an effective fire-stop, and wherever floor beams run parallel to the wall and wooden furring is used, such beams shall always be kept at least two and one-half inches away from the inside line of the wall, and the space between the beams and the walls shall be built up solidly with brickwork from



**BROADWAY COURT.**

**Corner of Garry Street and Broadway, showing south and east elevations.**

the underside of the floor to the top of the same, so as to form an effective fire-stop."

The regulations applicable to fire prevention are quite as important as those governing structural features, and are rigidly enforced.

### From the Tenant's Standpoint.

In the whole winter season the apartment dweller has everything in his favor. Compare the apartment with a detached residence of average size, heated by a hot-air furnace, the usual method. From eight to ten tons of coal will be required, besides the fuel—coal, wood or gas—used in the kitchen for cooking. Coal costs about $11 per ton. If the tenant does not want to attend to the furnace himself, it will cost him $4 or $5 per month to hire some one to look after it for him. The heating alone will cost about $100 each winter. This amount is saved to anyone living in a suite, to say nothing of the saving of time. Excepting a well-appointed hotel, no place of abode is more comfortable in winter than a first-class Winnipeg apartment of the fire-proof type. There is no dust from the handling of fuel, no noise, no trouble with the furnace or from frozen pipes. Everything is attended to by the owners of the "block" without extra charge.

It is not easy to secure capable domestic servants in Winnipeg at present. Most of those available are foreigners without training. As soon as they become accustomed to the country they graduate to the department stores and factories, or they get married. This class of labor is paid from $18 to $25 per month, and, allowing an additional outlay of $12 to $15 per month for food, sickness, etc., the cost of any kind of service is at least $30 per month.

The apartments so far constructed in Winnipeg are not intended for large families, or for families in which there are several young children. They are designed for occupancy by from two to five adults. In most of the suites there is only one bedroom. A few have two, and a very small number have three bedrooms. The work in a suite is reduced to a minimum by the compact arrangement of the rooms and the conveniences usually installed. It is the exception to find permanent domestic help employed, though it is often necessary to have temporary help.

It is interesting to note in this connection that the construction of so many apartment houses in Winnipeg has given employment at good wages to a considerable number of skilled workers. These people work by the hour in the different suites, and are available at all times for all kinds of work. This is a great improvement on the incapable permanent help and costs less.

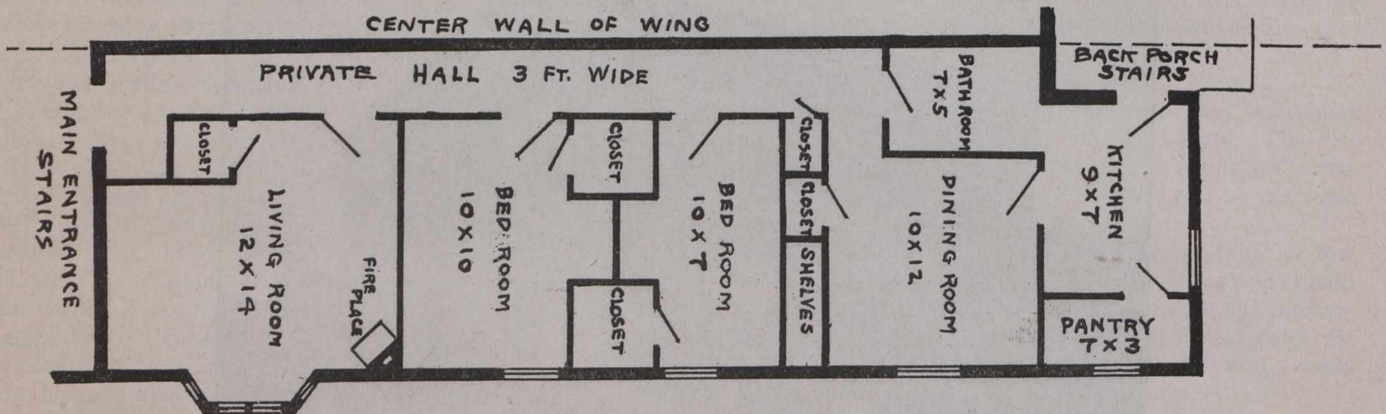
The cost of living in a Winnipeg apartment for two persons, where no servant is employed, is about $100 per month. This figure is based on the following expenditures: Rent, $55; food, $30; light, $2.50; gas (cooking), $2.50; ice, $1 ($12 for season); miscellaneous, including help, tips, etc., $5. These figures represent the actual average expenditure of five families. Each additional member of the family up to a total of four will cost about $120 per year each extra. Comparing these costs now with the cost of living in an ordinary residence, it will be found that, to secure a suitable house in the same residential district as the apartment block, the rent will be at least $45 per month. The heating is at least $100 for the winter. In a house domestic help is indispensable, costing $30 per month, as before explained, for one servant only. Assuming that the items of food, light, fuel (cooking), miscellaneous, etc., are the same as for the apartment, the monthly expense is found to be about $90, not including repairs, water, and incidental labor.

Many families dodge the heating problem and reduce expenses somewhat by living in apartments in winter and in houses in summer. It is usually easy to sublet a suite on short notice on account of the large transient population.

### From the Owner's Standpoint.

The apartment block proposition in this city as an investment is not a gold mine, as many of the tenants seem to think. To get down to figures, the cost of four of the largest "blocks" of the fireproof type, complete, ready for occupancy, would be about $1,000,000 to-day, including land, or approximately 32 cents per cubic foot of structure. In the four largest "blocks" there are two hundred suites, which, if all rented, would bring in a yearly revenue of $140,000—14 per cent. on the investment. The average yearly cost of operating one of the larger "blocks" is from $7,000 to $8,000, including janitor, helpers, fuel, light, repairs, insurance, taxes, water, miscellaneous. About 3 per cent. of the rental is lost every year through vacant suites. The net revenue under most favorable conditions is, therefore, not more than 7 or 8 per cent.—nothing to get excited over or to cause a stampede to Winnipeg.

Investment in a fireproof building, suitably located, having fifty or sixty suites well laid out, is a good, safe proposition, and will compare favorably with other similar classes of realty investments. The owner has to consider the usual business hazards, such as loss by fire from internal or external causes, depreciation caused by erection of industrial buildings on adjacent property, possible changes in neighborhood conditions common to every growing city.




**Sketch showing typical floor plan of five-room suite with private hallway. Solid fire wall dividing wing of building is shown.**

No apartment can be rented in Winnipeg for less than one year. The owner is protected to this extent against the moving tenant. Rules and regulations governing the actions of tenants are sometimes posted by the owners on every floor.

In the usual form of lease of an apartment the following clause will be found:—

"That the Lessee will take good care of the said premises, and keep same in a clean and healthy condition; that he will at all times during the said term keep clean and in good and perfect order and condition all furnishings, fittings and fixtures in said building, and will leave the gas range and the laundry stove and tubs, after each use thereof, clean and free from all rust and dirt; and will not remove or interfere with the storm windows or doors, or screen doors or window screens, but same shall be put on and removed by the Lessors at such times as they shall deem best; that he will replace with as good quality and size, and make good at his own expense, any glass broken on said premises during the continuance of this Lease (said glass now being whole); that he will not make any changes or alterations of the premises, or paper walls, or erect partitions without the consent in writing of the Lessors, and will not drive nails, tacks, screws, hooks or pins in any woodwork, floors or walls of said premises, or mark or deface the same, and will not put up any shades, blinds, or awnings except those provided or approved by the Lessors; and will make all repairs required to the walls, ceiling, paint, plastering, plumbing work, pipes and fixtures belonging to said apartments; that he will not permit anything to be thrown out of the windows or down the courts or light shafts, or hung from any part of the porches or the outside of the windows, or placed on the outside window sill of any window in the building; and will tie up in paper parcels all dry refuse and garbage, and deposit the same in chutes provided for that purpose, and will not deposit any liquids in same, and will place in the hall at the entrance door to said suite a sufficiently large and water-tight receptacle to receive the delivery of ice, milk, vegetables, etc., and will not permit any water or other liquid from any source whatever to lie upon the floors; that he will not use the halls, stairways or porches for the storage of furniture or other articles; that he will not drag or permit others to drag any trunk, box or other article up or down any of the steps or stairs, or along or over the floors of the said suite or premises; and will not waste or permit to be wasted from running taps or otherwise any water on said premises, and will only use clear water and a soft cloth for cleaning all hardwood floors and woodwork, and will not use any scrub or other brush, or any soda, ammonia, or other article or ingredient in cleaning the said hardwood floors or woodwork in said suite; that he will not keep or allow to be kept in or about said apartments any parrot, dog or other animal; that he will not keep or use on the said premises any naptha, gunpowder, fireworks, or any other like product, or spirit gas, or any burning fluid, or chemical oils; that said premises shall not be used as a "boarding" or "lodging" house, or for a school, or to give instructions in music or singing, and none of the rooms shall be offered for lease by placing notices on any door, window or wall of the building, or by advertising same, directly or indirectly, in any newspaper or otherwise; that there shall be no lounging, sitting upon or tarrying in or upon the front steps, the sidewalks, railings, stairways, halls, landing or other public places of the said building by the said Lessee; that no provisions, milk, ice, marketing, groceries, or like merchandise shall be taken into the demised premises through the front door of said building; that the Lessee will not interfere with the furnace, heating apparatus, or with the gas or other lights of the building, and will pay for all damage which may arise or be caused to or in the said suite, or in or to any of the adjoining suites through the using or misusing of the same."

These rules are, of course, necessary and for the benefit of all. They are not always carried out literally in practice, but there is not much variation from them.

### Conclusion.

The construction of apartment houses has just commenced. The future possibilities are enormous. The few apparent errors in location and lack of judgment in the layout of some of the suites will only serve to teach what to avoid hereafter. The finest of the new "blocks" to-day will, in ten years' time, be on the back number list. Even now there are buildings projected which will contain more than 100 suites—twice as many as any existing "block." Each new "block," to be successful, must have "features" —the more the better. All the known conveniences and a few newly invented ones should be in evidence. It is also imperative that the building itself be well located. Location is not everything, but it is next in importance to that prime essential in apartment house construction, the ability of the architect to work out a design which will result in giving the most of the best for the lowest rent. This appeals to the pocket of the apartment bargain hunter in just the same way as any other "bargain" does, and the suites are consequently never vacant.

Privacy is much desired by the people who are looking for the higher-priced suites. Some tenants even object to sharing a back stairway with a neighbor.

The curious results which obtain in some of the eastern American cities, due to the enormous development in apartment house construction, fortunately are not yet noticeable in Winnipeg. For instance, in New York and Boston certain "blocks" are popular with, and are occupied almost entirely by newly married couples. Some "blocks" are tenanted by elderly people, who love a quiet, simple life. Certain other "blocks" would strike the casual observer as being intended only for children. Some "blocks" are filled with musical people, professional and otherwise—not necessarily with music, however, and so on. We will reach that stage of development here before long without doubt.

Much could be written about the effect on the tenant of a long life in an apartment. The tendency to subdue individuality and to stifle the desire for an active life is ever present nowadays, even in Western Canada. The day of the rugged pioneer is about over, as far as North America is concerned. It would seem to be a fact that in all of our cities, in certain classes of society, all members do the same things in the same way, wear similar clothes, eat the same kind of food, have the same ideas, talk about the same things. Know one and you know them all. Visit one such family, and visits to others will be but a repetition. It is safe to say that this unusual development in apartment house construction, while necessary and desirable from an economic standpoint, will only increase the tendency to make one man just like his neighbor. Every day in this city there are 1,300 kitchens in operation in apartment blocks turning out meals of practically the same kind for 5,000 people—15,000 meals. It may be said that there is one ton of food wasted every day, to say nothing of labor and fuel. The value of this waste in one year is easily $25,000. Why not go one step farther and have community kitchens and dining-rooms, one for every 500 people or so, and raise pork on the waste?

## SANITATION OF VILLAGES AND PREMISES WITHOUT SEWERS.*

**John W. Hill, C.E., Member State Board of Health, Cincinnati.**

This subject has been well treated by my honorable predecessor, Dr. Byron Stanton, under the title "Rural Sanitation" at the meeting of the village health officers for the southern half of the State of Cincinnati, last October. But it is by no means an exhaustible subject, and it will be a pleasure if I can add anything to the timely and interesting suggestions offered by Dr. Stanton.

To give the paper a definite purpose and scope, it may be well to call it a discussion of the "disposal of village wastes," including domestic sewage and garbage, and assume that it applies to localities and premises unprovided with sewerage or modern methods for garbage and wastes disposal.

The wastes of a village community, or indeed of any small community or household may be grouped under three heads:—

**1—Domestic Sewage:—**

Including sink water, laundry water, hopper flushings and flushings from baths and wash bowls, where no plumbing exists, as often is the case where no public system of water supply has been installed; the wastes from hoppers, bath tubs and bowls will not occur, although the equivalent will be found in some other form.

**2—Domestic Garbage:—**

Including all kitchen wastes from the preparation and incomplete use of victuals.

**3—Rubbish:—**

Including all non-usable materials which accumulate about suburban premises.

In cities, the household wastes are easily disposed of through the sewers, or by depositing the kitchen refuse in the garbage can, which is daily or at frequent intervals removed to the dumps or to the reduction works. But in few villages and fewer farmsteads are found sewers of any kind, and in the small communities, as a rule, no organized methods of sewage and garbage disposal exist, and it is to individual effort that we must look for the sanitary disposal of household wastes.

In the large municipality, the city government must provide for disposal of household wastes, because the individual householder seldom has the facilities for proper disposal on his premises, and organized effort is absolutely necessary for the proper disposal of the domestic wastes. Wash and hopper water is run to the nearest sewer, and all other wastes are collected in boxes or cans and removed from time to time.

In some villages, the ashes and garbage are regularly collected and removed to a village dump. In this manner keeping the premises clean, but transferring the nuisance from the home to a less conspicuous locality. Coal ashes and clinkers can often be used to advantage for under drainage of roads and foot walks, and thus perform a useful function, but when deposited in the community dump, their value for any purpose is wholly lost.

When household wastes can be made to serve a useful purpose methods should be adopted to that end, and nearly if not quite all such wastes can be applied to some useful purpose, with economical results. Even old shoes can be burned in retorts and the carbonized leather used in case hardening forged and malleable iron. The case hardened parts of guns and pistols and some parts of sewing machines are heated in contact with burnt leather and bones, to produce the bluish gray mottled surfaces, and the hardening of the surface of the metal. All the rubber in old overshoes can be recovered and used again.

Metals and bottles accumulating about a household should be collected and sold. All metals have a value, and glass can be remelted like scrap iron and brass. Tidiness of the household should suggest that the cellar and the closet should not be made a dump, and if the refuse materials have no near value, they should be disposed of to best advantage and removed from the premises.

Sink water can be run into a cess pool with an overflow to a gravel or broken stone filter, so arranged that it may be examined and the filtering materials renewed from time to time. When it is readily obtainable, coke breeze will be found preferable to gravel, and with a porous sub-soil, a small filter bed about four feet deep will sufficiently purify the kitchen sink water. Laundry or wash water may be run onto such a filter, and the intermittent application of the waste water will constitute a dosing of the bed, and a large reduction of the objectionable features of wash water can be easily accomplished in this manner.

The wasting of wash water and sink water into village gutters or on the ground in the back yards is unsightly, and fails to rapidly destroy organic matter. Of course in due time by exposure to air and the sun's rays, the organic matter will be reduced to gases, and harmless nitrogenous compounds; but the rate of destruction will be slow, and the existence of spots where the wash and sink water is usually discharged will be an eyesore and sometimes a nuisance, especially when the ground becomes sour and incapable of supporting vegetation. On every country or village premises, a small filter can be constructed at no large expense, excepting labor, and by attention to this from time to time, the organic matter in sink and all wash water can be rapidly destroyed, and the effluent from the filter can run into open drains or mix with ground water, without risk to health.

Country privies should be provided with water-tight vaults or with removable boxes or galvanized buckets which can be changed at frequent intervals. Water-tight vaults can be pumped out by means of what are known as odorless excavators, which consist of a diaphragm pump and an air and water-tight metal tank, mounted on wheels, into which the fluid and solid contents of the vault is pumped. These odorless excavators are not very expensive, and they perform their work efficiently and without offence. The work may be done by day or night, although as a rule the night is usually chosen, and the apparatus takes the place of the old-fashioned nuisance known as soil or night carts. As the diaphragm pump will lift the contents of the vault 20 feet, any ordinary vault may be neatly and quickly emptied in this manner.

On the farm and in small hamlets and villages, the masonry privy can be made neat and sanitary at small expense, and the collected wastes be made useful and contribute to growing crops, and when not available for fertilization so long as the ground is not frozen, can be plowed into the soil and removed from sight and smell, and rendered harmless even though it may contain at times the germs of disease.

In winter the disposal of privy deposits is more difficult, and it is at this time, if the contents are spread upon the frozen ground, that germicides should be used sufficient in

*Bulletin, Ohio State Board of Health.

quantity to destroy all living organisms because many of these, while not acting during intense cold, lie dormant and are readily developed when warm weather arrives, and in this condition may find their way to running streams and constitute a danger to those below who may be compelled to use the stream for drinking water.

There is danger in spreading the contents of a privy vault over frozen soil, especially if typhoid excreta should form a part of it, and when such is the case the contents should be thoroughly disinfected and rendered innocuous before it is put on the ground.

During nine months of the year the material can be dug or plowed into tillable land with safety and usually with benefit to the soil, although the chief point to be considered is to dispose of it without risk to health. Lime is not an expensive disinfectant and can be had everywhere, and a thorough mixing of lime in quantity to act as an effectual deodorant will be a safeguard in disposing of the contents of privy vaults on land, besides the lime so used as a rule will be a benefit to the soil.

When a privy vault is dug in a porous soil like sand or gravel, it must be obvious to anyone that the leachings from it may reach wells or cisterns usually not far removed, and that such vaults, as a measure of safety, should be made water tight by carefully cemented brick work, or at the present time preferably of concrete to which has been added the proper proportion of some one of the several waterproofing compounds now in the market. Aside from the possibility of transmitting disease germs through a porous soil from a privy vault to a well or cistern the bare possibility of mixing filth with the drinking water of a household should be sufficient cause for the construction of suburban and rural privy vaults under the most rigorous supervision. They should be absolutely water tight, and no precautions to make them so should be neglected. No one can tell how much suffering has been caused by the reckless or ignorant use of non-water tight privy vaults in close proximity to wells and cisterns from which the domestic drinking water is drawn.

There is always a lot of rubbish stored around a house that should be removed to a safe dumping ground or be destroyed. Combustion is the best agent for this purpose. No harm can result from the gases and ashes of combustion, but much harm can come from the things we burn, if allowed to gather about the premises and slowly decompose. Things that attract mold, if not needed in the future, should be destroyed, or if needed in the future, molds should not be allowed to grow on them, many of the molds are poisonous and injury may result from the handling of moldy articles. Books bound in leather and infact any leather if left in a damp, dark place will attract molds and furnish them a habitat. Dry places and bright sunlight inhibit the growth of molds and if old shoes must be kept around the house, put them in dry places exposed to the light.

Garbage may be burned in the kitchen stove, but most housewives object to this manner of disposal, and when it cannot be utilized as on farms in feeding to hogs, it should be collected in water tight galvanized iron cans or wooden tubs, and be removed from the premises before it becomes sour.

In villages the garbage can be collected and removed to some place where it can be utilized as food for hogs, or be taken to a convenient dump, but the dump in due time will become a nuisance and when possible, and if no use can be made of it, garbage should be destroyed by combustion.

In the larger cities garbage has a value, and while the city pays for its collection and removal from the premises, the product and reduction companies obtain enough grease from digestion of the garbage to make the handling of it profitable. The solid residuum from digested and pressed garbage has been used to some extent as a fertilizer, but some farmers who have used it claim it has no value for this purpose, and the custom at the present time is to dessicate and burn it in furnaces built somewhat like furnaces for burning spent tan bark.

Decomposing garbage may not be the cause of disease, but it can become an unbearable nuisance, and as such should be abated by any means conveniently at hand. In many villages, the keeping of hogs and hog pens are prohibited by the rules of the local board of health, and in such instances the garbage should be destroyed as fast as it is formed, or be hauled away to dumps and not allowed to slowly decompose on the back lots.

While it cannot be recommended as a fertilizer, there are times when it may be dug or plowed under the soil and slowly decompose without offence.

Household cleanliness is easier of accomplishment in the suburbs of cities and rural districts than in the congested districts of cities, and as this is the first step in domestic sanitation, it should be practised from personal pride and in the interests of our own health and the health of our neighbors. Do not allow wastes to gather about the house or yards; destroy if convenient all waste matter subject to decay; fight dirt about the house as you would an enemy; keep everything clean, and have no out-of-the-way places where cast-off materials may slowly decay and become a nuisance to the senses, even if not seen.

The only danger about a new dwelling is the damp plaster and the mortgage, but these are less liable to injure the health of the family than old wastes stored in the damp, dark cupboards of old houses, and giving off odors, that a stranger can detect almost before he enters the house. Air, sunlight, hot water and soap should have free circulation in every dwelling, and they are everywhere to be had and do not cost much.

Cleanliness requires effort and work, but as it has long since been settled that man was made for work and not for play, it may be accepted that household cleanliness is part of the work which he must perform while going through this vale of tears, and what better work can he perform than that which inures to the health of his family and himself.

Every house in town or country should be provided with tight fitting fly screens and these should be kept closed and, as far as possible, flies and mosquitoes should be rigorously excluded from the dwelling. No sanitary expedient costs less than door and window screens and probably none does more good to the family. Flies, especially, are scavengers, and no decaying matter, however foul, is shunned by them as food. They walk on and through all kinds of filth and unless prevented, carry it into the house and distribute it on the things we eat and handle. It is well known that the frightful epidemics of typhoid fever in our military camps during the late Spanish war were attributed to the common house fly infesting the sinks and bringing the fever germ back on their feet to the camp kitchens, and victuals on the mess tables. Doubtless the same cause existed and maintained the high typhoid fever rates among the soldiers during the war of the States, but we did not know it then.

The mosquito or one of his species is now known to be the active cause and distributer of yellow fever, and although we do not have yellow fever in Ohio, who can say that aside from being a pest, the mosquito may not be the cause of other human ailments in our climate, the origin of which is as yet unknown.

Malaria fever is attributed to the mosquito and long before we suspected this insect as the cause, it was well known that the complaint was most frequent and persistent in the neighborhood of swamps and stagnant ponds, the favorite breeding places of the mosquito. At the present time, at least one state, New Jersey, is making a concerted and systematic attack on the mosquito by spreading crude petroleum over the water of swamps and stagnant ponds, to destroy the eggs or larvae of the insect before development. If all other states would unite in an effort to get rid of this insect, I believe we would succeed, and so far as I am aware, would realize no economic loss in its complete extinction.

Many people know from experience that mosquito bites are sometimes accompanied by incipient blood poisoning, and cases are not rare where considerable suffering has followed. The insect may be the direct cause of infection, if it has visited a corpse dead of infectious disease and then bites a sound person. In the hot climates verandahs are closed in with wire netting to exclude flies, mosquitoes and other insects, and the sanitary effect of this precaution is too well known to require comment.

The use of fly paper to capture the house fly is unsightly, and a use of window and door screens in suburban and country houses will accomplish the same result in a cleaner and neater manner. Few people realize how much we owe to the modern fly screen, it has been a boon to civilization, and has saved more lives than the Davy safety lamp and many other life-saving devices, the merits of which have been sounded in all languages. In the language of Iago, "Put fly screens in your houses" and exclude the insects as you do the burglars.

Some doctors have grown famous and wealthy, specializing on diseases due to the house fly and the mosquito, many of which can be avoided by a liberal use of fly screens.

In addition to the ordinary household wastes above mentioned, of late years there is an accumulation of empty tin cans about the premises, which, if collected in quantity and sent to the proper place, can be utilized for the tin, solder and iron which they contain. In large cities like Philadelphia and New York, there are a number of places where old tin cans are collected, and the softer metals melted and run into ingots and bars, and the iron or steel of the can when cleared of solder and tin, is packed in bundles, boiled, and worked into sash weights and gas pipes, so that the whole of the tin, less the losses incident to manipulation, is used again.

In a small community, it would not be inconvenient to provide a place where all the empty tin cans can be collected, and when a car load has been collected, let these be shipped to some reduction point, and the revenue therefrom go into the village treasury. While the income from this source of wastes disposal will not be large, it will justify the labor expended in collecting the cans, and provide a convenient avenue for the removal of unsightly heaps of tins from the back yards of many premises or from the village dump.

## NEW INCORPORATIONS.

**Sault Ste. Marie, Ont.**—Sault Star, $40,000; J. W. Curran, J. A. Furse.

**Ottawa, Ont.**—Mulhall Hardware, $100,000; W. E. Graham, C. McAdam, A. E. Shorter.

**Guelph, Ont.**—Mahoney Building Company, $80,000, J. J. Mahoney, J. D. Mahoney, R. Mahoney, jr.

## EXPERIMENTS ON FLOW AND MEASUREMENT OF WATER.

At a meeting of the Engineers' Club of Toronto, on January 5th, a paper on "The Application of Weirs and Orifices to the Measurement of Water with special reference to the V-notch," was given by Mr. James Barr, B.Sc. Mr. Barr devoted considerable time to research work in this subject at the James Watt Engineering Laboratories, Glasgow University. An abstract of Mr. Barr's paper, which was illustrated and most thorough in detail, is here given.

I thought I could best introduce this short paper by making a few general remarks upon the application of the three chief types of orifices in practical use—the submerged circular orifice, the triangular or V-notch and the rectangular notch.

For comparatively small flows, which do not vary greatly in quantity, the submerged circular orifice is best. With a small fall available, it is usually impracticable to use a submerged orifice. With a rectangular notch the discharge varies roughly as H-3/2 and with the triangular notch as H-5/2, where H is the head. Therefore, for equal heads, it is necessary to measure the head more exactly in the case of the triangular notch; but for the same discharge the head over the triangular notch is considerably greater than that over the triangular notch is considerably greater than that error in its estimation.

The rectangular notch is more suitable for dealing with large flows, but we are more certain of the discharge from the triangular notch, and it can deal with a large range of flows, with exceedingly small, as well as with large quantities. In this it possesses, in many instances, a great advantage over the rectangular notch.

### Submerged Circular Orifice.

**Co-efficients.**—The co-efficient of velocity of water issuing from a submerged orifice is 0.97. If the orifice be in a thin plate, or if the edges be bevelled off sharp, the issuing stream is contracted, the greatest contraction occurring at a distance from the orifice of about half its diameter. The co-efficient of contraction is 0.64.

The co-efficient of discharge is

$$0.97 \times 0.64 = 0.62,$$

and the discharge is therefore given in cubic feet per second by

$$Q = 0.62\,A \quad 2\,g\,H,$$

where A = Area of orifice in square feet,

H = head in feet.

In the case of a circular orifice in the bottom of a vessel the head H should be measured (down) to the place of contracted area, i.e., to a distance below the orifice of half its diameter.

**Bellmouths.**—If the orifice be bellmouthed so that it is of the form of the contracted stream the contraction takes place within the bellmouth and the co-efficient of discharge is 0.97; the diameter of the orifice being taken as that at its smallest section. The use of bellmouths on draw-off pipes from reservoirs, straining wells, etc., thus avoids the contraction and consequent loss of head.

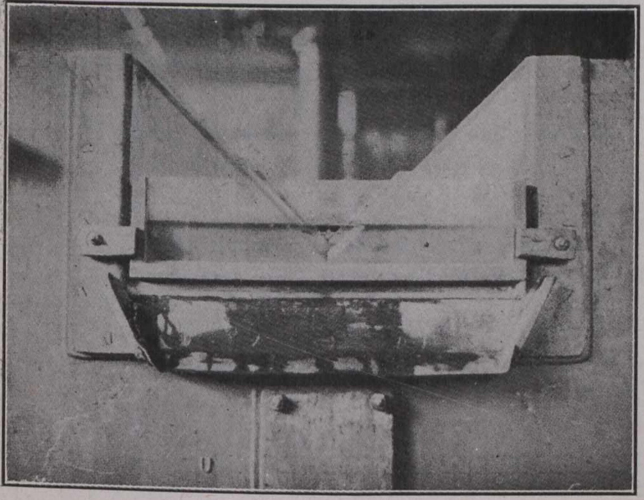
**The Triangular Notch.**—The formula generally used for the triangular notch is that given by the late Professor Jas. Thomson, C.E., namely, Q = C H 5/2, where Q is the discharge in cubic feet per minute, H is the head in inches, or depth in inches of the crest of the notch below the still water level of the pool, and C is an empirical co-efficient. The value of C given by Jas. Thomson for heads ranging from 2 to 7 inches is 0.305 so that his formula is $Q = 0.305 H 5/2$.

**Rectangular Notch.**—Mr. J. B. Francis's empirical formula, founded on the Lowell Hydraulic Experiments, is

$$Q = 3.33 (L - 1/10 n. H) H 3/2,$$

where Q = discharge in cubic feet per second. L = length of notch in feet. H = length of water in feet. n = 0, 1 of 2 = numbers of end contradictions in the flow.

This formula is founded on experiments made upon a notch 10 feet wide and for heads varying from 6 to 24 ins. It is not applicable where H is greater than 1/3 L i.e., when



**Methods of finding "Zero Level" on the Gauges.**

the length of the notch is not greater than three times the head. It is considered necessary to have considerable depth at the upstream side of the weir board.

There are several combinations and modifications of the above notches which have been applied in practice. The discharge from the three V-notch weir is rather more than three times that from one V-notch. In this case the little notch is treated as a submerged rectangular orifice when the level of the water is above the crest of the large notch.

A somewhat recent application of the V-notch, of considerable importance, is that for the measurement of the steam consumption of surface condensing engines (the air pump discharge being passed through a V-notch); and in instances where the flows are very small, notches, whose areas are ½ or ¼ that of the right-angled notch of the same depth, have been used.

Very unusually the triangular notch is provided with some type of recorder, which by means of some mechanism gives a good diagram record of the flow. Two types of recorder frequently made in the Old Country are the "Hutchison" and the "Lea" recorders. The Hutchison recorder is more generally applied to rectangular weirs.

I have a selected list of some thirty V-notches, which have been made by Messrs. Glenfield & Kennedy, Limited, hydraulic engineers, Scotland. They vary in size from 12 feet, 0 inches wide, by 6 feet, 0 inches deep, to 9 inches wide, by 4½ inches deep, and have been supplied to places in Britain, the Continent, India, South Africa, China and Australia.

It is to the V-notch that I wish to draw your attention and to a series of experiments which it was my privilege to make upon it.

**Objects and Results of Investigation.**—The primary objects of the investigation were the verification of the formula $Q = c H^{5/2}$, proposed by Mr. James Thomson, M.A., D.Sc., LL.D., F.R.S., Professor of Civil Engineering at Queen's College, Belfast, and at Glasgow University, for the flow of water over a right-angled triangular or **V**-shaped notch, and the experimental determination of the values of the co-efficient C in that formula. The effect upon the discharge over the notch of the width and of the depth of the channel of approach, and also of the nature of the surface of the notch on the up-stream side, have also been made objects of research. The results are chiefly practical in their aspect, and verify Dr. Thomson's anticipation that with the triangular notch the quantity flowing is in almost all cases very nearly proportional to the $^5/_2$ power of the height of the still-water surface from the vertex of the notch. In their philosophic aspect the results show that the prevention of the inward flow of the water at the sides of the notch, whether caused by the narrowness of the channel of approach, or by the roughness of the up-stream surface of the notch, produces an increase in the quantity flowing over the notch.

2. **Importance of Experimental Demonstration.**—In the reports of his experiments Dr. Thomson pointed out the suitability of the use of triangular instead of rectangular

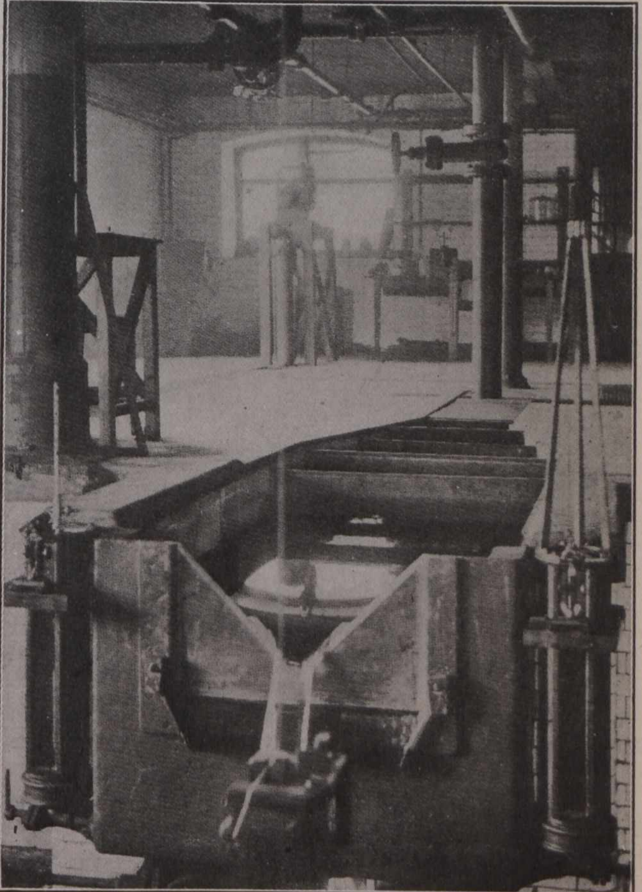


**FIG. 1.**
**Showing General Arrangement of the Flume.**

notches in circumstances where the quantities of water to be measured are very variable. He stated that if the rectangular notch be made wide enough to allow the water to pass through it in flood times, it must be so wide that for small flows the water flows so shallow over its crest that its indications cannot be relied upon. He showed that this objection would be removed by the employment of triangular notches, because, in them, when the quantity flowing is small, the flow is confined to a small space, admitting of accurate measurement. Dr. Thomson further advocated the use of triangular notches in cases in which it might not be convenient to form a deep pool of quiet water at the up-stream side of the weir-board, and stated that the bottom of the channel of approach might be formed as a level floor starting exactly from the vertex of the notch, and extending both up-stream and laterally, so far that the water entering on it at its margin may be practically considered as still water.

Triangular notches are now in constant use as a means of gauging water, and it is therefore important that the experimental data on which their application is based should be extensive and reliable.

**Sufficiency of Demonstration.**—In the summers of 1860 and 1861 Professor Thomson devoted much time to the carrying out of extended and accurate experiments. His apparatus was, however, when compared with modern appliances, extremely crude. The following particulars are taken from

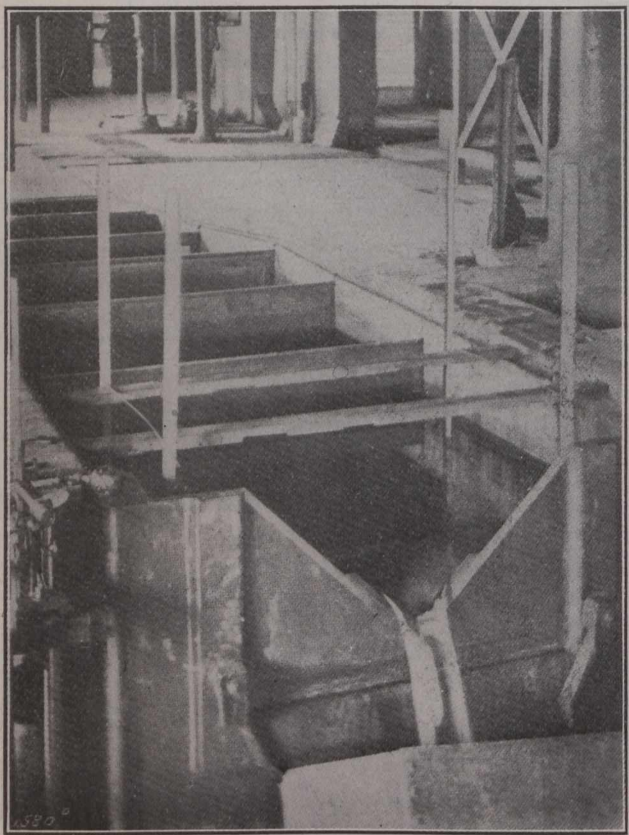


**FIG. 2.**
**Showing Method of Varying the Width and Depth of Channel of Approaches.**

his main report: The experiments were made in an open field near Belfast. The water was obtained from a course leading to a water-wheel at a neighboring mill, and arrangements were made to allow of a regulated supply, variable at pleasure, being drawn from the course to flow into a pond, in one side of which the weir-board with the experimental notch was inserted. The in-flowing stream was so screened from the part of the pond next to the notch as to prevent any sensible agitation being propagated from it to the notch, or to the place where the water-level was measured. A small outlet waste-sluice was fitted to the weir-board to control the water-level. A vertical slide-wand of wood, with the bottom end cut to the form of a hook, the point of which was a small level surface of about ⅛ in. square, was used for measuring the water-level. The water which issued from the notch was, by means of a horizontal tilting-trough, conveyed to either of two barrels, in which it was measured. Each barrel was fitted with an outlet valve in the bottom, and was in turn filled up to a point fixed near the top. Their joint capacity was about 230 gallons.

Professor Thomson's results are given in the subjoined table, where H is the head or height as measured vertically in inches from the vertex of the notch up to the still-water surface of the pond, Q is the corresponding flow of water in cubic feet per minute, as found by experiment, and c is the value of the co-efficient calculated from the formula $Q = c\,H^{5/2}$.

| H. | Q. | c. |
|---|---|---|
| 7 | 39.69 | 0.3061 |
| 6 | 26.87 | 0.3048 |
| 5 | 17.07 | 0.3053 |
| 4 | 9.819 | 0.3068 |
| 3 | 4.780 | 0.3067 |
| 2 | 1.748 | 0.3088 |

This table gives the average results for the two series of experiments—one made in 1860 and the other in 1861. The mean of the six values of c is 0.3064, but Professor Thomson, from a comparison of his experiments, prefers to adopt 0.305 as the co-efficient, and gives his formula for the right-angled notch as

$$Q = 0.305\ H^{5/2}.$$

Professor Thomson inserted a floor on the up-stream side of the notch, and on a level with the vertex, as already described, but his experiments indicated no variation in the value of c for different depths of the water, but such as lay within the limits of the errors of observation. He does not seem to have made any experiments upon the effect of the width of the channel of approach, although he proposes that instead of a single large notch, two, three, or more right-angled notches might be formed side by side in the same weir-board with their vertices on the same level.

The present experiments were made with the aid of very delicate and specially-designed apparatus. They were conducted under the supervision of Mr. Archibald Barr, D.Sc., M. Inst. C.E., Professor of Engineering at Glasgow University, and the range of investigation was considerable.

**Method of Investigation.**

The method of investigation was solely practical. H, the vertical height in inches of the still-water level from the vertex of the notch, and Q, the corresponding discharge over the notch in cubic feet per minute, were accurately measured; c, the co-efficient of discharge in the formula $Q = c\,H^{5/2}$, was then calculated, and the variations of c ascertained for different values of H, and under different conditions of flow.

**Description of the Apparatus.**

The apparatus was designed by Dr. Barr for the hydraulic section of the James Watt Engineering Laboratories.

**The Flume.**—The general arrangement of the flume is shown in Fig. 2. The total length is about 22 ft.; the width at the notch is 4 ft., and the approximate depth is 2 ft. below the apex of the notch. Baffles consisting of double sheets of perforated zinc, mounted on wooden frames, are fixed across the flume; the perforations are graded in size, the finer perforated sheets being up-stream. The water, which is supplied from a storage-tank on the roof of the laboratories, enters by the 7-in. diameter vertical pipe at

(Continued on Page 234).

# The Canadian Engineer

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## CONTENTS OF THIS ISSUE.



## INSPECTION OF CONCRETE.

It is time the general public became possessed of the idea that there is good and bad concrete. People should learn to distinguish the different grades of concrete. Just as there are first and second classes of masonry, brickwork, woodwork or steel construction, so there are different grades of concrete work.

Too frequently people look upon concrete as concrete, and attribute qualities to it which in the particular instance it does not possess. Concrete does possess many excellent qualities, but it is not foolproof, hence the necessity for careful, systematic inspection.

Concrete and reinforced concrete construction have proven their worth, and its wide usage is proof of its acceptance. The wharves on the sea coast, the immense piers under railway bridges, the massive dams of hydro-electric plants, the irrigation dams and canals on the prairie, and the pavements and foundations of the cities all attest the merits of this material. Last year in Canada alone there was consumed almost five million barrels.

Good cement, good sand and good gravel will not make good concrete unless properly handled, and inspection is just as necessary in the handling of the material as in its selection. Yet inspection of concrete is not so difficult as the inspection of steel. Almost any inspector of concrete building can tell by looking at the concrete as it goes into the forms whether it is good or bad, and whether or not the specifications are being lived up to. There are certain simple requirements in the making of concrete, and, if these are attended to, the place or method matters little.

In the use of concrete the first care must be in the design, for the selection of concrete for such incorrect uses as conveying acids, waterproofing (where the water is under a static head), or the use of concrete intention, will give poor results despite the most careful inspection; nor must concrete, strong as it may be, be required to carry loads beyond its capacity.

The selection of proper material is very necessary. Clean sand and gravel and good cement will give good results, but, strange as it may appear, it is true that failure in concrete through the selection of bad material reflects more on the whole industry than upon the individual builder, whereas, in the older building materials, the reverse is the case. It is in the execution of the work that the inspector has to show greatest care, and, although the inexperienced workmen are growing less and less as more concrete is being executed, yet some workmen and contractors require constant watching. More failures of concrete have occurred traceable to inexperience than to any other cause. Forms are built incorrectly, insufficiently clean, and frequently no judgment used in removing.

Although experience is required, yet more work can be done with inexperienced men in concrete than in any other material.

With careful inspection there must go reliable supervisors, for the contractor does not exist who cannot fool the inspector. Give the contract for cement work to a reliable bidder. Do not be fooled by the low bid. Look into the contractor's financial standing just as carefully as you would investigate the standing of your doctor or lawyer before you engage him. All the bonds and the inspectors in the world won't make a dishonest contractor honest. Good concrete work means, before all things, a good contractor.

## DEPRECIATION.

Depreciation has been defined as "a lowering in value." In auditors' reports and expert valuation it is better defined as "that element of expense which must be provided for to cover the wearing out of physical property."

Depreciation as applied to power plants, contractors' equipments, pumping plants, and machinery and buildings generally may be ascribed to the following causes:—

First, such loss in value as is due to the wear and tear occasioned by the use of property, exposure to the elements and subsequent natural decay.

Second, the inadequacy of the plant. Plants and equipments become quickly outgrown, and even bridges and rail lines have to be replaced by those of greater capacity. Increased business, increased traffic, means increased equipment and more apparatus. The conditions are properly chargeable to capital account, but this cause must not be used to offset depreciation in the original plant, although it is true it is held as an asset.

The third condition which causes depreciation in certain plants is the development in the art or business where fundamental changes and improvements are constantly being made which result in the scrapping of much of the plant.

We have had brought to our attention several times where careful calculation demonstrated that it would be a good investment to scrap the whole of the present equipments.

A fourth cause of depreciation which is frequently neglected in valuations is the loss occasioned by complying with new legislation and a further loss due to an effort to meet with public requirements. In municipal work this might appear in the moving of curbs to increase the width of street because of increased traffic and the substituting of longer poles for light and telephone cables because of the growth of trees.

The rate of depreciation must be governed entirely by local conditions, and varies from one or two per cent. to as high as fifteen or twenty, depending entirely on the utility.

The item of depreciation is a very important one, and is not given sufficient consideration by engineers when preparing their estimate, or auditors when preparing their annual report. Equipments will only last a certain number of years, and that number of years will depend largely upon the state or repairs, and it is against this depreciation, which cannot be made good under ordinary current repairs, that a sum of money should be set aside each year which will represent the amount of such wear and tear which occurs, so that when the equipment is worn out there will be sufficient in the reserve fund to create an equipment equal to the original.

It is obvious that deterioration, visible or invisible, is going on at every moment, and safe financing requires that rates should be fixed to provide for the necessary replacements.

Engineers and managers must not fail to note the distinction between depreciation and maintenance. Maintenance is a current account which takes care of the expense and labor and material involved in keeping things running smoothly. A depreciation account supplies a workable plant, which the maintenance account keeps in good order. Depreciation is a constant loss. Maintenance is the effort to secure the greatest utility out of the equipment possessed; but perfect maintenance will not prevent depreciation.

Neglect to provide for the item of depreciation is folly, and it is not only unwise but unjust to refuse to recognize this in estimating first cost and profits.

## TRUNK LINE ACROSS CANADA.

From Western Canada comes the news that a movement is on foot which has for its object the building of a trunk line wagon road from Winnipeg to the Pacific coast. It is suggested that a route be agreed upon, and that each of the provinces build the sections within their boundaries.

It is felt that a properly built and maintained road would show the people what government control of the highways would do; so that, in addition to a cheap transportation route, it would be an object lesson.

It is time for a change in the control and maintenance of roads. The county road plan adopted by a number of Ontario municipalities has had a good trial, and has been productive of good, and improved some of the leading roadways of the country, but too frequently counties planning for their own convenience have not considered the highways in the neighboring counties.

Permanent road-making will give good roads now, and fifty years from now, provided it is well looked after. Too frequently we have expected roads to maintain themselves, and because of the imperfect maintenance some of our road systems receive, government control of highways is more than ever desirable.

## ELEMENTS OF STRUCTURAL STEEL DESIGNING.

**Wm. Snaith.***

[This is the second of a series of articles by Mr. Snaith. The third article will appear next week.—Ed. Canadian Engineer].

### The Equipment of the Structural Draftsman.

In a previous article the mechanical processes involved in the manufacture of structural steel were outlined, and short reviews of the principal elementary works on the subject were made. From this broad survey of the subject we now turn to its application, and in this article we shall take up the equipment of the structural draftsman. In the matter of previous experience, time spent in shops in any way connected with mechanical work will show its effect to advantage, and some slight acquaintance with the mechanical drawing used in machine design forms an excellent foundation on which to build up experience.

The possession of a set of good drafting instruments and a knowledge of how to use them is assumed in all who read these articles. We shall not take up space with descriptions of these instruments, nor with instructions as to producing chisel or round points on lead pencils. In

*With Barber & Young, Structural Engineers, Toronto, Ont.

knowing how to use instruments we find that we cannot always include the knowledge of how they should be looked after. It may be worth while to point out that spring bow-pens, etc., when not in use will last much longer if they are not kept screwed up as tight as possible. The same thing is true of ruling pens; and of ruling pens it can also be said that they will be found to work better if the ink is not allowed to dry between the points. This suggestion is intended less as an incentive to speed as to cleanliness, and explains why some of the best instruments turn out the poorest work. While on the subject of ruling pens it may be said that while they are not constructed nor sold as lettering pens they may be made to do duty as such. It is possible to readily adjust the thickness of line as desired, and the letters can be made of uniform thickness throughout.

Of the instruments that are not in such general use as their possibilities would indicate they might be, brief notes will suffice. A good parallel ruler will displace a tee-square to great advantage on some classes of work, such as in constructing stress sheets and other graphical statics problems; but it must be accurate and as large as possible, or some surprising results can be obtained. There are several devices to replace the tee-square. The straight-edge fastened to an endless cord running over pulleys at the four corners of the board is satisfactory if good cord is used, and if drawings can be carried through to completion when once started. Easels on which the drawing board is almost vertical are in use in connection with this type of straight-edge, but we have never seen them used in structural offices, probably because of the difficulty in finding any place to spread out prints used for reference purposes. There are several simple forms of drafting machines which will materially assist the draftsman to increase his speed and accuracy; their first cost is high, and they are not as widely used as they might be.

### Mathematics

A knowledge of higher mathematics is not demanded of the structural engineer although much of that wherewith he works depends on higher mathematics. Geometry and trigonometry are constantly required, but almost all the cases met with can be reduced to such a form as to require the application of one or other of three propositions in geometry, or of a familiarity with the functions of angles in trigonometry.

The geometrical proposition of most common occurrence is the 47th of Euclid's 1st Book: In a right-angled triangle the square on the hypotenuse is equal to the sum of the squares on the other two sides. This may be expressed algebraically, referring to Fig. 1, thus:—

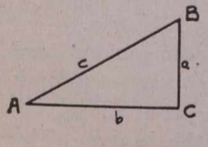



Fig. 1.

$c^2 = a^2 + b^2$.

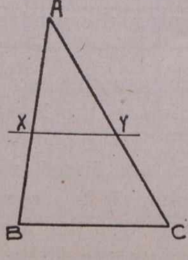



Fig. 2

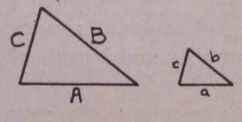



Fig. 3

Proposition 2 of Book VI. states that if a straight line is drawn parallel to one side of a triangle it cuts the other sides proportionally. The converse of this is also proved. Expressed algebraically, referring to Fig. 2, where XY has been drawn parallel to BC,

$$\frac{BX}{XA} = \frac{CY}{YA}$$

Proposition 4 of Book VI. proves that if two triangles be equiangular to one another, the sides about the equal angles shall be proportionals, those sides which are opposite to equal angles being homologous. Referring to Fig. 3, this is expressed algebraically thus:—

$$\frac{A}{B} = \frac{a}{b}, \qquad \frac{C}{A} = \frac{c}{a}, \qquad \frac{C}{B} = \frac{c}{b}.$$

The bare essentials of trigonometry will be found to be about covered by the definitions of the trigonometrical functions. These are matters of definition, and must be committed to memory in such a way as to be capable of instant application, as they will be used constantly. Referring to Fig. 1, the angle at A is any acute angle, and BC is drawn at right angles to AC at C. As long as the angle at A remains the same the following ratios remain the same, the second proposition quoted above being the proof.

The ratio $\frac{BC}{AB}$ or $\frac{\text{opposite side}}{\text{hypotenuse}}$ is called the **sine of A.**

The ratio $\frac{AC}{AB}$ or $\frac{\text{adjacent side}}{\text{hypotenuse}}$ is called the **cosine of A.**

The ratio $\frac{BC}{AC}$ or $\frac{\text{opposite side}}{\text{adjacent side}}$ is called the **tangent of A.**

The ratio $\frac{AC}{BC}$ or $\frac{\text{adjacent side}}{\text{opposite side}}$ is called the **cotangent of A.**

The ratio $\frac{AB}{AC}$ or $\frac{\text{hypotenuse}}{\text{adjacent side}}$ is called the **secant of A.**

The ratio $\frac{AB}{BC}$ or $\frac{\text{hypotenuse}}{\text{opposite side}}$ is called the **cosecant of A.**

These terms are rarely written in full, but are abbreviated to sin., cos., tan., cot., sec., and cosec. All these ratios have been calculated, and are arranged in tables, and by their means if any one side and one angle of a right-angled triangle be known, the remaining sides may be calculated. The solution of triangles other than where one of the angles is a right angle is very rarely called for in structural work.

Facility in the use of logarithms will be found of the utmost value in saving labor in computations involving multiplication and division. It may not be out of place to mention that no knowledge of mathematics more extensive than an acquaintance with the four principal rules of arithmetic are required for the mastery of the application of tables of logarithms. A slide rule is a graphical application of the logarithmic tables, and will prove a great labor-saver. The results read from the slide rule will generally be sufficiently accurate for all practical purposes. An adequate description of this rapid calculating device would take up space to little advantage. It is easily mastered, however, with practice, and will materially lighten many laborious calculations.

While on the subject of mathematical tables and labor-savers, the books of tables of squares and logarithms of numbers of feet and inches should be mentioned. Buchanan's or Hall's Tables give the squares, and Marshall's Tables the logarithms of dimensions up to 50 feet, expressed in feet and inches. Smoley's Tables give both the squares and logarithms for dimensions up to 100 feet. The application of such a table of squares is best illustrated by an example. In Fig. 1 assume a=3'—11 15-16"; b=8'—10⅜", and c required

$a^2=15.9584$ (from table)
$b^2=78.5808$ (from table)

$a^2+b^2=c^2=94.5392$
c =9'—8 11-16" (from table).

If such a table were not available it would be necessary to convert all dimensions into feet and decimals, or into inches before squaring and adding, and the result would have to be re-converted into feet and inches, a lengthy process involving approximations and possibilities of errors.

**Handbooks.**

Mention has been made of the handbooks published by the steel manufacturers. There are several of these, and one or other will be found to be the inseparable companion of every structural draftsman or engineer. They contain a wealth of information, in condensed form, on many subjects touched on in designing structural work. The three in most general use are issued by the Cambria, Carnegie, and Jones and Laughlin Steel Companies. Since the dimensions and properties of the principal structural shapes are the same whatever mill they may be rolled in, there is much information that is the same in all these pocket books of reference. Without attempting to mention all the material contained in these handbooks we shall briefly outline some of the principal items, repeating at the outset that, as mentioned in a previous article, the intention is to treat of matters that a beginner is likely to find are so familiar to those around him as to be considered not worth while explaining.

For two reasons we shall not attempt to specify the page on which any particular item will be found; there are several editions of each handbook, and such reference might be misleading, but the chief reason lies in the fact that it is advisable to cultivate familiarity with the contents to such an extent that the page desired may be found as quickly by leafing over as by referring to the index. Where no reference to a particular book is made it may be assumed that the information is contained in all three.

Completely dimensioned drawings of all the standard and special shapes take up the first few pages, and will be referred to in making layouts or scale drawings. It is convenient to note that the slope of the flange of I-beams and channels is the same for all sizes, and is 2-in. in 1 foot. These illustrations are followed by tables giving the dimensions of round and flat bars, the maximum thickness, width and length of plates, the various sizes and leg thickness of angles and other shapes rolled by the various companies. There are tables giving the safe loads on I-beams and channels for uniformly distributed loads. In using these tables it is necessary to keep several things in mind. The load in the table includes the weight of the beam, and therefore this weight must be deducted to find the capacity. The fibre stress is assumed at 16,000 lbs. per square inch, and if this unit stress, as is very frequently the case, is different from that in the specifications for the design, a correction must be made. The load is assumed to be uniform, and for any other distribution the capacity of the beam will be different; if the load is concentrated at the centre, the capacity will be one-half of that in the table. It will be noted that in most of the tables of safe loads the upper and lower portions are separated by heavy lines; figures below the heavy line give loads which may safely be imposed on the beam, but which will cause it to deflect to such an extent as to crack a plastered ceiling. In the explanations of the tables the method of finding the load which will not cause an excessive deflection is given.

The maximum spacings of I-beams for a uniform load of 100 lbs. per sq. ft. are also tabulated. The unit fibre stress is 16,000 lbs. If this uniform load is required to be greater or less than 100 lbs. per sq. ft. the spacing may be readily computed by multiplying the tabulated value by 100 and dividing by the desired uniform load.

The safe loads on angles and tees are given in all the handbooks, but much more completely in Cambria than in either of the others. In Carnegie and Jones and Laughlin all these safe loads are given in tons of 2,000 lbs., whereas in Cambria all the values are expressed in pounds.

The tables of properties of the standard shapes are practically the same in all the handbooks. These tables will be referred to more frequently by the designer than any others, and form the basis of all calculations for the capacities of the various shapes, as beams or columns. The preparation of such tables from the fundamental data given in the drawings mentioned, as given on the first few pages in the handbooks, is on a par with that of tables of logarithms, and their relative value is similarly comparable. We shall take up later the uses to which these tables are put, but desire here to emphasize their importance. In connection with the variation in weight of I-beams and channels it should be pointed out that while it is, for example, as easy for a mill to roll a 10-inch I at 40 lbs. as a 10-inch I at 25 lbs., the lighter size is the one generally carried in stock and looked on as standard. In case material is ordered directly from the rolling mills this need not be a matter of much concern, but if immediate delivery from stock is wanted the heavier weights will almost certainly not be procurable.

All the handbooks contain a number of pages giving the general formulas for flexure of beams, and diagrams and data as to bending moments and deflections, Cambria being much more complete than either of the others. The formulas for centre of gravity and moment of inertia, etc., for a great variety of shapes of possible application in beam and column design are also given. In addition to this there is much other information of a general character concerning strength of materials, weights of substances, mensuration, inches and fractions expressed as decimals of a foot, tables of logarithms, trigonometric functions, and complete manufacturers' standard specifications governing the production of all kinds of steel.

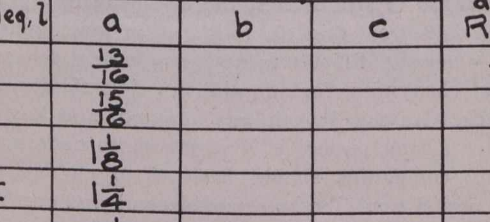
Many details of construction are practically entirely covered by the information in the handbooks, and some of these will be taken up in the remaining paragraphs.

Cast-iron separators are listed with dimensions and number and length of bolts. It is a common practice to omit the bevelled portion that fits the flange and allow the separators to fit snugly into the fillets of the beams. The office of a separator is frequently to cause the two beams to act together, and this type will transfer a load at least as effectually as that illustrated. In connection with the widths out to out of flanges, since this depends entirely on what the beam is to support, the separators will often require to be made specially to suit. The fact that the thicknesses of walls are in general fixed by other considerations than the size of bearing plates under beams and channels, the information in Cambria regarding the length and width of bearing plates is of very limited value. The plates specified in the Carnegie handbook are illogical in calling for a specified thickness which, it will be seen from Cambria, depends on too many variables to be thus easily disposed of.

The spacing of holes in flanges and standard connections for I-beams and channels, and the maximum sizes of rivets are given in all handbooks. The Carnegie standard connections differ in some sizes of I-beams from the Cambria and Jones and Laughlin's standards, and would appear to have been arrived at with the use of a multiple punching machine in view; in shops with the average equipment they would prove uneconomical. The minimum spans for which these connection angles give a sufficiently strong connection under maximum load on the beam are tabulated. It is pointed out in Ketchum's "Steel Mill Buildings" that where the member headed into is not rigid the standard connections may be insufficient. In the majority of cases, however, the only force acting is a vertical shear, and these connections will prove ample. No standard can be applied universally and the designer must be prepared to depart from these connections when they do not meet the requirements. The detailing of connections when beams of different sizes frame opposite has been illustrated with complete dimensions in all the handbooks.

The spacing of rivet-holes in angles is not taken up completely in any handbook. The accompanying table will be found to follow the practice of most offices.

RIVET SPACING IN ANGLES




| Length of Angle leg, l | Spacing a | Spacing b | Spacing c | Maximum dia. of Rivet. |
|---|---|---|---|---|
| 1½ | 13/16 | | | ½ |
| 1¾ | 15/16 | | | ⅝ |
| 2 | 1⅛ | | | ⅝ |
| 2¼ | 1¼ | | | ¾ |
| 2½ | 1½ | | | ¾ |
| 2¾ | 1½ | | | ¾ |
| 3 | 1¾ | | | ⅞ |
| 3½ | 2 | | | 1 |
| 4 | 2¼ | | | 1 |
| 5 | 3 | 2 | 1¾ | 1 |
| 6 | 3½ | 2¼ | 2¼ | 1 |
| 7 | 4 | 2½ | 3 | 1 |
| 8 | 4½ | 3 | 3 | 1 |

## CANADIAN SOCIETY OF CIVIL ENGINEERS' TWENTY-FIFTH ANNUAL MEETING.

The annual meeting of the Canadian Society of Civil Engineers for the election of officers and members, the council for the year 1911, and for the transaction of the general business of the Society, was held in the Royal Alexander Hotel, Winnipeg, January 24-5-6, and continued on the 27th.

This is the first meeting of the Canadian Society which has been held west of the Great Lakes, and the interest taken in this meeting by the membership from both east and west is very gratifying. Nova Scotia and British Columbia and all of the provinces in between were represented, as well as a number of engineers from the United States.

The report of the council stated that 19 members, 107 associate members, 4 associates and 126 students, in all 256, were elected to membership in the Society during 1910. In addition to this some 20 members were transferred from the Associate to the Membership class, and 50 students transferred to the class of associates. The present membership of the Society totals 2,739, being an increase of 170 over that of last year.

The treasurer's report shows total receipts for the year of $12,951.52, and a balance over expenditure of $6,561.76, with assets amounting to over $31,000.

A very interesting report was presented by the committee on ties. The report is signed by the chairman, Mr. D. MacPherson, and is as follows:—

Your committee would beg leave to report as follows: In their report, presented to the society in January, 1909, it was pointed out that some twelve million ties were being used annually in Canada, which number was being continuously and largely increased, so that probably, within the next 40 years, the consumption will be about one hundred and twenty millions, or equal to the present annual consumption in the United States.

Assuming the following data—average cost of untreated ties at point of shipment at 50c. freight and putting in track, 15c.; total, 65c.; average life, 8 years. Initial cost of treated tie the same as above; cost of treatment, including extra handling, 25c.; total, 90c.; average life, 16 years. Then if twelve million untreated ties are being used annually, and their average life is 8 years, there must be about ninety-six millions in use, and the capital necessary to place these ties in the track and provide for their renewal every 8 years, on a 4 per cent. basis, would be $2.41 per tie. The capital necessary to place treated ties in the track and provide for renewal every 16 years would be $1.93 per tie. The total capital necessary:

Ties.

= 96,000,000 × $2.41 = $231,360,000 for untreated ties.

96,000,000 × $1.93 = $185,280,000 for treated ties.

Total difference in capital..$46,080,000.

$46,000,000 at 4% = $1,843,200 = eventual annual saving.

As the cost of untreated ties and the numbers used are increasing very rapidly, and the cost of treatment is likely to be reduced, surely no more need be said to provide the urgent necessity of at once beginning the introduction of treated ties at all points where their capitalized values will show a fair saving on the investment, even if the question is only viewed from the standpoint of economy for the railways.

When the broader view of conserving our supplies, for fear of depletion, is considered, it assumes enormously greater importance.

Tie preservation by creosoting or otherwise has not hitherto received the attention it deserves in Canada, but it doubtless soon will, as the railway companies are becoming alive to this really vital subject. The American Railway Engineering and Maintenance of Way Association have, however, taken the matter up vigorously, and valuable information can be found in their "Proceedings," vol. x, part 1, for 1909, and subsequent volumes. In co-operation with this Association, Purdue University made a series of tests to determine whether or not treatment of tie timber had any injurious effect on the strength of the material. The conclusions arrived at, from these tests, are briefly summarized as follows:—

(1) No weakness was shown by treated ties, as compared with natural ties, either in rail-bearing or spike-holding strength, except in the case of ties treated with crude oil, and, even with that treatment, the weakening in rail-bearing was of a temporary character.

(2) The average stress under the rail at the elastic limit on the various woods was as follow^s: Red oak, 1,131 lbs. per sq. in.; short leaf pine, 642 lbs.; long leaf pine, 690 lbs.; red gum, 830 lbs.

(3) The extremes of atmospheric temperature have an appreciable effect on the strength of wood, especially when green. The warm timber was from 9 per cent. to 17 per cent. weaker than the very cold timber.

(4) The direct pulling resistance of common spikes in the various woods was as follows, in their natural state: Red oak, 7,639 lbs.; short leaf pine, 4,359; long leaf pine, 3,955; red gum, 3,883.

The lateral resistance of screw spikes depends on .he various woods was as follows, loads at elastic limit, in lbs.: Red oak, 2,026; red gum, 1,704; long leaf pine, 1,650; short leaf pine, 1,619.

The lateral resistnace of screw spikes depends on the diameter and length of shank under the head, elastic limit of the metal, and character of the wood.

(6) The screw spike had from 1.7 to 3.8 times the strength of the common spike against direct pull, and from 1.2 to 2.4 times the strength of the common spike against lateral resistance. The smaller screw spikes gave greater lateral and direct resistance per lb. of weight than the larger spike.

The strength of the common spike against withdrawal is increased when driven to follow a bored hole. The shape of the point of a common spike, however, leads it to drive out of a bored hole, and the resistance to withdrawal is thereby lowered.

A very interesting paper on the economic comparison of railway ties of different materials, written by Neil M. Campbell, appears in the "Engineering News" of September 22nd, 1910. The results are summed up in a table giving the order of merit of different kinds of wood treated by the three processes, zinc chloride, creosote, and Rueping, as compared with untreated ties, taking into consideration the first cost in the track and the average life.

Strange to say, the first in order of merit is untreated catalpa wood, but, as the writer does not give the value of treated ties of the same wood, this does not prove that it might not be still more valuable if treated.

The second in order of merit is cypress, also untreated, for which a life of 10 years is claimed, and initial cost in track 54c. The same wood, when treated with creosote, comes 19th in order of merit, having a life of 17.5 years and first cost of 95c. When treated by the Rueping process, the order of merit is 6, life 15 years, and cost in track 81c.

Oaks, untreated, come 30th in order of merit, 23rd when treated with zinc chloride, 15th when creosote is used.

Pine, when treated with creosote, comes 3rd in merit, 28th when zinc chloride is used, and 29th when untreated.

Tamarac, treated by the Rueping process, comes 10th in order of merit, but no mention is made of untreated tamarac or cedar. The table below will illustrate more clearly the comparative values of the woods above mentioned:

| Material. | Treatment. | Average life, years. | Cost in track. | Capitalization, 4%. | Annual cost. | Order of merit. |
|---|---|---|---|---|---|---|
| Catalpa.... | None ........ | 20 | 0.60 | 1.104 | 0.044 | 1 |
| Cypress.... | None ........ | 10 | 0.54 | 1.664 | 0.066 | 2 |
| Cypress.... | Rueping ..... | 15 | 0.81 | 1.822 | 0.073 | 6 |
| Cypress.... | Creosote ..... | 17.5 | 0.95 | 1.952 | 0.078 | 19 |
| Pine....... | Creosote ...... | 15 | 0.75 | 1.687 | 0.067 | 3 |
| Pine....... | Zinc Chloride... | 8 | 0.710 | 2.636 | 0.106 | 28 |
| Pine....... | None ........ | 6 | 0.615 | 2.933 | 0.117 | 29 |
| Tamarac... | Rueping ...... | 15 | 0.81 | 1.822 | 0.073 | 10 |

From the foregoing it appears that, for the best results, different woods require different treatments. The Rueping process is a creosote treatment, and is fully described in the "Railway and Engineering Review," of October 15th, 1910. It differs from ordinary creosoting in that the timber is first put under air pressure sufficient to fill all the wood cells with air. The creosote fluid is then forced in at higher pressure, and the theory is that, after the greater pressure is released, the expansive force of the air throughout the interior of the timber will expel part of the fluid from the cells, leaving the walls of the cells painted with creosote instead of having the cells filled with it.

The cost of treating ties, of course, will vary largely, and will depend, to a great extent, on the numbers treated, the efficiency of the plant, and the nature of the treatment, but the Atchison, Topeka & Santa Fe Railway, who have used the Rueping creosote treatment pretty extensively, report that the cost of treating inferior pine ties is 20 cents.

Mr. Kelly, a member of your committee, reports satisfactory personal experience with the Burnettizing process at a cost of from 15 to 20 cents.

With regard to size of ties, the 8-ft. length, 6-in. to 7-in. thick, with face from 6-in. to 10-in., is in most general use, but it is somewhat difficult to find any logical reason, other than initial cheapness, for adopting an 8-ft. tie for standard gauge track. As this length was adopted, and has been in use for such a long period, it is very easy to understand why the railway companies should hesitate to change, for the transition period would be both troublesome and costly. However, as the weights of rolling stock have more than doubled in the past 20 years, and steel rails have been increased in, roughly, the same proportion, it seems about time to make some correspondingly adequate change in tie dimensions.

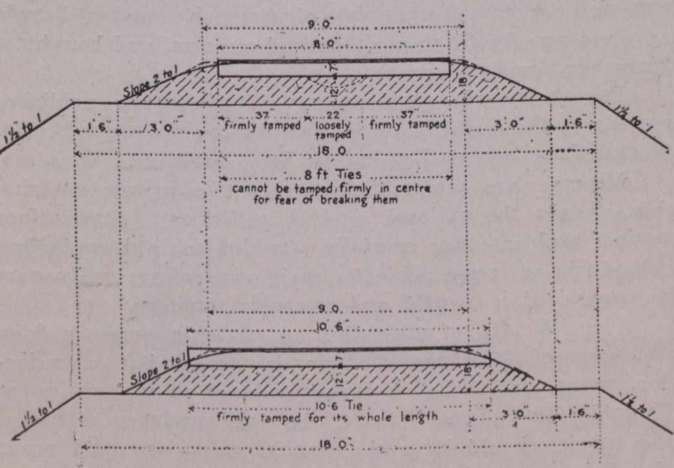
It is true that the spacing of ties has been, of late years, made slightly closer, but, while the loads have been increased from 200 per cent. to 300 per cent., the base of the superstructures to carry these loads, or the base area of the ties under a rail length, has been increased less than 50 per cent. As there is a practical limit to close spacing of ties, on account of the difficulty of properly tamping them when spaced closer than 20-inch. centres, the only resource left is to lengthen them, if more supporting area is required.

The 8-ft. tie, not only does not give sufficient support, but it is impossible to utilize its whole length for fear of breaking it, owing to the distribution of the loads on track of standard gauge.

The distance from the end of an 8-ft. tie to the outer edge of a 5-inch. rail base is about 16 inches, and the best practice is to firmly tamp such ties only 16 inches from the rails each way. The reason for this is that, if fully tamped to the centre of the track, they would give a firmer support, in proportion to the load, at centre than at both ends, and the ties would break. In other words, you cannot utilize much more than 75 per cent. of the bearing capacity of such a length of tie under a standard gauge track, without destroying the tie itself. In order to utilize the full uniform supporting capacity of the tie for its whole length, it should have the same length from the centre of rail to the end of tie, as from former point to centre of track, which would make it 10-ft. 8-in.—say 10-ft. 6-in. long.

It is certain that even the best roads would hesitate to make such a radical change, and, of course, your committee would not presume to say that they should make such a departure from long-established practice, but the fact remains that strong logical reasons can be given for the use of ties 10-ft. 6-in. long, and such reasons cannot be given for the use of 8-ft. ties.

Ties 7-in. thick, 10-ft. 6-in. long, with 9-in. face, would give about 70 per cent. increased support at an increased cost of only 31 per cent. No increased width of ballast section would be necessary for the longer ties, because no shoulder of ballast would be required at the ends of such ties, so that the actual yardage of ballast required would be slightly decreased by the increased space occupied by the ties. This is fully shown on the accompanying diagram, drawn to scale, illustrating how ties 10-ft. 6-in. long may be used in an ordinary ballast section for 8-ft. ties, without requiring any extra ballast.




**Note.**—8-ft. ties tamped firmly for 16-in. each way from rails only utilize the supporting area of 77 per cent. of tie, equal to 74-in. in length, or 740 square inches for a tie of 10-in. face.

10-ft. 6-in. ties could be used in the same ballast section, firmly tamped for the whole length, giving the maximum supporting area of 1,260 square inches, or equal to 170 per cent. the efficiency of 8-ft. ties.

At the present average price of 50c. for 8-ft. ties, they cost about 36 per cent. of 80-lb. rails and fastenings, which would only be increased to 42 per cent. by using the longer ties. The improved condition of track and saving in maintenance of rails and rolling stock would probably soon more than offset the difference in cost of ties.

It has been suggested that longer ties would make drainage more difficult, but, if good ballast is used, there would seem to be no difficulty in that regard, and if the ballast is inferior, the loose tamping under the centre of 8-ft. ties and the shoulder required at the ends of them would form pockets to retard drainage that would be obviated by the use of long ties. Your committee would suggest experimental tests with ties 10-ft. 6-in. long.

The best kinds of wood to use for ties depends upon so many conditions of climate, availability, and cost of timber treated and untreated, that it is very difficult to make definite recommendations.

For general use in our Canadian climate, however, the following woods, if untreated and used with tie-plates, might be recommended, and they are given approximately in their order of merit, having regard to life and initial cost: Cedar, tamarac, oak, yellow pine, hemlock.

For treated ties used also with tie-plates, the order of merit would be about as follows: Yellow pine, tamarac, hemlock, oak.

### Committee of Rails and Rail Fastenings.

The Committee of Rails and Rail Fastenings and Tie Plates were presented by Mr. H. G. Kelly.

The experiments with the new sections have not progressed sufficiently for your committee to present a statement of the results in this report, but the use of the new testing machine is proving most satisfactory, and is producing a uniformity of results in the physical tests at the different mills, which is of much value in the collation of statistics.

In considering the subjects for this year's report, it has seemed to your committee, that the next logical step is to consider the service to which a rail is subjected, and the physical qualities requisite for such a rail, leaving for future investigations the consideration of how such physical qualities can be obtained.

With the increasing traffic of railroads, there followed naturally and of necessity an increase in car capacity and of engine weights. From a freight car weighing about 16,000 lbs., with a carrying capacity of 20,000 lbs., there came gradually an increase to cars having a carrying capacity of 40,000 lbs., 60,000 lbs., 80,000 lbs., and finally 100,000 lbs., with an allowable overload of 10 per cent.

In this transition of car weight and capacity, it is interesting to note, that whereas the cars weighing 16,000 lbs. had a carrying capacity of 125 per cent. of their empty weight, that the cars of to-day carrying 100,000 lbs., with a maximum empty weight of 40,000 lbs., have a carrying capacity of 250 per cent. of their empty weight.

Freight cars having originally about 36,000 lbs., upon eight (8) wheels, or 4,500 lbs. per wheel, were superseded gradually by cars having, when overloaded 10 per cent., 150,000 lbs., upon eight (8) wheels, or 18,667 lbs. per wheel. Engines having 12,000 lbs. per driving axle, or 6,000 lbs. per driving wheel, gave place to engines having 50,000 lbs. per axle, or 25,000 lbs. per driving wheel.

The original weight of rails varied from 35 lbs. to 45 lbs. per yard, but with the increasing weight of equipment the change was rapidly made to 56 lbs., 60 lbs., 65 lbs., 72 lbs., 80 lbs., and finally to as high as 100 lbs. per yard.

The effects of these heavy loads upon track having been investigated both theoretically by mathematical analysis and practically by carefully conducted tests upon the rail and track, under actual train movements.

Allowing 100 per cent. for the impact of rapidly moving trains over the standard track in use in this country, with engine axle loading of 50,000 lbs., we obtain the following, in which the third column would probably be more nearly the correct one theoretically, provided the stresses were due to the effect of the assumed load only.

**Fibre Stress per Square Inch (Tension).**

| Weight of rail per yard. | Between 3 ties as a continuous girder having stable supports. | Between 3 ties as a continuous girder having an unstable centre support. |
|---|---|---|
| 60 lbs. | 24,878 lbs. | 28,000 lbs. |
| 80 lbs. | 16,668 lbs. | 18,750 lbs. |
| 100 lbs. | 11,417 lbs. | 12,842 lbs. |

The stresses shown in column 3 do not reflect accurately the actual condition to which a rail may be subjected, for there is a reversion of stress of tension to compression like the swing of a pendulum under the passage of every wheel.

In addition, the rail is subjected to a continual series of shocks, due to imperfect counter-balancing of engines, flat spots on wheels, irregularity of track surface, the oscillation and jar of equipment, the tension due to contraction in a falling temperature, and the effect of the tractive force of the engines.

To determine the actual effect upon rails by passing trains, a series of careful experiments were conducted on the New York Central and Hudson River Railroad, with a delicate automatic recording machine, by which the actual deformation of the rail could be measured for each passing wheel of a train, and the actual stresses in the rail determined.

These investigations demonstrated that at speeds of 30 to 40 miles per hour, engines having about 20,000 lbs. upon a driving wheel would produce tension stresses in the bottom flange of 80-lb. rails somewhere in excess of that shown in the third column of the preceding table, but well within the safe allowable limits of unit stress for good rail steel.

Experiments upon joints have also shown that a tensile stress of 12,000 lbs. per sq. in. could be produced in the unloaded rail due to its contraction in a falling temperature, before the grip of the angle bars would permit the rail to slip and relieve itself.

An accumulation of these varied stresses in the lighter sections of rail might therefore bring the total stress up close to the "Elastic Limit" or "Yield Point" of some of the rail steel.

The question has sometimes been asked, has the weight of the rail section increased as rapidly as the wheel loading? To this may be answered, Yes! In the days when a 60-lb. rail section was a common standard, an engine axle loading of 24,000 lbs. was not infrequent; this loading produced a tension in the rail under the conditions of column 3 of the table of 13,440 lbs. per sq. in., as compared with 12,842 lbs. per sq. in. for a 100-lb. rail, under an axle loading of 50,000 lbs.

From a study of the preceding conditions it is evident that certain physical characteristics must be secured, in a steel rail, to meet the requirements of modern transportation necessities; briefly these may be recalled as follows:—

(1) The steel must be sound and free from physical defects.

(2) It must be sufficiently hard to resist abrasion reasonably, and also deformation of section.

(3) It must be of uniform texture, tough, but not brittle.

(4) It must have a high limit of elasticity and ultimate tensile strength.

The question naturally arises, can such a rail steel be produced? The answer is, that it has been produced in the past, that it is produced to-day, although not uniformly, and therefore, that it should be produced uniformly in the future.

How to produce a rail steel uniformly possessing such qualities, and how to identify positively when such a steel has been produced, is a work, first, for the manufacturers, and second, for the manufacturers and users of rail jointly, and this knowledge must be the basis of a satisfactory specification in the future.

At the Ottawa meeting last year there was appointed at the suggestion of the Chairman of the Canadian Conservation Committee, a committee on conservation, and the report of this committee which covers some sixty pages, was one of the most valuable reports submitted at the meeting. Briefly reviewed, the report contains the following sub-reports:

(1) From Mr. Breithaupt, Toronto, Ont., 1,200 words on the "Conservation of Water in the Basin of the Grand River, Western Ontario," which empties into the eastern part of Lake Erie. The drainage area is 2,600 square miles, length 160 miles, and fall 1,130 ft. The fall is 600 ft. in the upper 45 miles, or 13.3 ft. per mile, and 530 ft. in the remaining 115 miles, or 4.6 ft. per mile. The steep upper portion to Elora drains nearly one-third of the whole basin area on to a comparative flat above Preston, where a branch, the Speed, adds its quota off 300 square miles of steep country, falling 9 ft. per mile. The problem of preventing waste and gorging on this river, without lake areas, forms an interesting study in conservation.

(2) From Mr. R. W. Leonard, 900 words and an extract from an address on "The Scope of Engineering in Canada," made at Toronto University, November last, 600 words.

Under the head of forests, a widened railway right-of-way of 400 ft. is mentioned as a preventive to forest firing by locomotives, and the Temiskaming and Northern Ontario practice of wide clearing is cited.

The enormously enhanced cost of sawn lumber is exemplified by actual examples of dimension timber bought 23 years ago for $4.50 per thousand on cars, and bought 19 years ago for $7.50 on cars.

For the benefit of intending manufacturers, published records of the quantity of all raw materials gathered, manufactured, or exported would be very desirable.

Minerals are said to be better left to private exploitation, despite the national method in Norway. Precautions against accidents are carefully attended to in Canada, but individuals are responsible for their own safety, and cannot be supervised in a wild and extensive territory.

The difficulty of extracting marketable products from the ores of Northern Ontario is great, but a reduction plant has been designed and put into operation at Thorold, Ont. That Canada, the sole producer of nickel and cobalt, should loose the wages, experience, and profit of refining them is regrettable, especially as the foreign-finished products, such as nickel anodes and commercial cobalt and arsenic are imported by Canadian manufacturers. An American refinery of Canadian nickel employs 2,000 people, who might as well be living in Canada. The mineral production of Canada in 1909 was over $90,000,000—nine times what it was in 1886.

Water powers are mainly confined to the Niagara district, where nearly half a million horse-power is developed. The average cost of a horse-power is $25 per year per 24-hour service, compared with $50 for gas engine and $75 to $150 per year for steam. An example of the improvement in transmission in 1893 is given. At that time a 12-mile line was not possible, while to-day high pressure (110,000 volts) makes possible a 200-mile conveyance.

(3) From Mr. McColl, 700 words on "Water Powers in Nova Scotia." The rivers emptying into Northumberland Strait have small power value, as also the rivers of Cape Breton, except the Margaree River. The granite formation along the south shore and Bay of Fundy holds as usual many lakes, and the outlet streams furnish numerous small powers. The powers developed are listed, and also promising ones not yet developed. The former amount to 12,000 h.p. and the latter to 30,000 h.p. Storage dams are required, and are possible on many of these rivers. Powers belonging to owners of land on each side of the rivers.

(4) From Mr. Sweezey, 900 words regarding "Forests and Water Powers." The greatest danger to standing timber is fire, which, largely, is started by carelessness of settlers. Reforestation is really necessary, as the self-seeding of pine is very slow and uncertain. Wider railway clearings are advised, from which stumps, debris, and grass should be cleared, and the blocking out of forests from lake to lake by wide fire guards is suggested.

**The Committee on Sewage Disposal.**

Another special committee appointed at the Ottawa meeting was a committee on sewage disposal with reference to the pollution of lakes and streams in Canada.

As this is a new question in Canada we have given this report very much in detail.

The rivers and streams of a country are the natural drainage channels into which all of the rainfall, not directly evaporated or taken up by plant growth, must ultimately find its way. A portion of it sinks into the ground and reaches the streams in the generally pure form of springs or seepage through their beds or banks. The remainder flows directly into them over the surface, and naturally and inevitably carries with it a considerable quantity of polluting matter, the character of which will depend upon the nature of the drainage area and density of the population.

The surface drainage from an uninhabited watershed will not generally cause any dangerous pollution, but may add to the color and turbidity of the water to an extent as to make it more or less objectionable for domestic purposes. Streams, however, rising in mountainous or other wild unsettled districts usually furnish good and wholesome water near the source of their supply; but where they pass through populated districts, devoted to farming and other industries, they receive from their banks, and from tributary brooks and rivulets, the drainage from farm yards, dairies, dwellings, manured land, and finally the sewage of villages and towns. Much of the objectionable drainage from country districts is more or less purified by natural processes, but on the other hand a considerable proportion often reaches the streams direct. That this is often highly dangerous in character has been demonstrated in several instances, as at Lowell, Mass. This city, which obtains its water supply from the Merrimac River, was visited in the autumn of 1890 by an unusually severe epidemic of typhoid fever. By careful investigation this was traced to an infection of the river water by a few cases of typhoid fever on a small brook which entered it about three miles above the water-works intake.

It is impossible, or at least impracticable, to prevent pollution of this kind except in the case of streams with very limited watersheds, where the conditions may be made subject to control. In this connection it is interesting to note the case of Liverpool, England. The water supply is obtained from a stream rising in the mountains of Wales, the watershed of which is owned or controlled by the city. This circumstance is not, however, depended upon to ensure the entire safety of the water, which is filtered through slow sand filters before being delivered to the consumers.

So far as the subject of this report is concerned, the pollution of lakes and streams referred to applies particularly to that produced by large isolated institutions, industrial establishments, etc., or by cities and towns provided with systems of sewers and drains. It, therefore, does not deal with all source of pollution, but rather is confined to those cases in which impurities are added, in comparatively large quantities, to water which is already more or less impure. It is important that this should be borne in mind when considering the general question of sewage disposal, and the degree of purification which may be deemed practicable or indispensable.

The necessity for the purification of sewage may be considered from two points of view, first, with regard to the organic matter which it contains, and, second, with regard to its germ content. The inevitable fate of the organic matter is to pass through certain processes of decomposition whereby it is ultimately reduced to harmless mineral forms. Under natural conditions, this may cause nuisances and conditions offensive to the senses. The main object of sewage disposal, as it is at present understood and practised, is to cause this decomposition to take place quickly under controlling circumstances, and at least to such a degree as will prevent it from undergoing further putrefactive changes. All modern methods of treatment are capable of accomplishing this, but without greatly diminishing the number of bacteria present in the raw sewage, where they often occur to the extent of several millions per cubic centimetre. Among them are to be found large numbers of germs from the intestines of man and the lower animals, and these usually include specific germs of disease.

**Sewerage Systems.**

Sewerage systems may be either combined or separate, that is, there may be a single system to carry both the domestic sewage and the street drainage; or the domestic sewage and the street drainage may be kept separate and carried by a system of sanitary sewers and a set of storm water drains. During heavy storms combined sewers will necessarily have to discharge a volume many times greater than the dry weather flow. It is obviously impracticable to attempt to purify more than a small percentage of the storm water discharge. The English Local Government Board requires sewage disposal plants for systems of this kind to have a capacity necessary to provide for six times the dry weather flow. Anything beyond this is discharged without treatment. It is therefore evident that the kind of sewerage system in use, whether separate or combined, will have an important bearing on the questions of the disposal or treatment of the sewage, and the pollution of the bodies of water into which it is finally discharged.

Detailed descriptions of the principles of sewage purification and the different methods by which it may be accomplished, are given in the various published works on that subject. It will be convenient, however, at this point to refer briefly to these methods and to mention a few sewage disposal plants now in operation which illustrate the different processes.

**Early Methods of Sewage Disposal.**

With the introduction of really efficient systems of sewerage, which has taken place almost entirely within the last fifty years, the first and most obvious method of disposal was to turn the sewage into the nearest body of water. Incidentally, it may be stated that this is still the practice in the majority of cases in every country with the exception of England. There, the density of the population, the great number of large manufacturing cities, and the small size of the rivers, soon combined to produce conditions which urgently demanded some measures of relief. The first method employed was Broad Irrigation, or Sewage Farming. The results obtained were in many cases fairly satisfactory, but the difficulty in obtaining the required areas of suitable land, and certain objections from a sanitary standpoint have led to a gradual restriction in their use, and even to their abandonment in Birmingham and several other places.

Many other systems involving chemical treatment of the sewage were attempted, but generally with indifferent success in the way of real purification. The example of England was followed to some extent in other parts of Europe and in the United States. In the latter country intermittent filtration through prepared beds of underdrained sand and gravel has been used with great success in some of the Eastern States where the natural conditions are favorable. Generally, however, there has been little development until within the last twelve or fifteen years. During this period the newer methods of sewage disposal, or the so-called "biological processes," have been more fully studied and developed, and are now being almost universally adopted.

### Modern Methods of Sewage Disposal.

These may be said to consist in a general way of two processes, viz.: (1) the separation of the greater part of the suspended matter or sludge, and (2) the oxidation of the remainder and of the organic matter in solution, in artificially prepared beds or filters. The first, or sedimentation process, is accomplished by screening the sewage and passing it through sedimentation, chemical precipitation, and septic tanks, and the deep tanks of the Hampton and Imhoff types.

In the second or oxidation process, there are two general methods employed, viz.: Contact Beds or Percolating Beds. These beds are commonly called filters, though the process is not one of filtration.

**Contact Beds** are briefly watertight basins, 4 or 5 feet in depth, filled with crushed clinker, coke, coal, broken stone, screened gravel, or any hard substance, broken to the proper size, which is usually from ¼-in. to 1½-in. The tank effluent is applied to the beds by means of overflowing grooves and troughs and through open jointed pipes. When the bed is filled to within a few inches of the surface, the inflow is stopped and the bed is held full for two or three hours. Next, the effluent valves are opened, allowing the beds to empty slowly and the interstices to fill with air. The beds are then allowed to remain empty for a time, when the entire process is repeated. The time of a complete cycle thus includes the periods of filling, resting full, emptying, and resting empty. Ordinarily, there are three such cycles in twenty-four hours. The beds are usually operated in groups, and the valves are opened and closed at the proper times by automatic devices. In many cases it is necessary to pass the effluent from the first contact beds through a second set.

**Percolating Beds** are sometimes referred to as Trickling or Sprinkling Beds or Filters. In this instance the materials used are the same as in contact beds, but usually of larger size. The walls need not be watertight, their purpose being merely to support the material of the bed. They are usually from 6 ft. to 8 ft. deep. The sewage is distributed over the surface of the beds in the form of a spray from jets placed at regular intervals, or from travelling distributors usually operated by power. The operation is continuous, the sewage trickling through the material of the bed and carrying the air down with it. The concrete floor of the bed is provided with a system of underdrains through which the effluent discharges.

### Efficiency of the Different Processes.

The degree of purification effected by the different methods referred to may be briefly stated as follows:

**Sewage Farming.**—Where sufficient areas of well drained suitable soil are available, the effluents are usually non-putrescent and often of a comparatively high degree of purity. The percentage reduction of bacteria is also satisfactory both with respect to the total number and to Bacillus Coli, which is a representative intestinal germ. In many cases, however, where there is careless management, over dosing, and a non-porous subsoil, the purification is inferior and the effluent contains large numbers of bacteria.

**Intermittent Filtration.**—Under favorable conditions this is the most efficient of all processes, the effluents being uniformly non-putrescent and the bacterial contents comparatively low, usually less than 10,000 per c.c. These results are not, however, always attained in practice, especially during the winter and early spring.

**Contact Beds.**—Treatment by single contact effects a moderate degree of purification, but a second treatment is generally necessary to secure a non-putrescible effluent. The removal of bacteria is imperfect, the effluent frequently containing a million or more per cubic centimetre.

**Percolating Filters.**—The purification effected by this process is superior to that obtained by double contact. The effluent is ordinarily non-putrescent, but at intervals it contains an unusually large proportion of suspended matter. When the removal of this is necessary it can be readily provided for by small sedimentation basins. The percentage reduction in bacteria is higher than with contact beds, but is still so low as to be of little importance from a sanitary standpoint.

From the experience of the last few years with contact beds and percolating filters on a working scale, and from the results of several series of experiments carried out in the United States, Germany, France, and England, the consensus of opinion seems to be in favor of the percolating filter, and this is the process which is now being adopted in the majority of cases, both in the United States and Europe. Manifestly the operation of either system during the winter season in cold climates will be attended with special difficulties. Two contact bed installations, one for the sewage of Macdonald College at Ste. Anne de Bellevue, and the other for a small district in Toronto, are reported to be working satisfactorily; and at least two percolating filters are being built in connection with institutions in Quebec.

In the colder parts of Canada no demonstration has yet been made of their possibilities, though several plants are contemplated, or are already in course of construction in Saskatchewan and Alberta.

Dunbar, a German authority on sewage disposal, states that "the object of sewage disposal may be briefly described as an attempt to preserve our rivers in a natural condition, to guard them against visible pollution, and to prevent danger to the health of those living near them."

These requirements can be fulfilled under all circumstances by methods described above. To what degree purification should be carried out, or whether it is necessary at all, will depend on local circumstances, each case requiring separate consideration. In large rivers such as the Ottawa and the St. Lawrence, the raw sewage of even large cities can be discharged without sensibly offensive results. The dilution is so great that the organic matter soon disappears under the action of natural processes of purification. The same is, in general, true of large lakes, where the sewage is discharged a sufficient distance from the shore. Where, however, the stream or lake is small and the volume of sewage discharged is relatively large, one or other of the complete processes must be employed, which will produce a non-putrescible effluent. In England, where the conditions are most unfavorable, this is practically the universal requirement; and the same may be said of Germany, France, and the United States.

When the water of a river or lake is to be used for domestic purposes, the aspect of the case is entirely changed. The presence of intestinal bacteria, which cause typhoid and other diseases, undoubtedly constitutes a menace to health; and while their tendency is to die, and eventually disappear, they may persist in sufficient numbers to render the water dangerous for drinking purposes for long distances from the point of discharge. Modern sewage disposal methods do not prevent such contamination. Unavoidable pollution of the same nature from combined sewerage systems, and from country districts, has already been discussed. Hence the only feasible method of securing complete protection for surface water supplies would seem to be the filtration of the water by the towns and cities using it. In Germany this is required by law for all surface supplies.

There may, however, be special circumstances such as the close proximity of a sewage outfall to a waterworks intake, which would render the filtration of the water unusually difficult or expensive; or where, as in the case of Baltimore, a shellfish industry is threatened. In such cases further treatment for the purpose of disinfecting the effluent, or the removal of the bacteria, should, if possible, be employed. The latter can be accomplished to a great extent by filtration through sand. Disinfection of effluents and even of raw sewage, by various chemicals, has been practised in emergencies for some time, but the high cost of the materials, and the large quantities employed, render it generally prohibitive on the score of expense. But within the last four or five years, experiments by Rideal, in England, and Phelps and others in the United States, have shown that filter effluents can be sterilized to the extent of destroying practically all the harmful bacteria by the use of chloride of lime or bleaching powder, and at an estimated cost of from $1.50 to $3.00 per million gallons of sewage. Tank effluents and even raw sewage can also be sterilized but at a considerably greater cost. Plants of this kind are contemplated for several places in the Atlantic States where the circumstances warrant their necessity. It should be observed in this connection that chloride of lime has lately been successfully used for the disinfection of water supplies, and at a mere fraction of the cost of treating sewage.

### Conditions in Canada.

Coming now from the foregoing general survey of the subject to consider more particularly the conditions in Canada, we find that with its large lakes and rivers, and its relatively small population, it has so far suffered less from inadequate methods of sewage disposal than most countries. For the purpose of obtaining definite information, a list of questions was sent to all places with populations of 1,000 or over. These questions with the answers are appended to this report (Appendix I.).

The list was sent to 327 places in all, and replies were received from 166, distributed by provinces as follows:

| Province. | Questions Sent. | Replies Received. |
|---|---|---|
| Prince Edward Island | 2 | 0 |
| Nova Scotia | 34 | 20 |
| New Brunswick | 15 | 9 |
| Quebec | 40 | 24 |
| Ontario | 164 | 80 |
| Manitoba | 17 | 9 |
| Saskatchewan | 12 | 5 |
| Alberta | 20 | 10 |
| British Columbia | 23 | 9 |

The replies may be briefly summarized where necessary as follows:

Question 1. 64 places report combined systems, 38 separate, and 64 none at all.

Question 2. Of those reporting from the Maritime Provinces, the discharge in every case but one is into the sea coast harbors or tidal estuaries unfit for domestic water supplies.

Quebec reports 8 discharging into the fresh water portions of the St. Lawrence or into the Ottawa, and 13 into smaller rivers.

Ontario reports 20 discharging into the St. Lawrence, or into the Ottawa River, or into the Great Lakes, and 30 into smaller rivers and lakes.

Manitoba reports 5 discharging into the Red and Assiniboine Rivers.

In Saskatchewan, 2 discharge into the Saskatchewan River and 2 into small creeks.

In Alberta, 3 discharge into the Saskatchewan, 5 into smaller rivers.

Question 3. The Maritime Provinces, Quebec, and Manitoba report no sewage disposal plants.

British Columbia reports 1 place with tank treatment.

In Ontario there are 15 reported, 9 with tank treatment only, 4 with tanks and bacteria beds, 1 intermittent sand filter, and 1 with treatment on land.

Saskatchewan and Alberta each report 1 place with septic tanks and a few others in which the newer processes are contemplated at an early date or are actually under construction.

That is, only 18 places report any kind of purification, and in 12 of these it is limited to treatment in tanks.

Questions 5, 6 and 7. Of the 166 places reporting, 145 have water-works. Of these, 36 have supplies from underground sources, 44 obtain their supplies from small lakes and streams in practically uninhabited watersheds, 25 from the Great Lakes and the St. Lawrence and Ottawa Rivers, and 40 from lakes and streams liable to some contamination by sewage.

14 places report mechanical filters for the water supply, 1 place a slow sand filter, and 9 natural filtration through river beds. In Toronto and Montreal the water is treated with hypochlorite.

The information furnished by these replies shows that not much has yet been done in Canada, in the way of the purification of either water or sewage. At the same time, it indicates that favorable local circumstances in many cases have so far prevented any serious consequences. Nowhere in Canada do such adverse conditions exist as are frequently met with in other countries, as for example, on the Hudson, Merrimac, Passaic, Susquehanna, and other rivers in the United States. These facts do not detract from the importance of the subject of this report, but rather serve to emphasize the necessity of taking prompt and effective measures to put an end where possible to any present pollution of the lakes and streams and to prevent it in the future.

In the Maritime Provinces the sewage is in most cases discharged into sea water unfit for domestic supplies, and where the dilution is sufficient to prevent nuisances. In such cases there is no immediate need of sewage purification.

In Quebec and Ontario, many of the towns discharge their sewage into, and obtain their water supplies from, the Ottawa and St. Lawrence Rivers or the Great Lakes. While the dilution is great, the water is, in important cases, unsafe for drinking without previous purification, and sometimes the effect of eddies results in the contamination of the water supply by the sewage of the same place. In such places, at least, thorough purification of the sewage as well as filtration of the water may be necessary.

The need of both water filtration and sewage purification will obviously be greater in the interior sections of these provinces, where the only available source of water supply may be from the smaller lakes and rivers tributary to the St. Lawrence and Ottawa Rivers and the Great Lakes.

In the Northwest Provinces the water supply problem is an unusually difficult one, as it must in many cases be obtained from the rivers which receive more or less directly the discharge from all sewerage systems.

In British Columbia the conditions on the coast are similar to those in the Maritime Provinces. Up to the present time the water supplies have been obtained from mountain streams or lakes whose water sheds can be protected. The necessity for sewage purification is therefore far less urgent than in the interior provinces.

(This discussion will be continued in the next issue).

# CONCRETE SECTION

## GENERAL CONCRETE PRACTICE.*

By Thomas Potter, M.C.I.

Concrete practitioners in the past engaged in building practice appear to have kept their experience very much to themselves, except in connection with engineering works and specialties in connection with reinforcement for walls, floors, roofs, and similar purposes, which have been dealt with in a voluminous manner by specialists and patentees. This paper, therefore, has been confined to the use of concrete in connection with buildings, apart from any association with reinforcement or steelwork, for the consideration of which the limited time at disposal does not permit.

Theory and Practice: Concrete and its application appear to set most theories at defiance—many that have been proposed hitherto, with every good reason for acceptance, have been negatived in practice. No doubt, eventually there will be much valuable information and data made common in connection with the use of concrete that may be relied on by the architect, builder, and clerk of works. At present the information available is not altogether of that character. For this reason treatises on concrete, written only a few years ago even, based principally on theoretical deductions should be read with caution. Its very simplicity has led to its abuse, for it has been and is still often considered that anything nearest to hand—for instance, pit gravel of any description, broken stone and brickbats mixed with all kinds of rubbish–will do for an aggregate, that the cheapest cement in the market is quite good enough for a matrix, and that the cleanliness of the water requires no consideration—anything will do. This is altogether wrong.

Suitable Aggregates: The principal materials more or less adapted for aggregates, most of which I have used, are granite and other stone quarry chippings, broken brick or tile-yard debris, burnt clay, slag chippings from iron ore, flints, furnace or boiler ashes, coke breeze, and chalk. Chalk would be rarely used in an ordinary way, more especially the top stratum, which is soft, porous, and easily affected by frost, but I have used it where it was difficult to obtain any other except from a long distance. For small holdings in chalk districts, no doubt, good substantial dry walls can be made with chalk concrete where better aggregates cannot be obtained.

Coke Breeze: Coke breeze as an aggregate is thought by many to be beneath notice. It was extensively used for many years, principally for floors, but I submit undeservedly lost its character some time since through a letter in the "Times" telling of its failure in Germany, where it had been prohibited. It was not stated, I believe, of what class of coal it formed the residue, and this is an important point. I have seen some in Scotland totally unfit for concrete purposes, but not in England. This letter was followed by others telling how it was of such an inflammable nature that if exposed to a severe fire it was second only to coal in assisting combustion. Another letter stated that it disintegrated in the course of a few years and crumbled away. It was a case of giving a dog a bad name, I think. So far as its strength is concerned Mr. Kirkaldy made some experiments for the West Ham Corporation some years since, with the following results: A brick pier 18 in. square and 18 in. in height made with best stock bricks and blue lias lime mortar, crushed at the end of two years with 46 tons per square foot; a similar pier of Harold Wood bricks and blue lias lime mortar crushed with 75 tons per square foot; another pier made of six parts of coke breeze to one part of Portland cement crushed with 131 tons per square foot. As to inflammability, the tests made by the Fire Prevention Committee with various kinds of floors, each under similar conditions exposed for three hours to an increasing and ultimate temperature of 1,900 deg. F., and water played on them from a hosepipe, gave the following results: Coke breeze and burnt ballast equal and best—each was found, after being allowed to cool, practically free from cracks or deflection—and Thames ballast and granite chips the worst. I have used some thousands of tons of coke breeze for floors and do not remember a failure of any kind therewith. I am aware that coke breeze is condemned by many as an unsuitable aggregate. I can only speak from my own experience; and although it is not, taken altogether, the best material for floors and roofs, I have found it one of the best. But like other materials there are good, bad, and indifferent qualities; I have known ashes from dustholes to be mixed with it.

Ashes: One of the best aggregates for most purposes is ashes from locomotive boilers. It contains no impurities, is obtainable at most railway stations, and is inexpen-

*Abstract of paper read at the meeting of the Concrete Institute held on December 15th, at the Royal United Service Institution, Whitehall, S.W.

sive; but one company (the London and South Western) allow their engine-drivers when passing through a lias limestone district to use fragments of limestone in the furnaces to economize the coal consumption; how they obtain it I cannot say, but it is not very perceptible among the ashes, and does not shake perhaps for some time after the concrete has been in place, but when it does it entirely ruptures the concrete. I have known floors and stairs to be entirely reconstructed as a result. I believe no other railway company sanctions this, but where locomotive ashes are employed inquiry should be made relative thereto.

Plaster of Paris: As is well known, plaster of Paris was used as a matrix previous to the employment of Portland cement. Where alterations have been made to buildings with floors of this description the old concrete has sometimes been re-used as an aggregate, with the result that expansion has taken place and the concrete been ruined. Aggregates that have passed through fire are charged more or less with sulphur, and slag from iron ore more than any other. The only way to liberate the sulphur that I know of is to expose it to the atmosphere for as long a period as possible. I have used slag that had been aerated for a long period, which made concrete less susceptible to change of form than any other aggregate. United States Government tests have proved that the carbonate of lime, which forms so large a constituent of Portland cement, neutralizes the effect of sulphur in aggregates to a great extent.

Parts of Aggregates equivalent to Sand: It is usual to specify that the sandy and dirty element in some aggregates shall be screened out and replaced by coarse, sharp sand, but I could never understand the object of this. The coarse sandy element of suitable aggregates, such as slag furnace ashes, brick debris or crushed stone chippings, is every way as good as pit or Thames sand, but it is desirable to eliminate the portion below the size of coarse sand, and I assume it is considered impracticable to remove one without the other. But my experience is that it is more economical and effectual to wash out the fine dirty and dusty particles and leave in the coarse sandy ones. Strange to say, I cannot call to mind ever at any time mixing sand with an aggregate or being called upon to do so. River gravels as a rule contain sufficient, and a stone crusher can be set to reduce any material to make quite enough for the purpose.

Grading Aggregate: The size of the aggregate has long been a disputed point, but United States Government tests have confirmed what has always been my practice, namely, that no matter the purpose for which it is used, the coarser the aggregate, provided perfect homogeneity or denseness is secured, the stronger the concrete. The size, however, depends upon the nature of the work. A very coarse aggregate so that it is graded by intermediate sizes down to that of coarse sand, would be the best for wide and deep foundations, but far too coarse for floors, roofs, walls, or partitions; it depends entirely upon their thickness. It has been attempted to standardize the size of aggregates for various purposes, but I submit that it is impossible. It depends entirely upon good grading, and there are few materials which come to hand in their natural state or converted by a crusher that are well graded.

Cleanliness: The cleanliness of the aggregate is another factor of the greatest importance. Most aggregates are unclean, except perhaps, river gravel from a quick-running stream. Very few pit gravels are clean, and as a rule they are the most difficult to wash. They are usually mixed with unctuous clay, which is difficult to get rid of and which is injurious to cement. If clean the particles are usually of a rounded shape, the result of attrition at some former period and not a desirable one for an aggregate. It may be thought that quarry waste, brickyard debris, slag, and materials generally that have passed through fire, are quite free from deleterious matter, but they are not. If they have passed through fire and been broken by hand, or by a stone crusher, the particles will be found covered with a fine impalpable dust, almost imperceptible. If washed in a tub, as an experiment, and kept well stirred, the water will be found charged to a considerable extent with this dusty element which is injurious to cement. Practically nearly all aggregates are very much improved by washing, which is an economic process if measured by strength.

Mixing Concrete: The aggregate and matrix should be turned over twice dry and twice while water is being added, and never less. The more they are mixed the better the concrete, and the more readily the various sized particles find their respective positions in the mass. For many years it was advocated that only as much water should be used as will coat the aggregate with the cement and render the concrete of a sticky character. Actual practice is convincing enough to prove that this is wrong. The particles of the aggregate do not slide easily into place, and the concrete is not dense. But if the concrete is in a sloppy condition, better homogeneity, or denseness, is the result. It is almost needless to say that the water used in mixing concrete should be clean; if otherwise it is equal to using an unclean aggregate.

Concrete Walls: The disadvantage of building monolithic concrete walls is the cost of the forms or shuttering necessary for forming the troughs in which the concrete is to be deposited. In some cases it is common knowledge that it has cost as much as the concrete. In addition, unless it forms a backing to stone or brickwork, it has to be cemented or rough cast externally, so that the cost is often more than brickwork. For buildings of some magnitude of a plain character, free from irregularities of plan, and of a simple design such as warehouses, farm buildings, and factories, it can be used in most cases to advantage, so far as regards cost, while it possesses much greater strength and durability and freedom from the necessity of repairs more so than ordinary brick walls. It is too early to affirm how long monolithic Portland cement concrete buildings are going to last, but there is not much doubt on that point. The oldest in this country probably does not exceed forty-five to fifty years. With regard to monolithic concrete walls being weatherproof, I have never known an instance of their being otherwise, if they were cemented or rough-cast externally. We are told at times that plastered concrete walls are subject to condensation, but they are not more so than walls of stone or brick or as much, with the further advantage that after a period of six months or thereabout condensation very rarely occurs in an ordinary house, owing to the walls being of a more equable temperature. The concrete walls of a public building, when the latter is crowded, may give evidence of condensation, but that does not come within my experience. As a hygienic material concrete is superior to any other. If we go into the rooms of a brick house after they have been shut up for some time, there is often a musty, fungusy smell prevailing. I never found this in a concrete house or cottage after being closed for a time. The rooms in a well-built concrete house are cooler in summer and warmer in winter than those of a brick house, as concrete walls are more equable in temperature owing to being non-absorbent and not so readily chilled as brickwork.

The Future of Concrete: With regard to the future of concrete for buildings and allied purposes in large towns, its present use seems to indicate that it will be confined principally to floors and roofs, and in connection with skeleton steel frame construction and certain purposes for which cement and granite chips can be employed such as pavings, steps, stairs, sills, lintels, etc. Monolithic reinforced walls will possibly not find much favor; there is the difficulty of external surface treatment, the cost of temporary forms and minor difficulties which would not occur in most districts. In the country there should be more scope for the use of concrete. Eventually, concrete buildings may be, and should be, a distinct occupation. The walls of factories, workshops, warehouses, and a similar class of buildings where no great architectural efforts are needed, and which are simple in plan and arrangement, can be built at a less cost than with brick or stone, and for farm buildings it is still better adapted as it is applicable not only to walls, but to pavings for live-stock places and for floors, and almost the entire fitments. Mangers, feeding-troughs, water-troughs, tanks for storing rainwater, stable stall divisions, channel gutters and manure pits, are all better executed with concrete than with any other material, and at a less cost. Buildings of this class are practically free from the farmer's enemies, rats and mice, or can be made so with a little care. Rats, the most cunning of rodents, very much dislike concrete buildings. They can bore their way through a brick wall, but they never attempt to practise on a well constructed concrete wall, and are averse to occupying buildings that afford no better retreat than open doors and harbors of refuge which are not out of reach of man and dog. On hygienic grounds it is superior to most other materials for farm buildings. Healthy surroundings are almost as much a necessity for cattle as for human beings. For cottages and buildings, for small holdings, it is also well adapted. Where low-lying grass lands and meadows are intersected by running streams there is a necessity for foot bridges, cattle bridges, sluices, hatchways, sheepways, etc., and for which there is nothing can compare with concrete for economy of cost and durability.

## NEW INCORPORATIONS.

**Montreal.**—J. M. Orkin Company, $500,000; J. M. Orkin, J. M. Malherbe, C. Reid, Westmount. Hill Motor Car Co., $25,000; R. Hill, J. Trotier, E. Trotier. British-Canadian Lumber Corporation, $20,000,000. G. V. Cousins, O. B. MacCallum, P. F. Brown.

## EXPERIMENTS ON FLOW AND MEASUREMENT OF WATER.

(Continued from Page 220).

the head of the flume. The flow is controlled by a sluice valve, and two ground-cocks, fitted to the flume for bypassing water from it to the waste channel, serve to further control the level of the water. On the end of the pipe a sack was tied to minimize disturbance in the entering water. The steadiness of the pool thus obtained was remarkable. Fig. 2 shows the reflection of objects on the surface of the water during an exposure of 2½ minutes, and when the depth of water flowing over the crest of the notch was 4 in.; Fig. 3 shows the appearance of the flow when H was 3.5 in and the exposure was 20 seconds.

**Width of the Channel of Approach.**—To find the effect upon the discharge of the width of the channel of approach, false sides made of wood were placed in the flume. They extended the full depth of the flume, and for a distance of 3 feet in the direction up-stream, and were capable of being fixed in any position. The fine right-angled notch was used.

Two sets of experiments were made, in one of which a head of 3 inches was maintained, and in the other a head of 4 inches. They show that in order that the flow may be independent of the channel width, the latter must be at least eight times the head.

**Combined Effect of Width and Depth of the Channel of Approach.**—The floor was placed upon staging erected in the flume, and on a level with the vertex of the notch, and the adjustable sides placed on the floor. With a very narrow channel the increase in the flow produced by the presence of the sides is, accidentally, very nearly equal to the diminution produced by the skin friction, so that the co-efficients have approximately the values which they have for the full dimensions of the channel of approach.

Dr. Thomson gave 0.305 as the average value of the co-efficient c for heads ranging from 2 to 7 in. It is a proof of Dr. Thomson's genius as an experimenter that, with the crude apparatus at his disposal, he was able to arrive at such an accurate result.

The table shows the practical application of the curves of experimental results. The values of the co-efficient c are taken from one of the curves of a plotted result of the experiment, the corresponding flows in cubic feet are then calculated from the formula $Q = c H^{5}/_{2}$, and the flows in gallons, by taking 1 cubic foot = 6.23 gallons.

| Head in Inches. | Value of Co-efficient C. | Flow in Cubic Feet. | Flow in Gallons. |
|---|---|---|---|
| 2 | 0.3104 | 1.755 | 10.94 |
| 2½ | 0.3084 | 3.045 | 18.97 |
| 3 | 0.3068 | 4.782 | 29.79 |
| 3½ | 0.3057 | 7.002 | 43.63 |
| 4 | 0.3047 | 9.750 | 60.74 |
| 4½ | 0.3038 | 13.05 | 81.29 |
| 5 | 0.3032 | 16.95 | 105.6 |
| 5½ | 0.3026 | 21.46 | 133.7 |
| 6 | 0.3021 | 26.63 | 166.0 |
| 6½ | 0.3017 | 32.49 | 202.4 |
| 7 | 0.3013 | 39.05 | 243.0 |
| 7½ | 0.3009 | 46.34 | 288.7 |
| 8 | 0.3006 | 54.06 | 338.9 |
| 8½ | 0.3003 | 62.92 | 392.0 |
| 9 | 0.3000 | 72.90 | 454.2 |
| 9½ | 0.2998 | 83.33 | 519.2 |
| 10 | 0.2995 | 94.70 | 590.0 |

Table showing flow of water per minute through a 90-degree narrow surface notch.

**Degree of Accuracy of Results.**

The tank calibration is considered correct to within 1 part in 500. An error of 1/500 in. in the estimation of the head affects the result at 1-in. head by 1 part in 200, and at 5-in. head by 1 part in 1,000. The zero level on the gauges and the level of the water at any head can be read to about 0.001 in., so that the head can be estimated to 1/500 in. The time intervals are considered correct to 1 part in 1,000. In general, an individual result is considered correct to 1 part in 200, while the curves which give the average values of many results are considered correct to 1 part in 300, or they give the true discharges for the specified conditions to one-third of 1 per cent.

# CONSTRUCTION NEWS SECTION

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

## TENDERS 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. |
|---|---|---|---|
| Edmonton, Alta., supply of tile and angles | Jan. 28. | Jan. 19. | 203 |
| Moose Jaw, Sask., supply of coal | Feb. 6. | Jan. 19. | 203 |
| Ottawa, Ont., post office fittings, Lindsay, Ont. | Jan. 30. | Jan. 19. | 203 |
| Ottawa, Ont., fittings, Postal Station B, Toronto, Ont. | Jan. 30. | Jan. 19. | 203 |
| Ottawa, Ont., post office fittings, Battleford, Sask. | Jan. 30. | Jan. 19. | 203 |
| Ottawa, Ont., electric light fixtures | Jan. 25. | Jan. 19. | ·03 |
| Ottawa, Ont., wharf | Feb. 13. | Jan. 19. | 203 |
| Ottawa, Ont., marine boiler | Feb. 15. | Jan. 12. | 66 |
| Ottawa, Ont., public building, Mount Forest, Ont. | Jan. 30. | Jan. 12. | 163 |
| Ottawa, Ont., tender for rails | Jan. 24. | Dec. 22. | 66 |
| Ottawa, Ont., tender for rail fastenings | Jan. 24. | Dec. 22. | 66 |
| Ottawa, Ont., twin screw steel steamer | Feb. 15. | Dec. 29. | 821 |
| Ottawa, Ont., departmental bldg | Feb. 28. | Jan. 5. | 131 |
| Ottawa, Ont., breakwater | Jan. 30. | Jan. 5. | 131 |
| **Souris, Man., water works supplies** | **Feb. 1.** | **Nov. 24.** | **54** |
| South Middleton, Ont., schoolhouse | Mar. 15. | Jan. 12. | 163 |
| Toronto, Ont., low level interceptor | Feb. 7. | Jan. 5. | 60 |
| Toronto, Ont., venturi water meters | Jan. 31. | Jan. 19. | 74 |
| Toronto, Ont., right to cut pulpwood | Apr. 10. | Jan. 19. | 203 |
| Toronto, Ont., power house | Jan. 30. | Jan. 19. | 203 |
| Vancouver, B.C., road roller | Feb. 7. | Dec. 29. | 68 |
| Winnipeg, Man., pumping plants | Feb. 6. | Jan. 12. | 66 |
| Victoria, B.C., addition to Court House | Feb. 2. | Jan. 19. | 203 |
| Victoria, B.C., purchase of ship | Jan. 24. | Jan. 19. | 203 |

### IS YOUR ADDRESS CORRECT?

Readers of The Canadian Engineer are urgently requested to examine the manner in which their copies of the paper are addressed. If the subscriber's name or address is spelled wrongly, or if the wrong address is given on the label or wrapper, kindly notify The Canadian Engineer, Department J, at once. The mail sheets are now being thoroughly examined and rectified, and it is requested that all subscribers co-operate to make them exactly right. If the name and address are printed correctly on the mail sheets, the subscriber will get his paper much sooner than otherwise.

## TENDERS.

**Mont-Laurier, P.Q.**—Tenders will be received until February 20th, 1911, for the construction of a water supply for the municipality of Mont-Laurier, County Labelle, P.Q. Anthime Dubreuil, Mayor of Mont-Laurier, Radide de l'Orignal, P.Q. (Advertisement in the Canadian Engineer.)

**St. George De Beauce, Que.**—Tenders will be received until February 13th, 1911, for the construction of an iron and concrete bridge on the Chaudiere River, St. George De Beauce. Chas. Bolduc, Secretary-treasurer.

**Ottawa, Ont.**—Tenders will be received until February 14th, 1911, for the supply and delivery of waterworks supplies. Newton J. Ker, city engineer, Ottawa. (Advertisement in the Canadian Engineer.)

**Ottawa, Ont.**—Tenders will be received until February 14th, 1911, for the supply of civic supplies. Newton J. Ker, city engineer, Ottawa. (Advertisement in the Canadian Engineer.)

**Ottawa, Ont.**—Sealed tenders will be received until January 30, 1911, for the construction of three 260 cubic yard dump scows for Vancouver, B.C. R. C. Desrochers, Secretary Department of Public Works, Ottawa.

**Ottawa, Ont.**—Tenders will be received until February 13th, 1911, for the construction of a steel tug boat for Vancouver, B.C. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

**Ottawa, Ont.**—Tenders will be received until February 20th, 1911, for the construction of an extension to the wharf at Ste. Famille, Island of Orleans, Montmorency County, Que. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

**Kingston, Ont.**—Tenders will be received until January 30th, 1911, for the supply of 4,000 barrels cement, more or less Portland cement, sewer pipe, hardware, lumber for walks and crossings, sand and street grates. H. B. R. Craig, city engineer.

**Pembroke, Ont.**—Tenders will be received until February 13th, 1911, for the laying and jointing of water mains, etc. A. J. Fortier, town clerk, Pembroke, and T. Aird Murray, consulting engineer, Toronto. (Advertisement in the Canadian Engineer.)

**Pembroke, Ont.**—Tenders will be received until February 13th, 1911, for laying and jointing an intake pipe, etc. A. J. Fortier, town clerk, Pembroke, and T. Aird Murray, consulting engineer, Toronto. (Advertisement in the Canadian Engineer.)

**Toronto, Ont.**—Tenders will be received until January 31st, 1911, for a travelling crane. G. R. Geary (Mayor), chairman Board of Control, City Hall, Toronto. (Advertisement in the Canadian Engineer.)

**Toronto, Ont.**—Tenders will be received until February 13th, 1911, for the several works mentioned as follows:—Concrete paving, etc., hardware, sliding poles, covers for sliding pole openings, metal weather-strips, light fixtures and stable fittings. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto.

**Toronto, Ont.**—Sealed tenders will be received until January 31st, 1911, for the construction of sewers on Summerhill Ave., Douglas Drive, Shaw Street, Junction Road, Awde Street, Davenport Road and Weston Road. G. R. Geary (Mayor), Chairman Board of Control, Toronto City Hall.

**Winnipeg, Man.**—Tenders will be received until March 1st, 1911, for the supply of asphalt for street paving for the city of Winnipeg. M. Peterson, secretary, Board of Control, Winnipeg.

**Winnipeg, Man.**—Tenders will be received until February 1st, 1911, for the supply of labor and material for the masonry work and iron work required in the erection of three gateways on Cornish Avenue, Armstrong's Point. M. Peterson, secretary, Board of Control Office, Winnipeg.

**Calgary, Alta.**—Tenders will be received until January 31, 1911, for the erection of timber trestle, including end and central towers over South Fork of Old Man River. N. E. Brooks, division engineer, C.P.R., Calgary.

**Strathcona, Alta.**—Tenders will be received until March 1st, 1911, for engine, boilers, and generator. David Ewing, chief engineer, power house, Strathcona, Alta. A. J. McLean, city engineer. (Advertisement in the Canadian Engineer.)

**Regina, Sask.**—Tenders will be received until January 31st, 1911, for the supply of trolley poles and railway ties. L. A. Thornton, city engineer.

**Arelee P.O., Sask.**—Tenders will be received until February 1st, 1911, for the purchase of materials and the construction of a school house. Fred Strate, secretary-treasurer, Arelee P.O., Sask.

**Moose Jaw, Sask.**—Tenders will be received until February 6th, 1911, for one year's supply of mine-run steam coal for the city power house. W. F. Heal, city clerk.

## CONTRACTS AWARDED.

**Amherst, N.S.**—The Nova Scotia Car Company, the successor of the Silliker Car Co., has received a contract from the Grand Trunk Pacific for five hundred steel underframe box cars. The company has also received a contract of 1,200 box cars from the Canadian Northern.

**Montreal, Que.**—The Union Oil Company of San Francisco has been given the contract for supplying fuel oil to the Canadian Pacific Railway steamships on the Pacific coast, and within a week the erection of a huge storage tank will be started at Vancouver. The oil will be conveyed to the steamers by a long pipe from the tank to the new Vancouver pier. The Princess May is at present being fitted with oil-burning engines, and it is the intention of the company to eventually equip all their Pacific coast steamships with the same apparatus.

**Ottawa, Ont.**—The Municipal Electric Department, Ottawa, has awarded the Canada Foundry Company, Toronto, the contract for ornamental posts, etc., the contract price being $6,951.

**Ottawa, Ont.**—The Pacific Construction Company, of Victoria, B.C., has been awarded the contract for the marine department depot at Prince Rupert. The contract price is $150,000.

**Ottawa, Ont.**—The contract for the construction of a breakwater at Chapel Cove, N.S., has been awarded to Mr. W. J. Landry, of Antigonish, N.S., at $11,148.

The following contracts have been awarded:

**Burke's Head.**—Breakwater, to Messrs. A. W. Girroir & Kinsman Sweet, of Antigonish, N.S., at $35,490.

**Nanaimo, B.C.**—Public building, to Alexander Henderson, of Nanaimo, B.C., $23,441.

**Grand Falls, N.B.**—Public building, to Messrs. Powers & Brewer, of Grand Falls, N.B., at $17,777.

**St. Joseph de Letellier, Que.**—Wharf, to Nap. Warren, of Chicoutimi, Que., at $18,900.

**St. Henri, P.Q.**—Additions and alterations to post office, to Messrs. Jos. Jacob & Company, of Montreal, at $4,890.

**Duncan's Cove, N.S.**—Breakwater, to Messrs. A. W. Girroir & Kinsman Sweet, of Antigonish, N.S., at $6,960

**Three Fathom Harbor, N.S.**—Beach protection, to Obed A. Ham, of Mahone Bay, N.S., at $7,848.

**South Ingonish, N.S.**—Wharf, to Messrs. Robert & Barth Musgrove, of North Sydney, N.S., at $5,100.

**Pembroke, Ont.**—The contracts for the supply of 18 in. intake pipe and 16 in. water main have been awarded by the Pembroke town council, to Messrs. Drummond, McCall & Company, Montreal.

**Hamilton, Ont.**—The International Harvester Company have let a contract for a new office at their plant to George E. Mills. It will cost $40,000 and is the last of a series of buildings they planned last year. By these additions, which have been built at a cost of nearly $500,000, the company have added eight and one-third acres of floor space to their plant.

**Winnipeg, Man.**—A contract for the construction of a sewer has been let to Mr. Newman. The cost amounts to $17,000.

**Morris, Man.**—The municipality of Morris has awarded Mr. Robert Coats, Morris, the contract for the construction of two pile bridges on the river Morris, the contract price being $3.13 per foot. Other bidders and their prices were: J. Rothery, Morris, one bridge $370, one $505; Oct. Bariel, St. Jean, one bridge $4.50 per foot, and one $5.50; James Thompson, Winnipeg, $4.00 and $4.50 per foot; Robert McQueen, Carman, $3.85 per foot. The municipality furnishes all the material. The tenders are for work only.

**North Vancouver, B.C.**—The council awarded contracts to McDonnell, Gzowski & Company, of Vancouver, B.C., for about 6 miles of vitrified clay, sanitary sewers, from 8 in. to 12 in. in diameter, with lot connections for $206,000.00 This is the first unit of the new sanitary system which is being installed. George S. Hanes, city engineer.

**Prince Rupert, B.C.**—The contract for the overhead crossing approaches to the Prince Rupert wharves has recently been awarded by the Provincial Government to the lowest tenderer, Mr. W. E. Gillett, whose bid is understood to have been at $22,185.

## RAILWAYS—STEAM AND ELECTRIC.

**Montreal, Que.**—New plans of the C.P.R., as announced by Mr. William Whyte here, include 100 miles of double tracking and 380 miles of new track in the west. The short stretch between Port Arthur and Fort William will be double tracked and work of the same kind between Winnipeg and Brandon will be continued. New yards will be laid out at Regina, Moose Jaw and Medicine Hat. Four new steel bridges will be erected. Old 60 lb. rails on Manitoba and North Western Branch will be replaced by 80 lb. steel for a distance of about 160 miles.

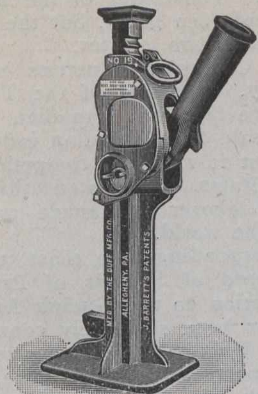
**Port Arthur, Ont.**—The Canadian Northern Railway are planning to spend about $50,000 this season improving the terminals at Port Arthur, Ont., preparatory to the construction of the eastern extension to Sudbury. The principal improvement will be a new coaling station. A 16 stall addition to the round house and an addition of 12 tracks to the freight yard have just been completed.

**Port Arthur, Ont.**—Mr. M. H. McLeod, general manager of C.N.R., stated that in 1910 the Canadian Northern had built 609 miles of new grade, laid 529 miles of steel and had a total mileage west of Port Arthur of about 2,400 miles.

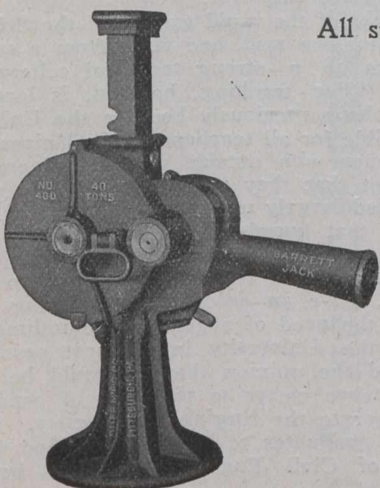
**Prince Rupert, B.C.**—General Superintendent W. C. Mehan returned a few days ago from the end of the steel at Mile 102. Should all go well the grade will be ready for the laying of the steel to Hazelton early in the spring. At Mile 102 the way track for reversing of engines has been completed. The contractors are working day and night shifts to get the tunnels and bridges ready with all possible speed. All the necessary material for the completion of this work is on the ground ready to be shipped out.

## LIGHT, HEAT AND POWER.

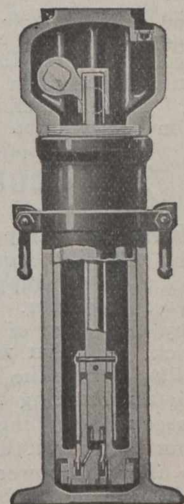
**Toronto, Ont.**—The Hydro-Electric Commission will be able to report to the Legislature distinct progress during the past year. Niagara power is now used in Berlin, Waterloo, and other places, the transmission line being also



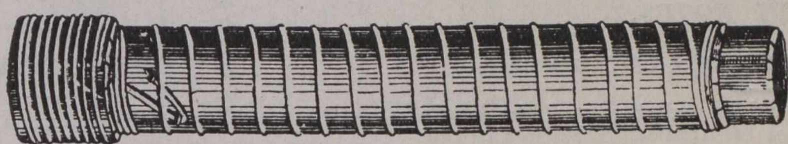












practically completed to Toronto. If the government decides to extend the southern line from St. Thomas to Windsor, a loan of about a million dollars will probably be arranged.

**Brantford, Ont.**—Cataract Power Company, like the London Electric Company, is starting upon a rate war with the Hydro-Electric Commission. The Cataract Power Company is pledged under certain conditions, to give Brantford a ten per cent. less rate than that charged by the Hydro-Electric.

## SEWAGE AND WATER.

**North Vancouver, B.C.**—The sewerage scheme which has been so eagerly looked forward to here is now fairly under way, work having been begun on seven contracts, involving eight miles of sewers, and costing more than $200,000. Messrs. Macdonnell, Gzowski & Co. were the successful tenderers in each case. The work to be performed will include the main sewer on Lonsdale avenue, extending to the city limits, that on Esplanade street, the remainder being tributaries to the main sewer, and will run west of Lonsdale avenue. The number of men who will be permanently engaged on construction is stated to be 350.

## CURRENT NEWS.

**Ottawa, Ont.**—Supply men in Ottawa will shortly be asked by the city engineer's department to tender on the $100,000 worth of supplies needed for the department during the coming year. On February 14th tenders will be called by the board of control for the large amount of piping, brick, etc., that will be used.

**Orillia, Ont.**—The power plant here was recently damaged by the bursting of the flume of the large generator, and consequent flooding of the plant. The power plant had been shut off to install new transformers and about twenty minutes after the power was resumed the accident occurred. It is said that it will be two weeks before light and power can be supplied again. In the meantime the auxiliary plant will be running supplying the town with water.

**Calgary, Alta.**—The city engineer is preparing estimates for the completion of the power house in Victoria Park. When completed the building and equipment will cost about $200,000. About half of this has been expended already.

## SOCIETY NOTES.

### SCHOOL OF APPLIED SCIENCE DINNER.

On January 19th the 22nd annual dinner of the Engineering Society of the School of Applied Science was celebrated at Convocation Hall, Toronto University. The affair was most successfully carried out and great credit is due to the Engineering Society and its executive for the brilliant and inspiring programme which they so completely carried out. Many guests of honor were present, including a large number of the members of the Toronto Board of Trade.

Mr. A. D. Campbell, president of the engineering society, extended a cordial greeting to all guests present and expressed a desire that they would continue to show the same interest in the School of Science by their visits.

Dr. Robertson, of the Technical Commission, in response to a toast to Canada by Mr. L. E. Jones, emphasized the need of bearing in mind the weal of Canada rather than the wealth. He said that he thought the University of Toronto was a large factor in impressing this phase of progress upon the community. While on a visit to the United States he had been told that the engineering department of Toronto University stood in the forefront for equipment, discipline and for men. He expressed the opinion that Canada required trained men to warn the settler not to rob, but to use Canadian resources, as conservation did not mean keeping out of use, but use to the best advantage. Major R. W. Leonard, also responding to the toast, spoke upon the need of a disciplinary training of the engineer as a means of preparation for the proper handling of men.

Major Leonard expressed the opinion that there was room for all in the great engineering works which must be carried out in Canada in the building of railways, canals, and similar engineering works. The duties of the men of the past generation, he said, had been great, but the duties of those of the present generation are greater.

In response to a toast to Canadian industries by Mr. R. A. Sara, Mr. R. S. Gourley, president of the Toronto Board of Trade, emphasized the fact that Canadian industries should be protected. He said that Canadian industries were not in a position at present to meet the competition of the industries in the United States. He stated that the relation between employer and laborer in Canada was the best to be found anywhere in the world.

The Hon. Mr. Duff, in responding to a toast to the Legislature, emphasized the need of Schools of Practical Science, paying particular attention to the Guelph Agricultural College with which he has been so closely connected.

President Falconer of the University, emphasized the need of working together, in partnership as it were, with a common interest in the work on the part of both the laborer, the artisan and the employer.

Dean Galbraith spoke of the rapid growth of the School of Applied Science, which, he said, had risen from a small body of seven students to a strong technical college of nearly eight hundred. The teaching, he said, is largely taken up by men who have previously been in the University, and it is not possible for all teachers in the University to keep in constant touch with outside methods of engineering to the full extent that they would like to. He said that the faculty depended largely upon the graduates of the University who gained that knowledge, which is only obtainable from constant contact with the outside works.

Mr. Francis, of Montreal, in response to a toast to the engineering profession, gave an exceedingly inspiring address. He emphasized the need of acquiring the rudiments of the profession in the University in the best possible manner. He expressed the opinion that it should be the desire of every graduate to cleave to that line of conduct which would bring honor to the Engineering Society. Mr. Francis also urged all graduates to become identified with the Canadian Society of Civil Engineers and thus better serve the profession.

The 31st annual meeting of the Association of Manitoba Land Surveyors was held in Winnipeg recently. At this meeting the following officers were elected for 1911:—President, G. A. Bayne; vice-president, John Francis; secretary-treasurer, C. C. Chataway; members of council, J. L. Doupe, G. B. McColl, R. C. McPhillips, and W. B. Young.

## PERSONAL.

**Mr. A. E. Eastman** of Regina, Sask., has just accepted a position with the Department of Railways and Canals, with office at Cornwall, Ont.

**Mr. J. T. Brower,** manager and engineer of the Structural Steel Company, Longue Point, will become general manager of the National Bridge Company of Montreal. He will take charge of the National Bridge Company on March 1st next.

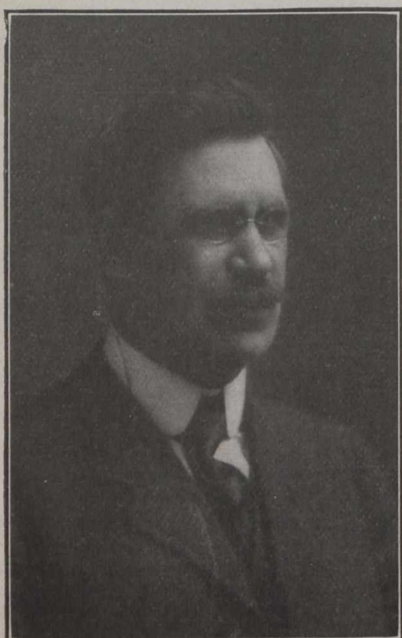
**D. C. & Wm. B. Jackson** has been retained by the government of Great Britain to advise the Postmaster General in regard to the value of the plant of the National Telephone Company, which will be taken over by the government this year and made a part of the post office system. Professor D. C. Jackson sailed on the Lusitania on January 18th, to spend a week in London conferring in regard to the execution of the valuation. He will return by the Kronprinz Wilhelm, which is due to arrive in New York, February 7th.

**Mr. N. T. Ker,** city engineer of Ottawa, has, it is understood, been voted an increase of salary by the city council. His salary, which was $4,000, will be raised to $6,000 a year. It is stated that Mr. Ker, by remaining in Ottawa has refused an offer of $12,000 made him by the city of Vancouver.

**Copies of the Canadian Engineer of the issue of Jan. 12th, 1911, are desired. By forwarding such copies your subscription will cover another month.**

## OBITUARY.

**Mr. J. E. Schwitzer's** death, which occurred at Montreal, on January 23rd, was made peculiarly sad by his recent promotion. It is only a few weeks ago that Mr. Schwitzer came to the forefront of the engineering profession in promotion to one of the most prominent engineering positions in Canada. As Chief Engineer of the Canadian Pacific Railway he was occupying a very important position. He was still a comparatively young man and in view of this fact his success is all the more brilliant. Mr. Schwitzer was born at Ottawa, April 19th, 1870, and graduated from McGill University with a B.Sc. in civil engineering, in 1891. He started his railway career in 1888 as a roadman on the Lake Temiskaming Colonization Railway, which subsequently became a part of the Canadian Pacific System. After that he became assistant engineer on location and construction of the Ottawa and Gatineau Railway. From January to July, 1892, he spent his time land-surveying and engineering at Ottawa. From July, 1892, to September, 1896, he was assistant engineer on location and construction of the Parry Sound Colonization Railway, and engineer in charge of the Central Counties Railway between South Indian and Rockland for the Canada Atlantic Railway. He was engaged from September to December, 1896, on surveys for the Hull Electric



**The late Mr. John E. Schwitzer.**

Railway. Between December, 1896, and July, 1899, he had a private practice as civil engineer and land surveyor at Rat Portage and became town engineer there in 1898. In July, 1899, he was appointed assistant engineer of the Canadian Pacific Railway, in charge of terminal improvements at Rat Portage and then became assistant engineer of maintenance of way at Winnipeg. His next appointment was that of resident engineer of district No. 2 of the Canadian Pacific Railway at Winnipeg and later became divisional engineer of the Central Division of the same road. In 1905 Mr. Schwitzer became assistant engineer of Western Lines of the road at Winnipeg, and in March, 1907, was appointed assistant chief engineer of Western Lines. On the first of the present year he was appointed chief engineer, a position which had not been filled for some time. He was for several years President of the McGill University Alumni Association of the Province of Manitoba. His recent promotion while but an incident in his brilliant career was up to the time of his death still a matter of current interest among engineers all over Canada and was especially a cause of rejoicing among his recent associates in the West. The convention hall at Winnipeg, where the Canadian Society of Civil Engineers have their annual gathering this week, has been fittingly draped in mourning.

## ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

12656—December 29—Authorizing the Atlantic, Quebec & Western Ry. Co. to open for the carriage of traffic that portion of its line of railway between Newport Station, mileage 35, and Grand River Station, mileage 51.5, a distance of 16.5 miles.

12657—December 29—Authorizing the Seymour Power and Electric Co., Ltd., to erect electric transmission line across the G.T.R. between Lots 8 and 9, Concession 1, Township of Murray, Co. of Northumberland, Province of Ontario.

12658—December 29—Approving plans and specifications for the construction of what is known as the "Dauphinais Drain" in the Township of Rochester, County of Essex, Province of Ontario, across the lands and under the track of the G.T.R. Co.

12659—December 28—Authorizing the C.P.R. Co. to erect wires under the Orillia Municipal Power Lines at mileages 26.51, 26.86, 27.04, 28.17, and 28.39, Township of South Orillia, Co. of Simcoe, Ontario.

12660—December 30—Authorizing the Erindale Power Co., Ltd., to erect electric power transmission line across the G.T.R. on Church Street, in the village of Etobicoke, Co. of York, Province of Ontario.

12661—December 30—Authorizing the Seymour Power and Electric Co., Ltd., to erect electric transmission line across the track of the Central Ontario Ry. Co. at Lot 5, Concession 2, Township of Murray, Co. of Northumberland, Province of Ontario, 32½ miles from Picton.

12662—December 29—Authorizing the G.T.P. Branch Lines Co. to construct its railway across seven highways in the District of Saskatoon, west of the 2nd Meridian, Province of Saskatchewan.

12663—December 30—Authorizing the C.N.O.R. Co. to construct its railway across the public road between Lots 78 and 80, Parish of St. Eustache, Co. of Two Mountains, at tation 1848.80.

12664-65—December 30—Authorizing the G.T.P. Branch Lines Co. to construct its railway across the highway in the south-west quarter of Section 30, Township 32, Range 23, west 4th Meridian, District of South Alberta, Province of Alberta; and across the highway in the south-west quarter of Section 5, Township 33, Range 23, west 4th Meridina, District of South Alberta, Province of Alberta.

12666—December 30—Approving and sanctioning the changes and alterations of that portion of railway of the C.P.R. Co.'s Regina, Saskatoon and North Saskatchewan Branch.

12667—December 30—Extending until June 30, 1911, the time within which the Guelph and Goderich Ry. Co. cut down and remove the small hill or mound on the south-east side of the highway at the crossing of Concession Road between Concessions 9 and 10, Township of Morris, at mileage 62.5.

12668—December 31—Approving C.P.R. Co.'s plan showing 20-foot arch at bridge No. 78.7, Toronto subdivision.

12669—December 31—Authorizing the G.T.P. Branch Lines Co. to divert road in the north-west quarter of Section 29, Township 41, Range 21, west 4th Meridian, on its Calgary Branch, in the Province of Alberta.

12670—December 30—Authorizing the C.P.R. Co. to construct an industrial spur for C. C. Snowdon at Calgary Junction, Province of Alberta.

12671—December 30—Authorizing the Hydro-Electric Power Commission of Ontario to erect its transmission line across the wires of the G.N.W. Telegraph Co. at Queen Street, St. Mary's, Ontario.

12672—December 31—Authorizing the Trenton Electric & Water Co., Ltd., to erect electric transmission line across the G.T.R. between Trenton and Belleville, at Lot 28, Concession 2, Township of Sidney, County of Hastings, Province of Ontario.

12673—December 31—Approving revised location of the C.N.R. Co.'s line of railway through Townships 29 and 28, Range 23, west 3rd Meridian, Province of Saskatchewan, mileage 125.

12674—December 20—Directing that in the Canadian Classification No. 15, finnan haddies are included in the description, "Salted, dried, or smoked fish," which, when shipped in bundles or boxes, is rated third-class in less than carloads, and fifth-class in carloads, and that any rates charged for the carriage of finnan haddies in bundles or boxes, higher than third-class in less than carloads, and fifth-class in carloads, as shown in tariffs published and filed, are unlawful.

12675—December 12—Directing that the C.P.R. Co. be authorized to deviate, change and alter the location of its line of railway crossing Eramosa Road, Norwich Street, and the city lane, in city of Guelph; and approving location of the proposed new station in the city of Guelph.

12676-7—December 31—Authorizing the C.P.R. Co. to construct an industrial spur in the city of Calgary for the Imperial Oil Company; also to construct a spur for the Canadian Oil Company, in the city of Calgary, Alberta.

12678—January 3—Directing that, within forty-eight hours from the date of this Order, the Grand Trunk Railway Co. remove its tracks at the east end of the viaduct on Richmond Road, in the city of Ottawa; and further directing that the Grand Trunk Ry. Co. be liable to a penalty of $100 a day for every day it shall be in default in carrying out the requirements of this Order.

12679—January 3—Authorizing the C.P.R. Co. to construct an industrial spur for the Ontario Wind Engine & Pump Co., Ltd., in the city of Winnipeg, Man.

12680—January 4—Extending until the 30th of June, 1911, the time within which the C.P.R. Co. shall construct industrial spur for the Great-West Felt Co., Ltd., in Elmira, Ontario.

12681-2-3—January 4—Authorizing the Water Commissioners for the city of London, Ontario, to erect electric wires across the tracks of the London and Port Stanley Ry. Co. across Horton St., in city of London, Ont.; and across the G.T.R. at Ridout Street, London, Ontario; and across track of London and Port Stanley Ry. Co., at Waterloo and Bathurst Streets, London, Ontario.

12684—January 4—Authorizing that cars and trains of the Canada Atlantic Ry. Co., (G.T.R. Co.), to pass the south-east corner of the abutment of the Somerset Street Bridge, Ottawa, Ontario, by a clearance of three feet three inches.

12685—September 23—Directing that the C.P.R. Co. publish and file, on or before February 15th, 1911, a freight tariff (or tariffs) placing the rates

from Port Arthur and Fort William to all stations intermediate to Winnipeg upon the same relative scale, with due regard to mileage as the rates from Port Arthur and Fort William to Winnipeg; and further directing that on or before said date, the Ry. Co. publish and file a special "town" tariff of rates on general merchandise distributed from the towns of Kenora and Keewatin.

12686—January 4—Authorizing the G.T.R. Co. to construct a branch line of railway, or siding, to and into the premises of the Mount Bruno Station, in the Province of Quebec.

12687—January 4—Authorizing the C.P.R. Co. to construct an industrial spur for the Riverside Lumber Co., in the city of Calgary, Alberta.

12688—December 1—Authorizing the Quebec Ry., Light, Heat & Power Co., Ltd., to construct and operate branch line of railway commencing at or near Beauport Station, and running in a north-easterly direction to the village of Montmorency, Quebec.

12689—December 2—Directing the Montreal & Southern Counties Railway to improve the condition of its right-of-way in the village of Montreal South.

12690—January 3—Authorizing the C.N.O.R. to take certain lands in the Township of Darlington, Ont., for the purpose of diverting a highway.

12691-92—January 4—Authorizing Hydro-Electric Commission to cross wires of the Bell Telephone Company at Concession Street, town of Tillsonburg and Michigan Central at same street.

12693—January 4—Authorizing Water Commissioners of city of London to cross with its wires track of the G.T.R. at Clarence Street, London, Ont.

12694—November 11—Authorizing city of Lethbridge, Alta., to maintain a sewer under the track of the C.P.R. and the Alberta Railway & Irrigation Co. at Galt St., Lethbridge, Alta.

12695—January 5—Authorizing Canadian Northern Pacific Railway to construct its lines and tracks under the lines and tracks of the E. & N. Ry. Co. in the district of Esquimalt, near Parson's Bridge.

12696—January 5—Authorizing C.P.R. to construct spur for Canadian Cooperage Manufacturing Co., Ltd., Smith's Falls, Ont.

12697—January 7—Authorizing town of Galt, Ont., to maintain storm drain under the track of the G.T.R. at foot of James Street, Galt, Ont.

12698—January 7—Authorizing Wm. J. Aikens, Dunnville, Ont., to lay gas main under the tracks of the G.T.R. on the Hamilton Road, in the village of Cainsville, Ont.

## MARKET CONDITIONS.

Halifax, N.S., January 23rd, 1911.

Weather conditions at the opening of the New Year have not been such as would encourage a large volume of trade. The price situation is steady, and it is expected the values will continue firm. Imported pig-iron is very steady in price, and an increase in metal prices is expected.

**Axes.**—Ordinary chopping axes, single bit, $6.50 per dozen, double bit, $11. Special brands, prices on application to jobbers.

**Bar Iron.**—The market for bar iron is open, but the situation is firm, and prices range as high as $2.25 base.

**Black Sheet Iron.**—This commodity is in good demand. We quote 24-gauge, $2.40.

**Cast Steel.**—The market is steady at 10 to 15c., according to makers.

**Cement.**—Stocks are low and market is steady, $2 per bbl.

**Coil Chain.**—The jobbing prices of English proof chain in Halifax are as follows: 3-16 x 4, $7.15; 3-16 x 3, $6.25; ¼, $5.35; 5-16, $4.30; ⅜, $3.90; 7-16, $3.85; ½, $3.60; ⅝, $3.60; ¾, $3.50; ⅞, $3.50; 1, $3.50; 1⅛, $3.50.

**Fencing Wire.**—We quote: Plain, twisted and galvanized at $3.25 per 100 lbs.; barb at $2.75 per 100 lbs.; bright staples in 100-lb. kegs at $3, and in 50-lb lots, $3.25. Galvanized staples are 25c. extra.

**Galvanized Sheet Iron.**—The wholesale prices are as follows: 16 to 20-gauge, $3.45; 22 to 24, $3.80; 26, $4.30; 28, $4.55. These prices are for less than case lots.

**Ingot Tin.**—The tin market as usual is a fluctuating one, and the present price is about 38c. net cash.

**Lead Pipe.**—Quotations here are open, and the price quoted to-day is about $4.75 for ordinary jobbing quantities.

**Linseed Oil.**—Raw is fully worth $1.20, and boiled, $1.25 per gallon. Orders are small, stocks low, and the outlook firm.

**Nails.**—Nails are firm. Wire nails, $2.45, and cut nails, $2.60. Business in this line is reported fairly active.

**Peavies.**—There is a better enquiry than last year. Prices are unchanged at $11 to $13 per dozen, according to make, but we are advised that there will be an advance.

**Pig Lead.**—We quote $4.25 for English and $4 for Canadian. The outlook is for higher prices.

**Pipe.**—Wrought iron, 1-in., $5.25.

**Roofing Paper.**—The demand is good. Tarred paper, $1.70 per 100 lbs.; three-ply roofing 90c. per 100 lbs.; two-ply roofing, 65c.; sheathing paper, 30 cents per roll; tarred sheathing, 40 cents per roll.

**Rope.**—The price of cordage for next spring's supplies is unchanged. For large lots dealers should write jobbers for quotations. Small lots are as follows: Sisal, 9½c. base; lobster rope, 9¾c.; British manilla, 9½c.; base, best manilla, 10½c. base.

**Sheet Lead.**—The price of sheet lead is also very firm, 3 lbs. and heavier, $4.75 per cwt., in rolls, and $5.75 in smaller quantities.

**Steel.**—Tire, $2.50; spring, $2.70; machine, $3.25; toe caulk, $3.50; sleigh shoe steel, $2.50; the above are all base prices.

**Tin Plates.**—I. C. coke, $3.95 to $4.10; I. C. charcoal, $4.75; I. X. charcoal, $5.50.

**Turpentine.**—Prices now quoted are as high as $1 to $1.10 in bbls., and $1.05 to $1.15 in smaller quantities. The market is open.

**White Lead.**—For Canadian pure, in 50 and 25-lb. irons, $6.25 is being asked. Brandram's B.B. genuine in 25, 50, and 100-lb. irons, $7.35, and B.B. No. 1, $6.10. The trade expect prices to be much higher before long.

**Zinc.**—This commodity is very firm, $7.50 for casks and $8 for smaller quantities. Spelter is $2.75 per cwt.

Montreal, January 25th, 1911.

The principal change of the week seems to have been the advance of $1 per ton in the price of wire in the United States. This incident, of itself, gives encouragement to the situation—in fact the iron and steel trade is thankful for almost anything these days. The production of pig-iron is about 50 per cent. of the capacity of the furnaces of the country, and the consumption is considerably less than this, the result being that at the present time stocks are reported large in all parts of the country. The following figures show the actual production of iron ore and pig-iron in the United States in the years 1907 and 1908, with the estimated figures for the years 1909 and 1910:—

| | Iron Ore. | Pig-iron. |
|---|---|---|
| 1907 | 51,720,619 | 25,781,361 |
| 1908 | 35,983,336 | 15,936,018 |
| 1909 | 51,750,000 | 25,795,471 |
| 1910 | 53,250,000 | 27,099,422 |

As has been stated before, prices during 1910, particularly during the latter quarter of the year, were unusually low. The year 1904 struck a low point in earnings, per ton, of the United States Steel Corporation, previous, as well as later years being larger, as the following table will show:—

| | Shipments, tons. | Total earnings. | Net. earnings. |
|---|---|---|---|
| 1904 | 6,792,780 | $10.80 | $ 8.70 |
| 1905 | 9,226,386 | 13.50 | 10.45 |
| 1906 | 10,578,433 | 14.80 | 12.00 |
| 1907 | 10,564,537 | 15.24 | 12.61 |
| 1908 | 6,206,932 | 14.80 | 12.06 |
| 1909 | 9,859,660 | 13.34 | 10.93 |
| 1910 | 11,000,000 | 13.04 | 10.82 |

During the year, notwithstanding the falling off in price and demand, the United States Steel Corporation exported 1,489,819 tons of steel, this being considerably greater than the few previous years.

There is a talk among the merchant furnaces of the United States of building steel mills to take care of their output, but the view seems to prevail that this would be too costly. Some producers talk of building small foundries instead, but here again a very considerable undertaking is involved as small foundries would not be equal to taking care of the output of furnaces of a reasonably large size.

The feeling is that the furnaces which are now blown out are unlikely to resume operations for a considerable time yet,—in fact, not till business shows indications of doing much better than at the present time. Prices of pig are very low, and have declined somewhat from the low level of a month ago. Basic iron, at Valley furnaces, is quoted at $13.25 per ton, or $1.75 below the cost of production, it is claimed. Foundry iron, at Birmingham, is $11, with some sales below that figure. Grey forge iron, at Pittsburg, has advanced to $14.15 per ton, which is 25c. up. The following comparison of prices will show how the market has declined during the year:—

| | Year ago. | Present. |
|---|---|---|
| Bessemer, at Pittsburg | $19.90 | $15.90 |
| Valley, basic | 17.00 | 13.25 |
| Foundry, Valley | $13.50 to 14.00 | 11.00 |

In Great Britain, no change has taken place in the situation. Demand continues fairly steady, and there is some promise of improvement. In fact, the market is reported quite strong throughout the whole range of iron and steel. Advances have taken place in several lines, and other advances are looked for.

The local market is showing firmness, in sympathy with the English situation as regards steel products. Some lines have advanced recently, but pig-iron continues at previous prices, and is not in too strong a position. The market, however, remains steady, and demand, though light, is quite as good as was expected for this time of year.

The market holds steady, as follows:—

**Bar Iron and Steel.**—Trade is reported first-class. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.95 for 1 x ⅜ base; tire steel, $2.05 for 1 x ⅜-base; toe calk steel, $2.75; machine steel, iron finish, $2.00; imported, $2.05.

**Antimony.**—The market is steady at 8¼c.

**Building Paper.**—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; carpet felt, $2.50 per 100 pounds; tar sheathing, 36c. per roll of 400 square feet; dry sheathing, No. 1, 28c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

**Cement.**—Canadian cement is quotable, as follows, in car lots, f.o.b.. Montreal:—$1.35 to $1.40 per 350-lb bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

**Chain.**—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

**Coal and Coke.**—Anthracite, egg, stove or chestnut coal, $7 per ton, net; furnace coal, $6.75, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

**Copper.**—Prices are easy at 13¾c.

**Explosives and Accessories.**—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 5,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5.

**Galvanized Iron.**—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots: 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

**Galvanized Pipe.**—(See Pipe, Wrought and Galvanized)

**Iron.**—The following quotations are now given, basis of carloads, ex-store:—No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Carron special, $21 to $21.50; Carron soft, $20.50 to $21; Clarence, $18.50 to $19; Cleveland, $18.50 to $19.

**Laths.**—See Lumber, etc.

**Lead.**—Prices are firm at $3.65.

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

**Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $17 to $21 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $12 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points** carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar **shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3.**

**Nails.**—Demand for nails is steady and prices are: $2.40 per keg for cut, and $2.30 for wire, base prices. Wire roofing nails, 5c. lb.

**Paints.**—Roof, barn and fence paint, $1.25 to $1.45 per gallon; girder, bridge, and structural paint for steel or iron—shop or field— $1.45 to $1.55 per gallon, in barrels; liquid red lead in gallon cans, $2 per gallon.

**Pipe.—Cast Iron.**—The market shows a firm tone and trade is said to have been most satisfactory. Prices are firm, and approximately as follows:—$33 for 6 and 8-inch pipe and larger; $34 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

**Pipe.—Wrought and Galvanized.**—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27. On the following the discount is 73½ per cent. for black, and 63½ per cent. for galvanized: 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50. Discount on the following is 71½ per cent. off on black, and 61½ per cent. off for galvanized: 3½-inch, $95; 4-inch, $1.08.

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

**Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.**

**Railway Ties.**—See lumber, etc.

**Roofing.**—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. Roofing cement in bbls., of 40 gallons, 15c.; in 5-gallon tins, 20c. per gallon. (See Building Paper; Tar and Pitch; Nails, Roofing).

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

**Spikes.**—Railway spikes are steady, at $2.45 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

**Telegraph Poles.**—See lumber, etc.

**Tar and Pitch.**—Coal tar, $4 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 75c. per 100 pounds; No. 2, 55c. per 100 pounds; pine tar, $9.50 per barrel of 40 gallons; refined coal tar, $4.50 per barrel, pine pitch, 3c. per lb.; rosin, 3¼c. (See building paper, also roofing).

**Tin.**—Prices are firm at $44.

**Zinc.**—The tone is easy, at 6¼c.

### CAMP SUPPLIES.

**Beans.**—Prime beans, $1.85 to $1.90.

**Butter.**—Fresh made creamery, 24 to 26c.

**Canned Goods.**—Per Dozen.—Corn, $1.00; peas, $1.20 to $2.00; beans, $1.00; tomatoes, $1.45; peaches, 2s, $1.90; and 3s, $2.90; pears, 2s, $1.80; and 3s, $2.40; salmon best brands, 1-lb. talls, $2.07, and flats, $2.25; other grades, $1.40 to $2.10.

**Cheese.**—The market ranges from 11 to 12c., covering all Canadian makes.

**Coffee.**—Mocha, 22 to 30c.; Santos, 18 to 21c.; Rio, 15 to 18c.

**Dried Fruits.**—Currants, Filiatras, 6¾ to 9½c.; dates, 5½c.; raisins, Valentias, 7¾ to 8¼c.; prunes, 8¼ to 12c.

**Eggs.**—No. 1 eggs are 26c.; selects, 30c.; new laid, 50 to 60c.

**Flour.**—Manitoba, 1st patents, $5.60 per barrel; and patents, $5.10, **strong bakers', $4.90.**

**Molasses and Syrup.**—Molasses, New Orleans, 27 to 28c.; Barbados, 34 to 36c.; Porto Rico, 40 to 43c; syrup, barrels, 3c.; 2-lb. tins, 2 dozen to case, $2.25 per case.

**Potatoes.**—Per 90 lbs., good quality, 85 to 95c.

**Rice and Tapioca.**—Rice, grade B, in 100-lb. bags, 3¼ to 3½; Tapioca, medium pearl, 5½ to 8c.

**Rolled Oats.**—Oatmeal $2.45 per bag; rolled oats, $2.20, bags.

**Sugar.**—Granulated, bags, $4.60; yellow, $4.20 to $4.45; Barrels 5c. above bag prices.

**Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.;** China, green, 14 to 50c.

**Fish.**—Salt fish.—No. 1 green cod, $8 to $9 per bbl.; herring, $4.50 per bbl.; salmon, $8.50 per half barrel. Smoked fish.—Bloaters, $1.25 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20 to $1.40.

**Provisions.**—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 14 to 19c. per lb.; lard, 14 to 15c. for pure, and 11½ to 12c. per lb. for compound; bacon, 13 to 18c.

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Toronto, January 26th, 1911.

Trading in the United States is a mixture of purchases and sales at present, with the net result in doubt. The stock market in New York is distinctly apathetic on a very light volume of business.

There is a decline of exports from United States port of New York showing the great decrease of $[illegible] as compared with the same week for 1910.

It is considered by the London Economist that the present dullness in trade and the recent financial depression in the United States are explained mainly by a distrust of the banking and currency laws, and by the policy of maintaining high tariff prices whatever the consumptive demand may be.

There are no especial features in Canadian trade at the moment. A fairly steady consumptive demand exists and prices are maintained.

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

**Antimony.**—The demand is less active, and the price remains unchanged at $8.50.

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

**Bar Iron.**—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement.

**Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25.** Sleigh shoe and other **take same relative advance.**

**Boiler Plates.**—¼-inch and heavier $2.20. Boiler heads 25c. per 100 **pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds.**

**Boiler Tubes.**—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50 to $9; 2¼-inch, $10; 2½-inch, $10.50; 3-inch, $12.10; 3½-inch, $15; 4-inch, $19.

**Building Paper.**—Plain, 27c. per roll; tarred, 35c. Nothing doing.

**Bricks.**—In active movement, with very firm tone. Price at some yards $9.50, at others, $10.00 to $11.00 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

**Broken Stone.**—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa, or Quebec Province. In October and November competition forced prices of limestone up to 90c., the city and the province competing for several thousand tons. But the reservoir and the hydro-electric being both supplied, normal prices have been resumed. One quarry (Maloney's) will run all winter to supply stone for the Island.

**Cement.**—Car lots, $1.65 per barrel, without bags. In 1,000 barrel lots, $1.55. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra.

**Coal.**—Anthracite egg and stove, $7.25 per ton; chestnut, scarce, $7.50; pea coal $6.00 per ton. In the United States there is an open market **for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at** $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connelsville, 72-hour coke, $5.00 to $5.25. Nut coal is very scarce.

**Copper Ingot.**—The market has reached a firm basis, and holders are quite stiff at $13.50 per 100 lbs.

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

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

**Felt Roofing.**—Not much moving, price continues as before, $1.80 per 100 lbs.

**Fire Bricks.**—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton.

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

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

**Iron Pipe.**—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

**Pig Iron.**—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. A steady business is being done at these figures.

**Lead.**—Trade is steady, with good outlook, price unchanged at $3.75 to $4.

**Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car without freight. Demand is moderate.**

**Lumber.**—Demand less brisk, because of the late season of the year, but prices are not materially altered. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $30 to $40; hemlock is in demand and held quite firmly, we quote $17.50 to $18; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked.

**Nails.—Wire, $2.35 base: cut, $2.60; spikes, $2.85 per keg of 100 lbs.**

**Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50** per barrel. Season is over.

**Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots,** $1.05; retail, $2.15 per barrel of 300 lbs.

**Putty.**—In bladders, strictly pure, per 100 lbs., $2.60; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.

**Ready Roofing.**—Prices are as per catalogue.

**Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy.**

**Rope.**—Sisal, 9½c. per lb.; pure Manila, 10½c. per lb., Base.

**Sand.**—Sharp, for cement or brick work, $1.05 per ton f.o.b., cars, Toronto siding.

**Sewer Pipe.**--

| | 4-in. | 6-in. | 9-in. | 12-in. | 24-in. |
|---|---|---|---|---|---|
| Straight pipe, per foot ........... | $0.25 | $0.40 | $0.65 | $1.00 | $3.25 |
| Single junction, 1 or 2 ft. long........ | 1.00 | 1.60 | 2.60 | 4.00 | 13.00 |
| Double junctions .................... | 1.25 | 2.00 | 3.25 | 5.00 | 16.25 |
| Increasers and reducers ............... | .... | 1.60 | 2.60 | 4.00 | 13.00 |
| P. & H. H. traps .................... | 2.00 | 3.20 | 6.50 | 15.00 | ..... |
| Bends ................................ | 0.75 | 1.20 | 1.95 | 3.00 | 9.75 |

Above is the October list, as changed. The retail price is less 65 per cent. off these figures on all sizes 9 inches and under, or less 60 per cent. off these figures on anything over 9 inches. For car-load lots 73 per cent. off list at factory. Demand normal.

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

**Sheet Steel.**—American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices.

**Sheets Galvanized.**—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs. Active and firm at these prices.

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

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

**Tin.**—The market is cornered, stocks are light and high prices are asked: we still quote 40 to 41c.

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

**Zinc Spelter.**—Demand not so brisk, and the market easier at $6 to $6.25.

## CAMP SUPPLIES.

**Beef.**—By carcases, $8.50 to $9.50.

**Butter.**—Butter is firmly held since last issue, dairy prints are 21 to 23c., creamery prints, 27 to 28c. per lb.

**Canned Goods.**—Peas, $1.35 to $1.75; tomatoes, 3s, $1.35 to $1.40; pumpkins, 3s, 97½c.; corn, 95c. to 97½c.; peaches, 2s, $1.87½; yellow, $1.82½ to $1.87½; strawberries, 2s, heavy syrup, $1.80; raspberries 2s, $1.80 to $1.97½.

**Cheese.**—Moderately firm, large, 12½ to 12¾c.; twins, 12¾ to 13c.

**Coffee.**—Rio, Green, 14½ to 15c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 15 to 16c..

**Dried Fruits.**—Raisins, new, Valencia, 8 to 8½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 8½c.; fine, 9½c.; choice, 10 to 11c.; fancy, 12c.; Filiatras currants, cleaned, 7¼ to 8c.; Vostizzas, 9 to 10c.; uncleaned currants, 6¾ to 7¼c.

**Eggs.**—Ordinary fresh, 30c.; strictly new-laid, 50c.

**Flour.**—Prices unchanged thus far; thus, Manitoba flour, first patents, $5.40; second, $4.90; strong bakers', $4.70; Ontario flour winter wheat patents, $4 per barrel. Lower quotations at some points.

**Feed.**—Bran, $20 per ton; shorts, $21 per ton.

**Lard.**—Tierces, ¾c. up abroad, and we quote 13c. here; tubs, 13¼c.; pails, 13½c.

**Molasses.**—Barbados, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium.

**Pork.**—Not much doing, short cut, $26 to $26.50 per barrel; mess, $1 off, heavy, $24.50 to $25.

**Rice.**—B. grade, 3½c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c.

**Salmon.**—As before stated. We quote Fraser River, talls, $2.05; flats $2.20; River Inlet, $1.90; cohoes, $1.70.

**Smoked and Dry Salt Meats.**—Long clear bacon, 12 to 12¼c. per lb., tons and cases; hams, large, 14 to 15c.; small 16 to 16½c.; rolls, 12 to 13c.; breakfast bacon, 17 to 18c.; backs (plain), 19 to 20c.; backs (pea-meal), 19 to 20c.; shoulder hams, 14c.; green meats out of pickle, 1c. less than smoked.

**Spices.**—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 25 to 28c.; compound, 18 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 25 to 30c.

**Sugar.**—Granulated, $4.70 per 100 lbs., in barrels; Acadia, $4.65; yellow, $4.30.

**Syrup.**—Corn syrup, special bright, 3¼c. per lb.

**Teas.**—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, 17 to 38c. per lb.

**Vegetables.**—Potatoes—Ontario, 90c. per bag, on railway track, Toronto; Ontario Delawares bring $1, and New Brunswick Delawares $1.10; onions by crate, Spanish, $2.25 to $2.50; Canadian, $1.50 per bag; carrots, 60c. per bag; beets, 80c. per bag; turnips, 40c. per bag. Fall apples sell at $3 per barrel, for ordinary, but first-class bring $3.50 to $5.

## TORONTO HORSE MARKET.

There are a number of people looking around for cheaper grades of horses for shipment to the North-West. Crops being a little light in the West farmers are looking for cheaper horses, or trying to obtain the same horse at a price 25 per cent. less than the regular figure.

Prices are standing at about the same level as last week. Desirable drafters are bringing $225 to $275, general purpose $150 to $200, wagon horses $160 to $200, drivers $100 to $225, and serviceably sound $35 to $100.

## AMERICAN HORSE MARKET.

The Chicago horse market closed the year fairly active, with somewhat brisk retail trade. There have been symptoms of revival of farm trade during the past week, and that outlet is expected to broaden early in the new year.

Desirable drafters are selling at $225 to $325, light drafters $175 to $225, chunks $150 to $200, delivery wagon horses $150 to $200, and choice heavy feeders $175 to $215.

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Winnipeg, January 23rd, 1911.

Trading shows that the markets are still quiet, but from inquiries made last week, the outlook for the building trade for 1911 is very bright indeed. Local architects assure inquirers that the instructions they have already received for all classes of buildings are greater in number and in importance than ever before given them at this season of the year.



The probable erection during the summer of head offices for the Winnipeg Electric Railway at the corner of Notre Dame and Albert Street, the building of the Sterling Bank on Portage Avenue, and the re-erection of a great building for the Bank of Commerce on Main Street, together with the building of a head office for the Grain Growers on Lombard Street are only a few of the great buildings for which plans have been made and intentions indicated for the present year. As it is, builders look forward to a big year, and the architects say that the documents are in course of preparation in their offices to prove it, even if public announcement may not yet be made regarding them.

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

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

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

**Bar Iron.**—$2.50 to $2.60.

**Bars.**—Crow, $4 per 100 pounds.

**Beams and Channels.**—$3 to $3.10 per 100 up to 15-inch, (4, 30, 41, 50, 118, 119, 127, 132, 145, 176.)

**Boards.**—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 2 White Pine, 6 in., $55; cull red or white pine or spruce, $24.50; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6in., $55; No. 3, $45.

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

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

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

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

**Cement.**—$2.40 to $2.75 per barrel in cotton bags.

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

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

**Dynamite.**—$11 to $13 per case.

**Hair.**—Plasterers', 90c. to $1.15 per bale.

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

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

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

**Lumber.**—No. 1 pine, spruce, tamarac, 2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $29; British Columbia fir and cedar, 2 x 4, 2 x 6, and 2 x 8, 12 to 16 feet, $32; 2 x 20, 4 x 20, up to 32 feet, $42.

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

**Picks.**—Clay, $5 per dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb. (132.)

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

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

**Plaster.**—Per barrel, $3.25.

**Roofing Paper.**—60 to 67½cc. per roll.

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

**Shingles.**—No. 1 British Columbia cedar, $4; No. 2, $3.50; No. 1 dimension, $5; No. 1 band saw, $6.

**Spikes.**—Basis as follows:—1¼, 5 and 6, $4.75; 5-15 x 5 and 6, $4.40; ⅜ x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sides.

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

**Staples.**—Fence, $2.40 per 100 lbs.

**Timber.**—Rough, 8 x 2 to 14 x 16 up to 32 feet, $38; 6 x 20, 8 x 20, up to 32 feet, $42.

**Tool Steel.**—8½ to 15c. per pound.

# Index to Advertisements

## POSITIONS WANTED

**WATERWORKS ENGINEER** with valuable experience in design and construction of reservoirs and other hydraulic works, management of works, waste prevention, etc., is open for engagement. Box 144, Canadian Engineer.

**AN ENGINEER,** with considerable experience (abroad) on railway's survey and construction, good testimonials and references; desirous of obtaining work on any railway in Canada, six years on railways in India. Apply, care of Box 150, The Canadian Engineer.

## POSITIONS VACANT

**WANTED** for a town in British Columbia a road-way foreman or inspector. In applying, state fully experience, I. D., Box 408, Canadian Engineer.

**APPLICATIONS** will be received by undersigned for the position of Commissioner of Works for Town of North Bay. Applicants will state salary, experience and references. M. W. Flannery, Town Clerk, North Bay.

**FOR SALE**—Set of books on stationary engineering; also a set on telegraph engineering, including a complete electrical experimenting outfit. Address Box 146, Canadian Engineer.

**FOR SALE.**—Complete detailed drawings of an automatic vacuum heating system. This is an excellent opportunity for some civil engineer with a little capital who will consider the financing of a new business. Box 152, Canadian Engineer.

### PATENT NOTICE.

**Any one desiring to obtain the Sumping Grate, covered by Canadian Patent No. 116292, granted on January 26th, 1909, to Chas. Thos. Coe, of Albany, New York, may do so upon application to the undersigned, who are prepared to supply all reasonable demands on the part of the public for the invention, and from whom all information can be obtained. Fetherstonhaugh & Co., 5 Elgin St., Ottawa, Canada; Russel S. Smart, resident.**



# Tenders Called For

### CITY OF STRATHCONA, ALBERTA.

**Tenders for Engine, Boilers and Generator.**

Tenders addressed to David Ewing, Chief Engineer, Power House, Strathcona, Alberta, for above machinery, will be received until noon, Wednesday, March 1st, 1911. Specifications may be obtained upon application to the undersigned.

A. J. McLEAN,
City Engineer.

### TENDERS CALLED FOR.

### MUNICIPALITY OF MONT-LAURIER, CO. LABELLE, P.Q.

**Water Supply.**

Sealed tenders addressed to the undersigned, registered and endorsed "TENDER FOR WATER SUPPLY AT MONT-LAURIER, P.Q.," will be received until Monday, February 20th, 1911, for the construction of a water supply for the said municipality.

Plans, specifications and form of contract can be seen, and form of tenders obtained at Mont-Laurier or at the office of the Engineers of the Municipality, Messrs. BEIQUE & CHARTON, Room 502, Quebec Bank Building, Montreal.

Persons tendering are notified that tenders will not be considered unless made on the forms supplied, and signed with their actual signatures, stating their occupations and places of residence. Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Mayor of Mont-Laurier, for the sum of three hundred dollars ($300.00), which will be forfeited if the person tendering declines to enter into the contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted, the cheque will be returned.

The municipality does not bind itself to accept the lowest or any tender.

By order,
ANTHIME DUBREUIL,
Mayor of Mont-Laurier,
Rapide de l'Orignal, P.Q.
Mont-Laurier, January 19th, 1911.

(Continued on page 66.)

# Tenders Called For

**NOTICE TO CONTRACTORS.**

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, January 31st, 1911, for Travelling Crane.

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

Specifications may be seen and forms of tender obtained from the Toronto Hydro-Electric System, City Hall, Toronto.

Tenderers shall submit with their tender the names of two personal sureties (approved of by the City Treasurer), not members of the City Council, or officers of the Corporation of the City of Toronto, or, in lieu of said sureties, the bond of a Guarantee Company approved as aforesaid.

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

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, January 19th, 1911.

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**TOWN OF PEMBROKE, ONTARIO.**

**Tenders for Laying and Jointing an Intake Pipe, Etc.**

Tenders are required on or before Monday, the 13th of February, 1911, at 2 o'clock p.m., addressed to Mr. E. A. Dunlop (Chairman of Water Committee), Pembroke.

Tender to include for all labor, etc., in connection with laying about 5,400 feet of 18-inch Lapwelded Steel Intake Pipe, and the construction of a Concrete Pump Well.

Forms of Tender may be obtained and Specifications and plans examined either at the offices of Mr. T. Aird Murray, No. 303 Lumsden Building, Toronto, or at the office of the Resident Engineer, Mr. J. L. Armour, Pembroke, on or after the 30th inst.

The right is reserved to reject any or all tenders.

By order,
W. L. HUNTER, Mayor.
T. Aird Murray, Consulting Engineer, Toronto, Ont. Pembroke.

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**TOWN OF PEMBROKE, ONTARIO.**

**Tenders for Laying and Jointing Water Mains, Etc.**

Tenders are required to be delivered on or before Monday, 13th February, 1911, at 3 o'clock p.m., addressed to Mr. E. A. Dunlop (Chairman of Water Committee), Pembroke.

Tenders to include for all labor, etc., in connection with laying about 5,900 feet of 16-inch water main, together with fixing valves and hydrants.

Forms of Tender may be obtained and Specifications and plans examined either at the offices of Mr. T. Aird Murray, No. 303 Lumsden Building, Toronto, or at the office of the Resident Engineer, Mr. J. L. Armour, Pembroke, on or after the 30th inst.

The right is reserved to reject any or all tenders.

By order,
W. L. HUNTER, Mayor.
T. Aird Murray, Consulting Engineer, Toronto, Ont. Pembroke.



**NOTICE TO CONTRACTORS.**

**Civic Supplies.**

Sealed tenders addressed to the Chairman of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., Tuesday, February 14th, 1911, endorsed "Tender for Broken Stone, Brick, Stone Curbing, Stone Setts, Cement, Plank and Cedar, Sand Vitrified Clay Pipe, Asphalt, Castings, or Hardware, as the case may be.

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall, Ottawa.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

NEWTON J. KER,
Ottawa, January 21st, 1911. City Engineer.

---

**NOTICE TO CONTRACTORS.**

**Waterworks Supplies.**

Sealed tenders addressed to the Chairman of the Waterworks Committee, City Hall, Ottawa, will be received by registered post only, up to 4 p.m., Tuesday, February 14th, 1911, for the supply and delivery of Brasswork, Special Pipe Castings, Hydrants, Cast Iron Pipe, Lead Pipe and Pig Lead, Valves or Oils and Grease as the case may be.

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall, Ottawa.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

NEWTON J. KER,
Ottawa, January 21st, 1911. City Engineer.

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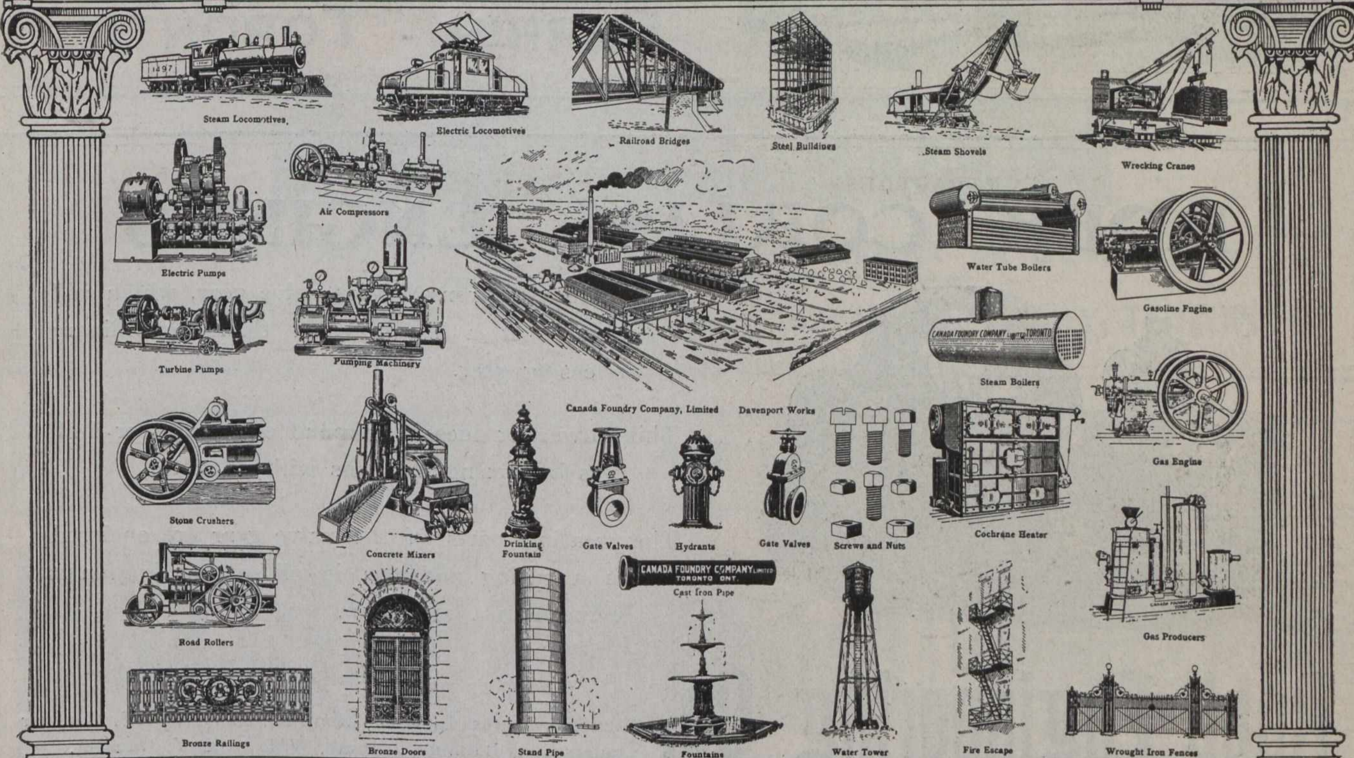


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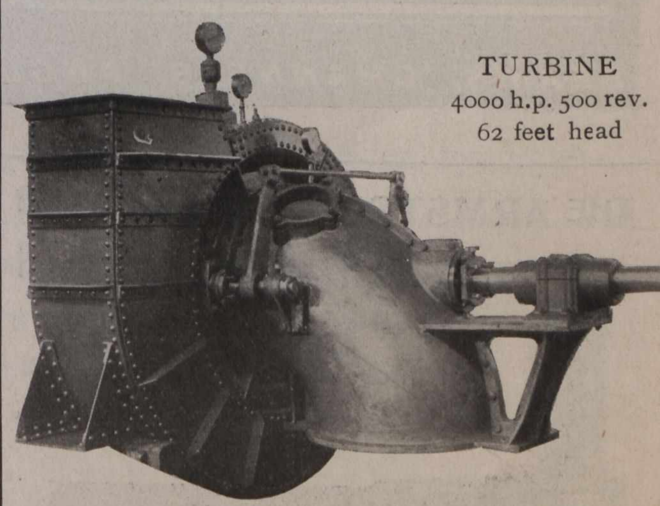

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# CATALOGUE INDEX

Some of the most valuable information on engineering and contracting subjects is to be found in the trade literature of the large supply houses.

**The Canadian Engineer maintains a card index upon which is kept an up-to-date list of manufacturers of contractors supplies and engineering equipment. If you want the catalogues of any of these firms all you need do is to send us a postal giving your address and the list numbers (as printed below) of the catalogues you wish sent. This will save you time and labor and insure prompt service. This department can put you in direct communication with the principal manufacturers of and dealers in engineering equipment of all kinds.**

1 Air compressors.
2 Air lift pumping machinery.
3 Alloys.
4 Aluminum.
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6 Architects' supplies.
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8 Asphalt.
9 Asphalt plants and tools.

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212 Wagons (garbage).
213 Wagons (oil).
214 Well-drilling machin
215 Wheelbarrows.
216 Winches.

# AMONG THE MANUFACTURERS

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

## AIR COMPRESSOR FOUNDATIONS.

A timber foundation is frequently used for small sizes. A compressor, however, is usually a permanent fixture and a first-class foundation costs little more than a poor one, and is so much more satisfactory in the end that we will assume the purchaser of the compressor will put it on a good secure foundation.

The foundation should be constructed of concrete mixed in the following proportions:—One part best Portland cement, three parts clean sharp sand and five parts broken stone, by measure. The sand and cement should be mixed dry, after which the water is to be added. The stone is put in last and all are thoroughly mixed. In ordering materials provide one cubic yard of stone, one half yard of sand and one 375 pound barrel of Portland cement for each cubic yard of foundation.

For roughly estimating the cost of foundations a figure of seven to eight dollars per cubic yard may be used, including the excavation (in earth) and all materials and labor.

We furnish in advance of the shipment of the Compressor, if requested, a foundation plan showing the location of bolts, dimensions of foundation, distance between the fly-wheels, etc. From this plan a wooden template should be made and located at a height which will bring the top of the anchor bolts, suspended from it, at the proper distance above the top of the foundation. To allow for possible inaccuracies, sufficient space should be left around each bolt to premit of moving it an inch in every direction. This is best accomplished by slipping pieces of pipe over the bolts. The upper ends of the pipes should come just below the surface of the foundation so they may be left in after the foundation is completed. Tight wooden boxes may be used but we recommend pipes. If wooden boxes are used, follow instructions on foundation plan. "Make boxes of water-soaked lumber and loosen them daily while building foundation. Remove boxes as soon as foundation has set and fill around bolts with grout after the compressor is placed."

The top of the foundation should come about one to two inches below the level at which the base of the compressor is set, to allow for pouring grout under the machine, as described in the next paragraph. The top of the foundation should be left rough and should be kept wet until the machine is grouted in so that the grouting will bond to the top of the foundation.

When the foundation is "set" the compressor may be lowered upon it, each bolt being guided to its proper position. A level should then be placed on the crosshead guides. A number of iron wedges are to be inserted between the foundation and the base of the machine and driven in so as to bring the compressor perfectly level without strain and about 2 inches above the rough top of the foundation. Every precaution should be taken to have the compressor set level for this insures correct adjustment and alignment throughout. When the levelling is completed (with the nuts loose on the foundation bolts) the holes around the foundation bolts should be filled with a grout thin enough to flow readily. A dam for holding grout should then be formed around the edge of the foundation and the top should be about 1 inch higher than the base of the machine. The top of the foundation should be washed off thoroughly with water and a broom. Make a grout composed of one part Portland cement, one part clean sharp sand, and four parts gravel screened to ½-inch mesh and free from earthy matter. The sand and cement should be thoroughly mixed dry, then the gravel added and thoroughly mixed and then just enough water added to make a stiff mixture. This should be tamped under the base of the machine thoroughly, using a 1 inch board and tamping it in sufficiently to bring it up about a couple of inches inside the castings and continuing until the grout is built out 4 inches or 5 inches around the base of the frame and pillow block, in order to hold the grout from flowing back out. The whole top of the foundation should then be covered with grout to the height of the dam and levelled off with a straight edge and trowel, finishing about 1 inch above the base of the machine. In warm weather or in a warm engine room the top of the foundation should be kept damp a few days to prevent it setting too quickly. When the grout is thoroughly set, for which not less than a week should be allowed, the foundation bolt nuts should be screwed down tight and the setting of the machine is completed.—(Canadian Rand Company Catalogue.)

## NEW INCORPORATIONS

**Edmonton, Alta.**—Northern Commission Co., $25,000.

**Red Deer, Alta.**—Colonial Securities Corporation, $250,000.

**Galt, Ont.**—Canadian Motors, $250,000; G. A. Dobble, E. J. Getty, F. S. Scott.

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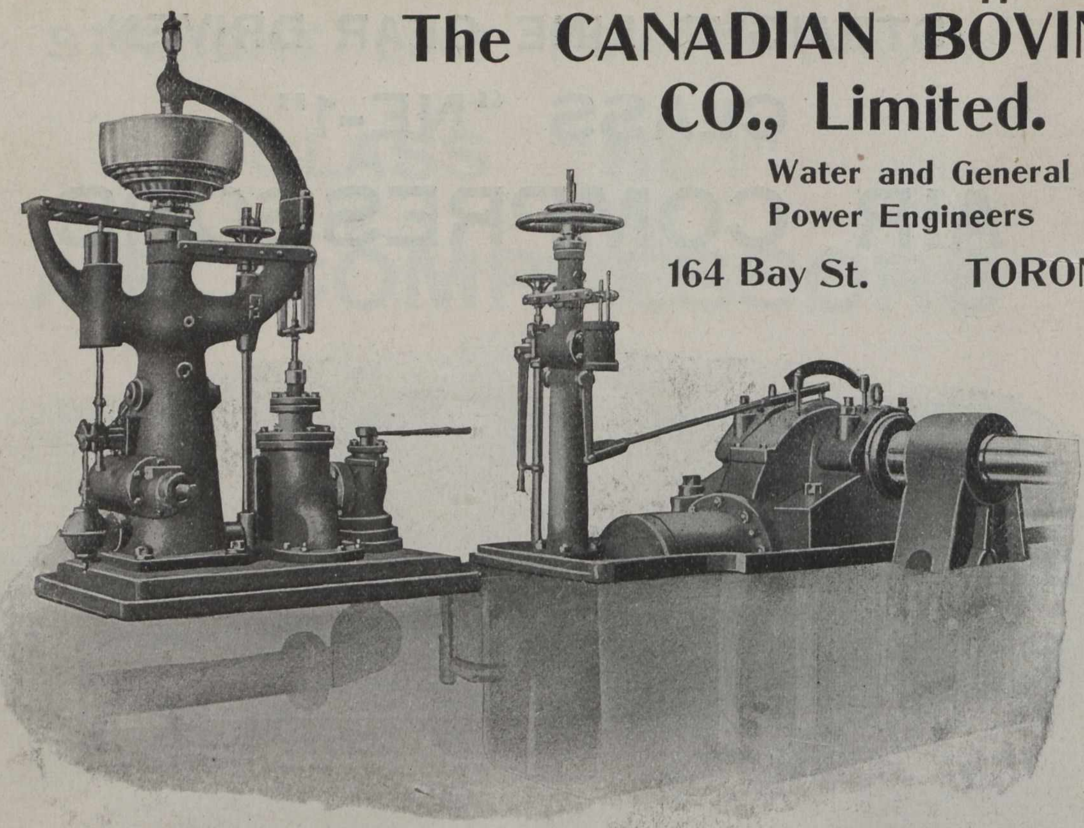





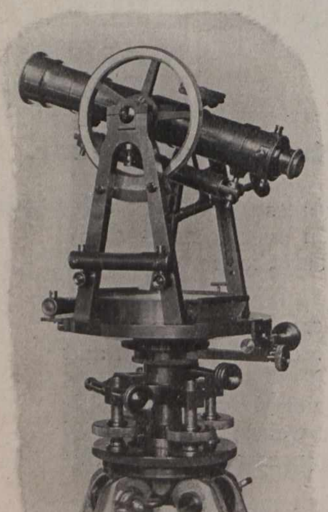

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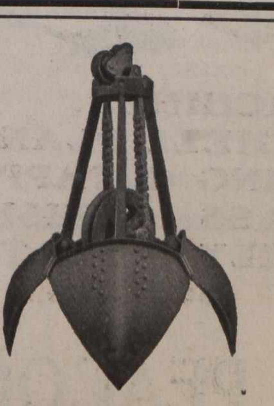

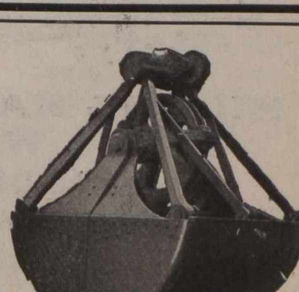

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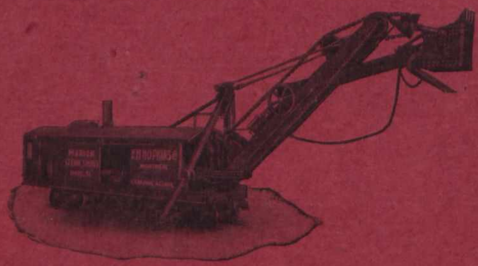

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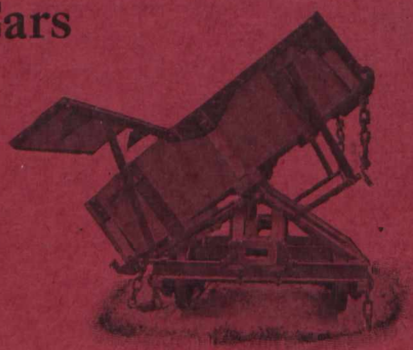

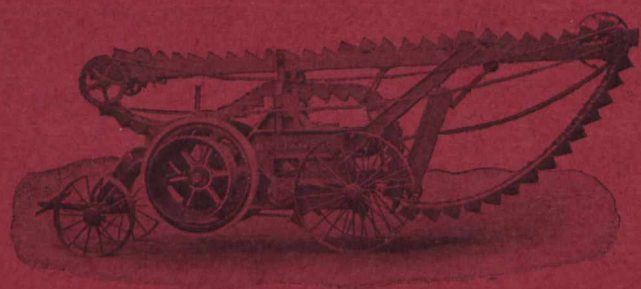

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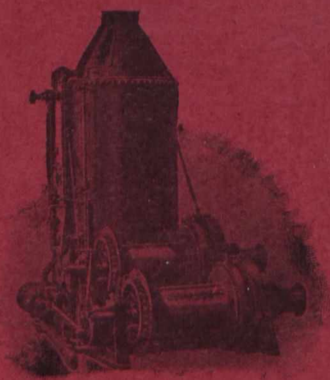

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