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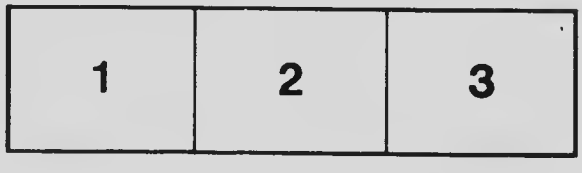
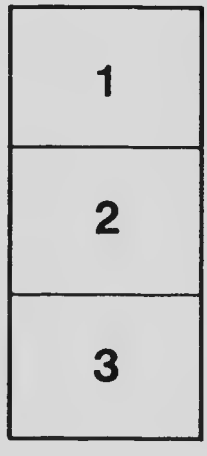
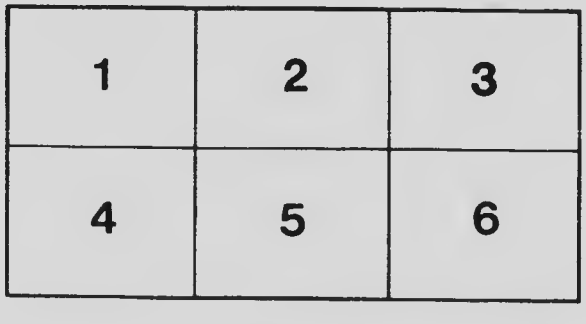






DOMINION BRIDGE Co. LIMITED
MONTREAL, CANADA.

BRIDGES
AND STEEL STRUCTURES

42

THE

DOMINION BRIDGE COMPANY, LIMITED

MONTREAL, CANADA

ENGINEERS AND CONTRACTORS FOR,
AND MANUFACTURERS OF

FIXED AND MOVABLE BRIDGES—TURNTABLES—STEEL BUILDINGS—GIRDERS —ROOF TRUSSES—TRANSMISSION TOWERS AND POLES—TANKS—BUNKERS— HOPPERS—STEEL PIPE—HYDRAULIC REGULATING GATES—CAISSON GATES— SCOWS — DERRICKS — ELECTRIC AND HAND POWER TRAVELLING CRANES —AND MACHINERY FOR ALL CLASSES OF STRUCTURAL WORK.

Main Offices and Shops	**LACHINE, Que.**
	TORONTO, Ont.
Branch Offices and Shops	**OTTAWA, Ont.**
	WINNIPEG, Man.

Total Annual Capacity
120,000 Tons
(Over 100,000,000 Kilogrammes)

CATALOGUE S. 1.

JANUARY 1915

FOREWORD

THE DOMINION BRIDGE COMPANY, LIMITED of LACHINE, CANADA, had its origin in a small concern located in Toronto and known as The Toronto Bridge Company. This original company was founded in 1879 to cope with a demand for iron and steel bridge work which was at that time springing up in Canada. During its earliest years the company fabricated and erected numerous highway and railway bridges of various types, plate and lattice girders, pin and riveted trusses, trestles and viaducts as well as several buildings for industrial purposes and by 1882 the owners decided to organise and equip for the manufacture of the various larger bridges which were at that time receiving the attention of promoters and engineers. Additional capital was however considered to be essential and this was therefore sought and successfully secured. With this new capital new property was acquired in the town of Lachine, Quebec, about seven miles west of Montreal and in 1883 the Dominion Bridge Company Limited was incorporated, the Toronto organisation being carried as a branch. A shop was built on the Lachine site, was well equipped with the best class of machinery then available and was indeed accepted as one of the largest and most efficient bridge shops then existing on this continent. In fulfilment of the hopes of the managers of the company the contract for the St. John Cantilever Bridge was secured soon after incorporation. Reference is made to this span on pages 14-15 where an illustration of the steel during erection is given. As this work was nearing completion the company was awarded the contract for the steelwork in connection with the Canadian Pacific Railway Bridge over the St Lawrence River above Lachine Rapids. This became one of the famous bridges of the continent and is described and illustrated in the following pages.

From about this time, 1886, the development of Canada and Canadian Railways became much more rapid and the company built in quick succession a series of important bridges in various parts of the Dominion. Before 1890 for example the following structures of more considerable magnitude had been erected:—

FOREWORD (Cont'd)

(*a*) The C. P. R. bridge at Sault St. Marie consisting of 10 fixed spans 240 feet long (73.15 m) and one swing span of 405 feet (123.43 m).

(*b*) The Fredericton bridge on the Fredericton and St. Mary's Railway over the St. John River, consisting of 6-239 feet (72.85 m) fixed spans, 2-161 feet (49.07 m) fixed spans and a 242 feet (73.76 m) swing span.

(*c*) The Coteau Bridge on the Canada Atlantic Railway over the St. Lawrence River aggregating 3906 feet (1190.1 m) illustrated and described on pages 22, 23 and 24

(*d*) The Cape Breton Railway bridge over the Grand Narrows, C.B. including 6 239 feet (72.85 m) fixed spans and n 242 feet (73.76 m) swing span.

In the Coteau and Grand Narrows bridges th fixed spans were assembled on shore and floated on barges into correct position, and it is believed that these were among the first instances where this method of erection was applied and carried out.

Adding to the above mentioned larger bridges the weight of the numerous smaller structures built during this first period of the Lachine Shops, the total tonnage from the inception in 1883 to the end of 1890 reached 32,811 tons* (29,766,000 kg), distributed approximately under the following heads:

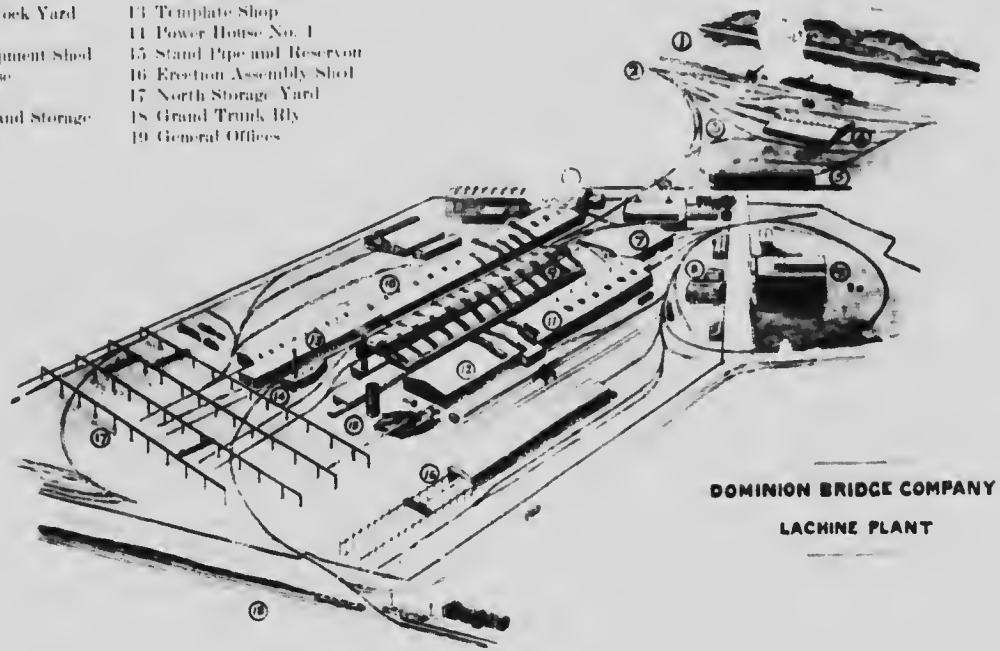
The six bridges referred to above	17,205 tons	(15,608,000 kg)
Other bridgework	11,107 "	(10,316,000 kg)
Steelwork outside of bridges	1,202 "	(3,812,000 kg)

In 1888 the Toronto branch was dismantled as it was found that the Lachine shops could easily and efficiently handle the fabrication of all the work secured.

* ... of 2,000 lbs is used throughout this catalogue

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

1 Lachine Canal
2 C. P. R.
3 Canal Bank Stock Yard
4 Stock Shed
5 Erection Equipment Shed
6 Shipping House
7 Painting Shop
8 Pattern shop and Storage
9 Main Shop
10 Girder Shop
11 Machine Shop
12 Blacksmith Shop
13 Template Shop
14 Power House No. 1
15 Stand Pipe and Reservoir
16 Erection Assembly Shed
17 North Storage Yard
18 Grand Trunk Rly
19 General Offices



DOMINION BRIDGE COMPANY

LACHINE PLANT

FOREWORD (Cont'd)

Indeed it was not until 1897 that any further extension of the plant at Lachine was found to be advisable. At this date a small machine shop was constructed and the necessary land acquired to permit the erection of an additional structural shop. This was the commencement of a long period of development. The advancement of the country was accelerated, the demand for steel structures grew apace and for several years the company was continually occupied in keeping its organization and capacity equal to the task of fulfilling the contracts that could be secured. New girder shops, assembly sheds, shipping aisles, have been added. New and commodious offices have been built — extensive additions to crane ways, storage yards, railway tracks have been made — erection equipment has been greatly increased and every reasonable effort made to bring the whole plant into line as a modern and efficient bridgeshop.

The Lachine works have at present 458,600 sq. feet, or 10½ acres (4.26 hectares) of floor surface under roof which is 7¼ times the area of the original shop of 1883. The total area of the Lachine property is 43 acres (17.4 hectares) while the length of single track standard gauge railway line in the works reaches 6 miles (9.6 km). The shipping facilities include a long frontage on the Lachine Canal in addition to direct connection with Grand Trunk and Canadian Pacific main lines, while the capacity has risen to 72,000 tons (65,000,000 kg) per annum.

After the first construction of the Grand Trunk Railway (about 1853) and the Intercolonial Railway (about 1870) with their iron bridges built by British and American firms, there was a temporary cessation in this type of work and the history of the Dominion Bridge Company from 1879 onwards is representative of the subsequent progress of Canadian bridge building.

In more recent years the growth of the company's business, which, in common with the general trend of Canadian development, has been most marked in the Western provinces, has led to the establishment of branch shops and offices. These branch works, beginning usually as beam shops equipped with shears and punches and carrying stock material suitable to local demands, have been extended and improved until both at Toronto and Winnipeg there are organizations capable of supplying any kind of building work and certain classes of bridge work. The Winnipeg shops indeed, as enlarged in 1912-3 are now fitted to handle long and heavy bridge material of all but the most extreme sections. The first branch, historically, was located in Toronto the property being bought and the shop commenced in 1906.

South yard showing erecting shed
North yard and crane runaways

LACHINE SHOPS

South yard showing offices
Inside erecting shed

FOREWORD (Cont'd)

In 1912 this was rebuilt and considerably increased until the area under roof is now 71,000 square feet or 1.63 acres (66 ares) and the annual capacity for structural steel and small bridgework about 18,000 tons (16,300,000 kg) The Winnipeg branch was started in 1908 and after the 1912 enlargement referred to above, the area under roof reached 130,000 square feet (1.21 hectares) or 3 acres and the annual capacity approximately 27,000 tons (24,500,000 kg). At Ottawa also a local shop has been established which at the present time, January 1915, covers 20,000 square feet (18.5 ares) and can produce about 3,000 tons (2,720,000 kg) of building steel annually. In the City of Montreal a local contracting office is maintained and also a large storage yard for city and suburban erection purposes

Including the Lachine plant and the above mentioned auxiliary plants the total yearly capacity of the Dominion Bridge Company as now being operated is 120,000 tons (109,000,000 kg). Besides all the preceding the company owns a half interest in the shops of the St. Lawrence Bridge Company at Rockfield, near Montreal, where the steel for the new Quebec Bridge including the 1800 feet (548.6 m) cantilever span is now being manufactured. This plant specially built and furnished for the heaviest and most superior class of bridgework is able to produce 30,000 tons per annum (27,200,000 kg).

The company has always sought to maintain a trained and experienced staff of engineers. Its President today was in responsible charge of the early bridgework including the St. John Cantilever, the Lachine Bridge, the Coteau Bridge and the Grand Narrows Bridge, and certain of the present leading officials have been connected with all its important undertakings. Attached to the technical staff are

Original Lachine Shop 1883.
Ottawa Shop and Yard.

FOREWORD (Cont'd)

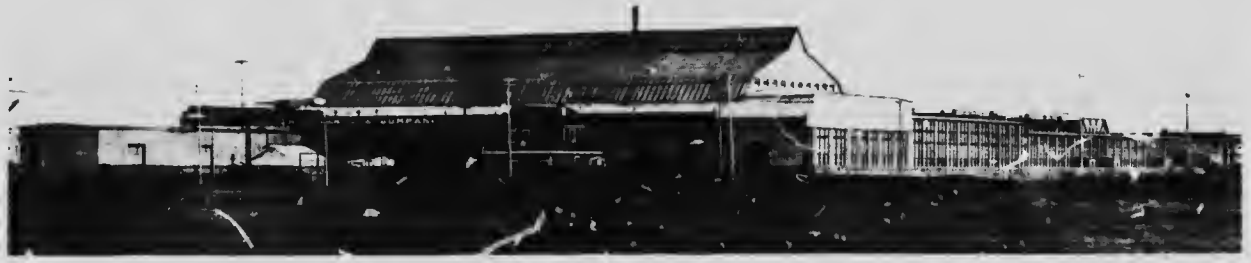
engineers from other countries both European and American, the general policy always having been to keep abreast of the best practice throughout the world. The contracts for many of the most important structures built by the company have been obtained on the designs of its own engineers, entered in open competition with the designs of other companies. In the case of the new Quebec Bridge the design which ultimately secured the award of the contract was figured and prepared by the company's engineering staff.

Attention has been drawn to a few of the more important and early contracts but it is manifestly impracticable to include in a catalogue of these dimensions a complete list of the structures built during the thirty years of the company's existence. A brief memorandum indicating the distribution of work between the principal railway companies of Canada, the Provincial and Dominion Governments and leading industrial concerns is however appended, together with a tabulated statement in regard to movable bridges.

Special reference must here be made to the mechanical department of the plant at Lachine. This department undertakes the design and manufacture of every description of mechanical work. Possessing as it does a large and exceptionally well equipped machine shop, it is able to execute work of almost any magnitude. The hydraulic lift locks at Peterborough and Kirkfield, the movable dams at Sault St. Marie, the regulating gates at Shawinigan Falls are among the better known structures of this variety, fabricated by the company. A special departmental catalogue is issued to cover this portion of the company's business, in which suitable mention is made of the large and varied output of cranes.

The cuts given in the following pages are all taken from actual photographs and serve to illustrate the scope of the company's work. They can only touch a very limited number of the contracts, but it is hoped that they will be of interest in depicting not only the magnitude and variety of the structures, but also occasionally, the general features of the situation and their effect on the schemes of erection.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.



Winnipeg Shops.
Toronto Shops.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

Distribution of Lachine Shop Tonnage to representative leading customers (Principal contracts only)

Purchaser		Short Tons (2,000 lbs)	Metric Tons (1,000 kg)
Canadian Pacific Railway and constituent lines	(bridgework only)	99,637	90,400
Grand Trunk Railway and constituent lines	" "	46,158	42,140
National Transcontinental Railway	" "	37,067	33,620
Intercolonial Railway and constituent lines	" "	26,170	23,740
Canadian Northern Railway and constituent lines	" "	16,735	15,180
Atlantic Quebec & Western Railway		7,212	6,570
Reid Newfoundland Railway		4,021	3,648
Dominion Government (exclusive of railways)		20,650	18,733
Province of Nova Scotia		1,878	1,704
Province of New Brunswick		5,311	4,847
Province of British Columbia		4,289	3,891
City of Montreal		2,610	2,395
City of Toronto		1,825	1,656
City of Winnipeg		1,220	1,107
City of Vancouver		4,399	3,991
City of Edmonton		1,327	1,204
Bell Telephone Company		3,067	2,782
Canada Sugar Company		1,659	1,505
Canadian Car & Foundry Company		9,618	8,726
Canadian Copper Company		4,282	3,884
Canadian Steel Foundries		3,482	3,159
Consumers Gas Company, Toronto		3,110	3,093
Dominion Coal Company		4,605	4,177
Dominion Iron & Steel Company		3,515	3,189
Laurentide Pulp & Paper Company		2,733	2,479
Montreal Harbour Commissioners		14,989	13,599
Montreal Light, Heat & Power Company		7,771	7,050
Montreal Tramways Company		3,869	3,151
Steel Company of Canada		1,419	1,287
St. Lawrence Sugar Company		1,500	1 361
Wayagamack Pulp & Paper Company		1,377	1 249
Total output of Lachine Shop from 1883 to 1911 inclusive		600,104	544 440

LIST OF MOVABLE BRIDGES

In addition to the bridges illustrated in the succeeding pages the company have fabricated and erected the following movable spans

RAILWAY SWING SPANS

Date	Location	On	Span feet	Span metres	Weight	Weight tons	Weight kg
1887	Fredericton, N.B	C.P.R.	242	73 76	R	215	195,000
1889	Coteau, Que.	C.A.R.	355	108 2	R	330	299,000
1892	Welland Canal	G.T.R.	198	60 35	R	206	187,000
1892	Lachine Canal	G.T.R.	250	76 2	R	176	160,000
1894	Soulanges Canal	C.A.R.	182	55 48	P	109	99,000
1895	Sorel, Que.	D.& H.R.	236	71 93	R	164	149,000
1896	Parry Sound, Ont.	G.T.R.	166	50 6	R	109	99,000
1897	Lacolle, Que.	C.A.R.	183	55 78	R	117	106,000
1898	Crows Nest, B.C.	C.P.R.	166	50 6	R	105	95,000
1898	Sault Ste Marie	C.P.R.	408	124 35	P	392	356,000
1900	Yamaska, Que.	D.& H.R.	137	41 76	R	93	84,000
1901	Winnipeg	C.P.R.	251	77 12	R	290	263,000
1901	False Creek, B.C	C.P.R.	128	39 01	R	83	75,000

Date	Location	On	Span feet	Span metres	Weight	Weight tons	Weight kg
1903	Hillsboro'	P.E.I.R.	210	64 01	R	275	249,000
1909	Soulanges Canal	G.T.R.	183	55 78	C	270	245,000
1910	Assiniboine R. Sourris.	C.P.R.	230	70 1	R	320	290,000
1910	Lake Couchiching	C.P.R.	161	49 07	C	136	123,000
1911	Wellington St. MTL	G.T.R.	256	78 03	R	451	409,000
1911	Lacadie Junc. Que.	G.T.R.	241	73 47	R	370	336,000
1913	Moose River	D.A.R.	156	47 55	C	182	165,000
1912	Rose Point, Ont.	G.T.R.	171	52 12	R	220	200,000
1912	Red River, Winnipeg	C.P.R.	255	77 72	C	*630	572,000
F 14	Pitt River, B.C.	C.P.R.	273	83 2	C	*515	749,000
1911	Chambly, Que	C.P.R.	112	34 14	C	*150	136,000
1915	Lachine Canal and 22 others.	C.P.R.	238	72 54	C	*600	545,000

HIGHWAY SWING SPANS

Date	Location	Span feet	Span metres	Weight	Weight tons	Weight kg
1892	Norwood, Winnipeg	200	60.96	R	91	82,000
1895	Osborne St., Winnipeg	254	77 42	R	85	77,100
1896	Soulanges Canal—5 spans	211	73.46	P	315	286,000
1897	Main St., Winnipeg	187	57	R	94	85,300
1903	Buctouche, N.B.	283	86 26	P	118	107,000
1904	Welland Canal, Allenburg	254	77 42	P	127	115,000

Date	Location	Span feet	Span metres	Weight	Weight tons	Weight kg
1907	Redwood Av., Winnipeg	251	76 50	L	327	297,000
1908	Fraser River, B.C.	190	57 91	R	84	76,000
1908	Granville St., Vancouver	261	80 17	P	460	417,000
1909	Chipman, N.B.	147	44 81	P	41	37,000
1914	Elm Park, Winnipeg and 23 others.	276	84 12	P	220	200,000

Note: * = double track. R = Rim bearing. C.= Centre bearing. P Partly Both.

OTHER MOVABLE BRIDGES

1899 Shubenacadie vertical lift span, Nova Scotia.
1887 Pictou Harbour, N. S., bascule lift. I.R.C.

1888 Louise Dock, Quebec, 120 feet (36.57 m) Retractile span.
1896 Morris Brook, Newfoundland, Bascule, R. N. Ry

TURNTABLES SINCE 1910

1	100 feet	(30.48 m)	C. P. R.	weight	96 tons	(87,100 kg)
5	90 feet	(27.12 m)	C. P. R.	weight	105 tons	(367,400 kg)
29	70 feet	(21.33 m)	C. P. R.	weight	1120 tons	(1016,000 kg)
1	80 feet	(24.38 m)	C. P. R.	weight	76 tons	(69,000 kg)
4	85 feet	(25.9 m)	G. T. R.	weight	248 tons	(225,000 kg)
2	80 feet	(24.38 m)	G. T. R.	weight	87 tons	(78,900 kg)
6	75 feet	(22.86 m)	N. T. R.	weight	286 tons	259,500 kg
1	80 feet	(24.38 m)	I. R. C.	weight	62 tons	56,200 kg

ST. JOHN CANTILEVER BRIDGE

As already remarked the Cantilever Bridge at St. John, New Brunswick, was one of earliest contracts secured by the Company. This bridge spans the famous Reversible Falls of the St. John River and serves as the only railway entrance to the town of St. John from the west. The local topography is distinctive, the river at this point narrowing down to a width of about 500 feet (150 m) for a short distance. The banks are high on both sides and consist of limestone rock so that the locality is destined by nature to be the site of both railway and highway bridges, the more so as there is no practical crossing of the river on the upstream side until Fredericton which lies some 67 miles (103 km) while the downstream side is the harbour and river mouth. The appearance of the gorge will be best appreciated by reference to the photographs both on the pages opposite and on pages 37-39. The view given on page 15 illustrates the construction in 1884 and shows the light top chord traveller building out the cantilever arm, the shore arms having been erected on falsework by a high wooden outside traveller. The bridge was built for a special company with the purpose of joining up the Canadian Pacific on the west side to the Intercolonial on the east. The principal dimensions are as follows:—

Length of bridge proper 813 ft. (247.8 m) with channel span 477 ft. (145.4 m).

Length including approach trestle 1220 ft. (371.8 m).

Width 20 ft. centres (6.1 m).

Maximum height 80 ft. over pier (24.38 m)

Total weight 4465 tons (4,050,000 kg).

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

LACHINE BRIDGE

The Lachine bridge by which the main line of the Canadian Pacific Railway crosses the St. Lawrence River was first built in 1886. The site is about seven miles west of Montreal and was chosen by the railway company as their outlet for the east after several locations had been considered.

As originally built the bridge was somewhat remarkable, including as it did the longest continuous span in the world. The main channel was crossed by two 408 feet (124.34 m) spans which with their flanking spans of 270 feet span (82.3 m) made a continuous layout over five supports with a total length of about 1356 feet (443.3 m). The remainder of the bridge consisted of an approach from the east of a 120 feet (36.6 m) deck lattice girder and an approach from the west of three 80 feet (24.4 m) deck plate girder spans followed by eight deck trusses of 240 feet span (73.45 m). The channel spans were made of the through type to give waterway, the transition from the deck construction being achieved in graceful curves. The first illustration on page 47 gives a view of this early bridge which remained in service up to 1943 when the increase of traffic, in weight and volume, demanded a modern double track structure. The necessity of permitting full continuance of both railway and river traffic had an important bearing on the design of the new bridge, and after careful investigation by the engineers of the railway in collaboration with the engineers of the bridge company, it was decided to build two separate but adjacent bridges. New piers were built to divide up four of the 240 feet (73.15 m) openings so that the new structure consists for each track of the following spans beginning from the west end:— Three 80 feet (24.4 m) deck plate girders, eight 120 feet (36.6 m) deck lattice girders, four 240 feet (73.15 m) deck trusses, one 270 feet (82.4 m) deck truss span, two 408 feet (124.34 m) through truss spans over the main channel, one 270 feet (82.3 m) deck truss and one 120 feet (36.5 m) deck lattice girder. The channel spans and their flanking trusses are built to a 20′0″ (6.1 m) centre to centre width, the 240 feet spans to 46′ (4.877 m) width, the lattice girders to 10′ and the plate girders to 9′, the distance between centres of tracks varying from 16′3″ (4.953 m) at the west end to 27′0″ (8.23 m) on the channel spans.

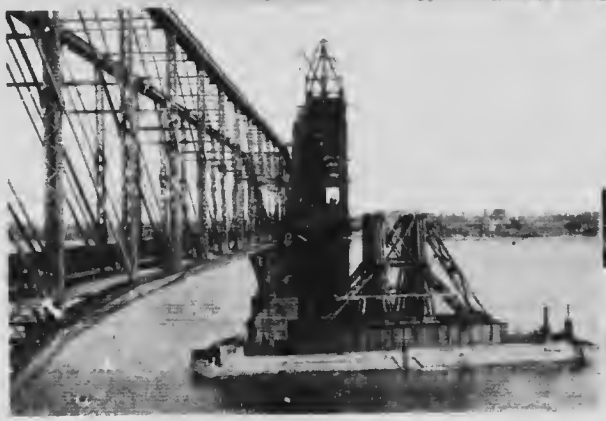
Upper view—as built in 1886 Lower view—as rebuilt in 1913.

LACHINE BRIDGE (Cont'd)

The erection problems were numerous both for the original bridge and the new one, and many schemes were resorted to by the contractors. The illustrations opposite indicate various features in the construction of the bridges, the first view showing the cantilever method employed in 1886, and the others the different stages of the reconstruction during 1912-3. The use of erection trusses, of needle beams, of skidding tracks is well exemplified, in addition to the special appliances adopted for the channel spans. The top chord traveller, equipped to climb up and down the sloping chord, the specially built steel scows with their falsework and also the distributing frame at the land end of the long span during sliding, are all to be seen in the photographs. These 108 feet spans were pulled out with their fore end carried on the scow whilst the distributing frame at the rear slid on specially prepared greased rails. The new truck bridge was completed before the continuous portion of the old structure was removed. The weights of the principal spans are as follows:

Original Bridge	Continuous portion	2050 tons (4,860,000 kg)
	8 — 210′ spans	1930 tons (4,750,000 kg)
	Total steel	1350 tons (3,946,000 kg)
New Bridge	4 — 408′ spans	5200 tons (4,747,000 kg)
	4 — 270′ spans	2760 tons (2,504,000 kg)
	8 — 240′ spans	3900 tons (5,538,000 kg)
	18 — 120′ spans	2170 tons (1,969,000 kg)
	6 — 80′ spans	340 tons (281,000 kg)
	Total steel	14,730 tons (13,009,000 kg)
Total length of either bridge		3657′ 5½″ (1.1147 km)

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.



Erecting 1st 108 feet span on top of 270 feet span.
Entering scow under 2nd 108 feet span.

Launching 1st 108 feet span.
Launching 1th 108 feet span.

1st and 2nd 408 feet spans ready to launch
Dismanting old channel spans

4th 408 feet span ready to launch

COTEAU BRIDGE

The Canada Atlantic Railway which now forms the Ottawa-Valleyfield line of the Grand Trunk System crossed the St-Lawrence at Coteau Landing in a long bridge over three channels. This first Coteau Bridge was built during 1889 and aggregated some 2715 tons (2,190,000 kg) of steel covering a total length of 3906 feet (1,190 km). The crossing of the North or main channel included a 355 feet (108.2m) swing span with three fixed spans, two of 175 ft. (53.34m) and one of 139 feet (42,37 m). Over the middle channel were ten spans of 217 feet (66,11 m) and over the South channel four spans of 223 feet (67,96 m). The middle channel spans are shown in the first illustration on page 23. All these old spans were of the double intersection type statically indeterminate and of very light construction. Nevertheless they carried the increasing traffic up to 1910 when the whole bridge was replaced by a modern structure. The new spans were placed on the old piers and consequently the arrangement is identical with the original layout. The weight of the bridge as rebuilt amounts to 5365 tons (5,112,000 kg) a typical 217 ft. span (66,11 m) weighing 312 tons (283,000 kg) and the centre bearing swing span about 609 tons (553,000 kg).

The erection of this bridge was an interesting undertaking and was mainly achieved in the case of both the old and the new structure by floating. In 1889 the fourteen spans of the south and middle channels were floated into place between October 12th and November 23rd, the illustrations on page 24 showing the landing of the last span. In 1910 the corresponding fourteen spans were built up at the site, on an island conveniently situated and floated off skids into scows and thence towed to position. The "nest" of spans is illustrated in one of the views as also is the arrangement of the barges. The swing span was built on falsework across the old one and then both were swung round together to bring the new span into alignment. The simple Warren system of truss design and the plain substantiality of the new bridge are well depicted in the various photographs.

Middle channel spans 1889.
Middle channel spans being replaced 1910.

ERECTION OF COTEAU BRIDGE

Floating last span of middle channel into place, Nov. 1889
Nest of spans ready for floating, 1910

Floating new span into place 1910
New swing erected across old, 1910

BOUT DE L'ISLE, Mont. This bridge built in 1903 consists of 20 spans including 15 truss spans of 137 feet (41.75 m). It carries the Canadian Northern Railway and also two roadways. The length totals about 2530 feet (771 m) and the weight 2078 tons (1,881,000 kg).

GRAND NARROWS, C. B. This is one of the early bridges referred to on page 4. It now forms part of the Intercolonial Railway and as originally built consisted of 6 fixed spans and one swing, the whole crossing weighing 1490 tons (1,350,000 kg) and being 1700 feet long (519 m).

"ALEXANDRA" INTERPROVINCIAL BRIDGE, OTTAWA

The Interprovincial bridge across the Ottawa River was built during 1900 and on the visit of King George V as Duke of York in 1901 was formally opened under the name of the Alexandra Bridge. As the term Interprovincial implies the bridge provides connection between the Provinces of Ontario and Quebec and gave accommodation to what were then known as the Pontiac Pacific Junction Railway and the Ottawa Northern and Western Railway. In addition to a single track for steam railway use there are two electric railway tracks and two road ways for vehicular traffic as well as two footpaths. The total length of crossing is 2681′9″ (818.2 m) including the trestle approaches, whilst the bridge proper covers 1495′9″ (455.9 m). This latter figure is made up of cantilever structure 1049′9″ (319.9 m) with two truss spans of 247′ (75.28 m) and 140′ (42.67 m) respectively and also two short girder spans at the Ottawa end totalling 59 feet (17.98 m). The trusses are 24′0″ (7.315 m) apart centre to centre and the cantilever brackets of 21′7″ (6.578 m) overhang make a total overall width of 67′2″ (20.471 m). The railway and two footways are carried between the trusses whilst the electric tramways are outside near to the trusses with the carriage ways more remote. The weights of the more important items are 2370 tons (2,150,000 kg) for the cantilever portion, 372 tons (337,500 kg) for the 247 feet (75.28 m) simple span with a grand total of 3809 tons (3,455,000 kg) for the whole structure.

The erection of this bridge presented some unusually difficult features due largely to ice conditions. Unavoidable delay in starting coupled with unexpected trouble from frazil ice compelled a change from the original erection scheme. The 140 feet (42.67 m) span was built on ordinary falsework between December 20th, 1899, and January 3rd, 1900 and upon it the traveller was immediately constructed. The 247 feet (75.28 m) span was then begun, using floating falsework. A Howe truss carried on four specially built scows supported in its turn, bents of timber framing designed to act as falsework for each of the three 247′ (75.28 m) spans, the two anchor arms and the simple span. The floating falsework was placed ready for the 247′ simple span early in January 1900 and by the 30th of the month the span was complete, that is to say, without the brackets which were placed on all spans later in the erection.

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"ALEXANDRA" BRIDGE, OTTAWA, (Cont'd.)

The great trouble with the ice was now experienced when it was hoped to be able to move the scows and falsework to the next opening, but it was the 23rd of February before they reached the desired position. The depth and consistency of the "frazil" together with the speed with which it rose and filled all the space cut in the solid ice, combined to make the operation arduous and expensive and it was decided to erect the lower chord, lower web members and floor system of this Hull side anchor arm, clear of their true position and then float them over to the Ottawa anchor arm opening completing the erection as the Ottawa anchor span. The break up of the river ice came late in 1900 and it was April 19th before the assembled steel could be moved across. (See illustration, page 29). The falsework was taken downstream, turned end for end, and towed upstream to its new position. The erection was then continued and this span reached its final position complete and on the masonry on the 29th of May. The cantilevering from the Ottawa side was immediately proceeded with and the centre of the suspended span reached by July 10th. On June 2nd the floating falsework was moved back to the Hull side anchor span, and this steel was erected when the traveller had been transferred by derrick scow from the Ottawa Cantilever. The Hull cantilever was commenced August 30th and the last pin driven on October 7th, 1900.

The scows used in this work were launched at Lachine and towed up to the site of the bridge carrying the timber for the falsework trusses and bents, and all blocking, tackles, derricks, and other equipment. The four used in the floating falsework were each designed to carry 225 tons (204,000 kg) load consisting of the steelwork built over them, the traveller, blocking, falsework, etc.

An interesting item in connection with this bridge was the finding of a layer of sawdust and mill refuse on the river bed extending across the greater part of the river and reaching a depth of 50 feet (15.24 m).

The views on page 29 show various stages of the erection whilst the photograph on page 27 shows the main spans complete.

Erecting Ottawa cantilever, June 23, 1900
Floating steel across river, April 21, 1900

Erecting Hull cantilever, August 30, 1900
View from Ottawa Shore, September 1, 1900

FRASER RIVER BRIDGE, NEW WESTMINSTER, B. C.

The combined Railway and Highway Bridge across the Fraser River at New Westminster, B. C. was built for the Provincial Government in 1903 and serves to give entrance to Vancouver to the Great Northern Railway. The trusses for the greater part of the crossing are placed 19 feet (5.79 m) apart on centres, the accomodation for highway being provided in an upper deck. At the North end of the bridge the railway track bifurcates and the somewhat unusual feature of a spreading span was made necessary. The actual dimension centre to centre of bearings at the wide end is 135 feet 6 inches (41.29 m), and the effect of this layout both in the general appearance and the design of the floor system is illustrated in the view on page 32.

As indicated by the photograph on page 31 this is another important piece of bridgework where resort was made to the scheme of floating the spans into position.

The steel bridge consists of five similar spans of 159 feet 3 inches (48.15 m), one fixed and one swing span of 380 feet (115.8 m), the spread span already mentioned, which has a length of 225 feet (68.56 m), and a short trestle approach to the highway deck. There are also the railway approach girders at the North end leading the east and west bound tracks on to the span where they connect.

The length of the railway crossing is about 2010 feet (622 m) whilst the highway including north end trestlework amounts to some 1980 feet (603 m). The total weight of steel in the bridge is approximately 3786 tons (3,431,000 kg) distributed as follows:—

5	159 feet double deck spans	836 tons (758,100 kg)
1	380 " " " span	805 tons (730,200 kg)
1	380 " " " swing span	729 tons (661,300 kg)
1	225 " spread span.	991 tons (899,000 kg)
Girders and approach trestles.		125 tons (385,500 kg)

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FRASER RIVER BRIDGE, NEW WESTMINSTER, B. C.

SALMON RIVER ARCH

The SALMON RIVER ARCH illustrated on page 33 was built in 1893 and is situated on the Canadian Pacific Railway 137 miles east of Vancouver. It has a span of 270 feet (82.3 m) and a rise of 50 feet (15.24 m) the depth being 60 feet 3⅝ inches (18.385 m) at the ends and 10 feet 3⅝ inches (3.133 m) at the centre. The trusses are 16 feet (4.857 m) apart at the centre line of top chord but are placed in inclined planes at a 1 in 10 batter. The approach at either end consists of two plate girder spans making the total length of bridge 490 feet (149.3 m) and the total weight 388 tons (372,000 kg) the arch proper contributing 317 tons (287,000 kg).

The SURPRISE CREEK ARCH as shown on page 35 is another Canadian Pacific bridge and is located near Glacier in the Selkirks, about 435 miles east of Vancouver. It was built in 1897 and has an unusual feature in its lack of symmetry, one pair of shoes being about 22 feet (6.7 m) lower than the other. The batter in this case is 1 in 8, the greater end depth 92 feet (28.04 m), the centre depth 16 feet, (4.875 m.), and the width between centre lines of top chords also 16 feet. The length is 290 feet 11½ inches (88.5 m) between end pins, the weight of the arch 520 tons (472,000 kg) and the total weight including the approach spans 605 tons (549,000 kg).

The ST. MAURICE CANTILEVER bridge also illustrated on page 35 was built in 1895 for the Great Northern Railway of Canada now forming part of the Canadian Northern System. The nominal dimensions are: total length 400 feet (121.9 m) channel span 250 feet (76.2 m) width 20 feet (6.096 m). The bridge is situated near Grand Mere, Quebec. The steel in the cantilever weighs 305 tons (277,000 kg) to which the trestle approach adds 64 tons (58,000 kg).

The THREE RIVERS crossing by which the Canadian Pacific spans the St. Maurice on the main line from Montreal to Quebec consists of five 220 feet spans (67.1 m) built to the standard C. P. R. specifications of 1905. The centre to centre width is 18 feet 6 inches (5.64 m) and the weight of each span 380 tons (344,700 kg).

Surprise Creek Arch C. P. R.

St. Maurice Cantilever C. N. Q. R.
Three Rivers C. P. R.

ST. JOHN ARCH

The Highway Arch Bridge over the gorge of the St. John River ranks among the heaviest and shallowest structures of this type. It is designed to carry the regular city highway traffic including two lines of street railway and will eventually replace the old suspension span built in 1852. The floor of the new bridge is to be of reinforced concrete with a creosoted wood block surface, with concrete slabs for the sidewalks. These latter are 7 feet wide (2.133 m) and are partially cantilevered on brackets from the tops chord. Between curbs the roadway measures 36 feet (10.97 m), the trolley poles for the electric railway being placed on the centre line while the lamp posts are incorporated in the railings at either side.

The arch spans across the Reversible Falls and lies between the Suspension Bridge and the railway cantilever. River traffic being considerable at slack tides, clearance was demanded as nearly as possible equal to that previously existing, consistent with good design and pleasing appearance; and this feature led to the adoption of the flat parabolic spandrel braced arch. The distance between centres of skew back pins is 565 feet (172.2 m) the height between skew back pins and the centre pin in the bottom chord being 61 feet 3 inches (18.666 m). The depth of the trusses is 60 feet (18.286 m) at the end posts and 8 feet 6 inches (2.59 m) at the centre, and they are spaced 41 feet (12.5 m) apart centre to centre.

At each end of the arch there is an approach span of plate girder construction, equal in length to two panels of the main bridge, the total length between abutments thus being 651 feet (199.3 m).

The steel in the structure including railings and skewback castings amounts to 2181 tons (1,978,000 kg).

ST. JOHN ARCH (Cont'd.)

The span was erected as a cantilever from both ends, and upon the junction being made at the centre, the condition of a three hinged arch was secured. By the insertion of the centre portion of top chord, accurately fitted and under no stress, all further dead load such as flooring and minor steelwork, as well as live load was carried by the truss as a two hinged arch. The anchorage during erection was accomplished by connecting a chain of eyebar members to the upper chord and guiding them by inclined shoes at pin points into anchor pits. The pits were excavated to a sufficient depth to secure ample reaction against uplift, chambers were hollowed out at the bottom, and cross beams and girders served to engage the concrete with which the pits were then filled. By this means the weight and strength of the natural rock were used as anchorage factors, the total uplift in each pit being calculated at about 1075 tons (975,000 kg). Adjustment of the position of the cantilevered truss was made possible by the provision of a toggle arrangement, consisting simply of powerful hydraulic jacks, reacting against the abutment, and capable of lifting that pin point in each eyebar chain which was situated some fifty feet from the arch end post. Two 100 tons jacks for each truss were sufficient for all purposes including the final adjustments necessary for the insertion of centre pin and centre top chord.

The photographs illustrate the erection progress as carried out during the autumn of 1911 and serve also to indicate the character of the site. The uniqueness of the situation is realised when a suspension, a cantilever and an arch bridge are seen side by side.

The new span was built for the Province of New Brunswick, the general design being prepared by Mr. C. C. Schneider, of Philadelphia, and the Dominion Bridge Company being contractors for the supply and erection of steel work, concrete flooring and the wood block pavement.

West end anchor bars.
West arm cantilevered.

Erecting east arm.
West arm from east bank.

LYTTON ARCH

The arch bridge over the Fraser River near Lytton, B.C., illustrated on page 41 lies on the line of the Canadian Northern Pacific Railway, for whom Messrs. Waddell and Harrington acted as consulting and designing engineers. It is three hinged and spandrel braced having its trusses in inclined planes and its deck carried directly on the top chord. It was erected cantileverwise from both ends, ordinary parallelogram toggles being used as means of adjustment. Anchorage at the west end was provided by rails as the nature of the ground and rock precluded their being taken advantage of, but at the east end the natural rock being good, it was engaged through eye bar chains concreted into an anchor pit. Steel was passed from the west end to the east end by a cable way as access to the east end was practically impossible. The arch is 425 feet span (129.5 m) and has a rise of 90 feet (27.43 m); the top chords are 14 feet (4.267 m) centres and the batter of the truss planes one in eight. The approach from the west is by a trestle 347 feet long (105.76 m) and at the east end a 40 feet (12.19 m) girder leads to a deep rock cutting. The weight of the arch alone is 1131 tons (1,029,000 kg) and of the whole crossing 1458 tons (1,323,000 kg).

THE CANADIAN NORTHERN PACIFIC BRIDGE over the Thompson River near ASHCROFT, B. C., illustrated on page 42 and known as No. 5, is a 210 feet (64.0 m) simple truss span. The erection was a difficult problem and was accomplished by counterweighting with a load of rails and cantilevering across the cañon.

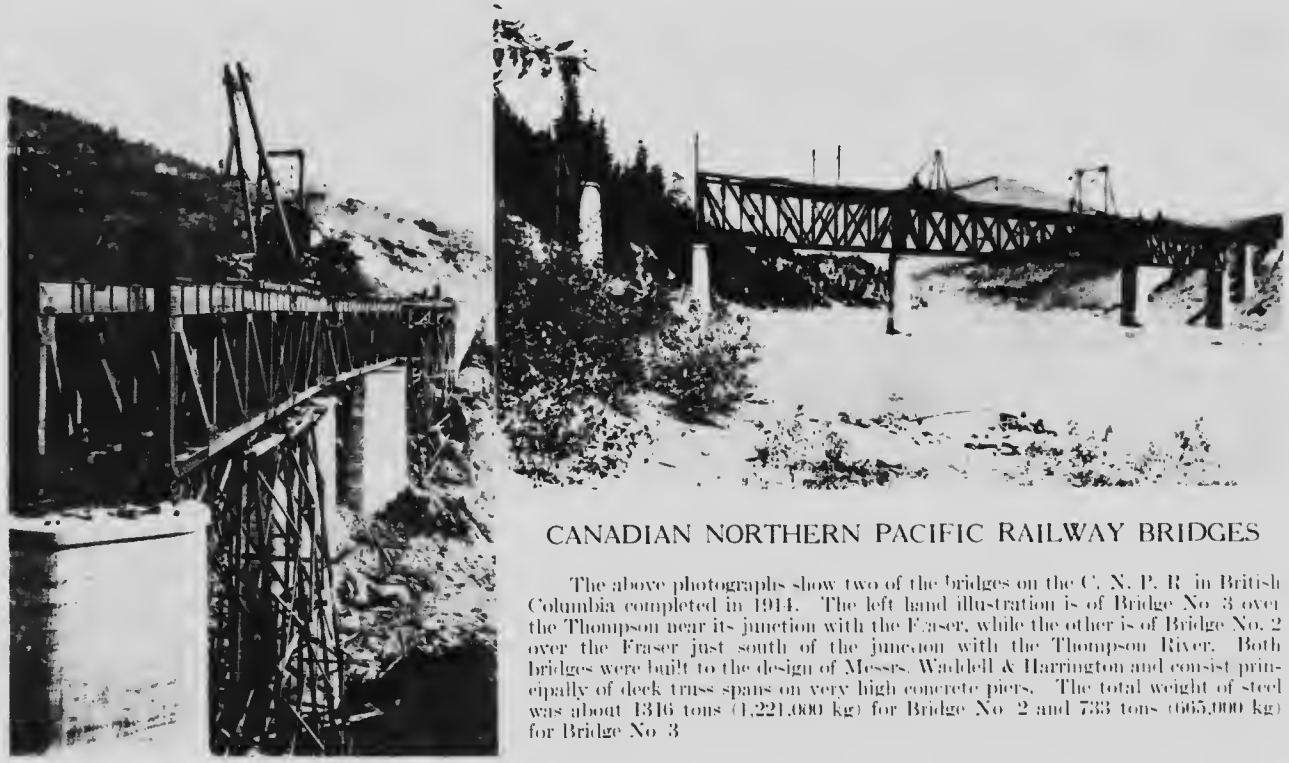
THE CANADIAN PACIFIC RAILWAY BRIDGE across MUD LAKE on the C. L. O. and W. branch is also shown on page 42. This bridge consisted of deck plate girders and deck trusses, and cantilevering was again the only means of erecting the main spans. The photographs illustrate the general method adopted, and on the lower one is seen the unusually deep pier whose foundations are 108 feet (32.9 m) below the surface of the liquid mud which forms the lake.

LYTTON ARCH

Erecting east end. Shows west end toggles and anchorage. Showing arch completed. C. P. R. bridge in background.

Bridge No. 5, C. N. P. R. near Ashcroft, B. C.

Mud Lake Bridge on C. L. O. W. Ry.



CANADIAN NORTHERN PACIFIC RAILWAY BRIDGES

The above photographs show two of the bridges on the C. N. P. R. in British Columbia completed in 1914. The left hand illustration is of Bridge No. 3 over the Thompson near its junction with the Fraser, while the other is of Bridge No. 2 over the Fraser just south of the junction with the Thompson River. Both bridges were built to the design of Messrs. Waddell & Harrington and consist principally of deck truss spans on very high concrete piers. The total weight of steel was about 1346 tons (1,221,000 kg) for Bridge No. 2 and 733 tons (665,000 kg) for Bridge No. 3

RAILWAY BRIDGES

The upper cut on page 15 shows one of the Intercolonial Railway crossings over the MIRAMICHI RIVER near Newcastle, N.B. This bridge is over the North-West arm and was built in 1901. An almost identical bridge spans the South-West arm. Each consists of six spans 205 feet (62.5 m) long and each span weighs about 300 tons (272,000 kg).

The PITT RIVER bridge on the Cascade Division of the Canadian Pacific was built in 1913-1 and is a modern heavy double track structure designed to the Railway Company's own specifications. The crossing comprises nine 85 feet (26. m) half deck plate girder spans weighing 110 tons (99,800 kg) each; two 253 feet (77.12 m) through truss spans weighing 775 tons (703,000 kg) each; one 178 feet 6 inches (54.1 m) through truss span weighing 162 tons (119,000 kg) and a swing span 273 feet 6 inches (83.36 m) long weighing 764 tons (693,000 kg) complete with machinery. The whole crossing is thus 1729 feet (527 m) long and involves 3767 tons of steel (3,417,000 kg).

The Canadian Northern bridge over the RIVER DES PRAIRIES near Montreal of which the 275 feet (83.92 m) span is shown in the illustration lies on the Hawkesbury Montreal line and forms the easternmost of the crossings whereby this railway enters Montreal Island from the Quebec Province mainland. The span seen in the photograph was erected partly on falsework and partly cantilevered, the fore end being then lifted by pumping out water ballast from a special scow, which had been towed from Lachine and placed under the cantilevered portion. The rear end was mounted on a heavy railway freight car truck and the whole span was pulled forward by suitable tackle leading from the engine of the derrick car on the shore. Besides the 275 foot span the east channel bridge includes a 75 feet (22.86 m) half through plate girder span, and two 150 feet (45.72) through truss spans; the west channel crossing being composed of five 80 feet (24.38 m) half through plate girders and the River Mille Isles crossing, just immediately north of the Des Prairies, including fifteen spans 65 feet long (19.8 m), also of the half through plate girder type. The long span illustrated weighs 550 tons (499,000 kg) and the complete series mentioned reaches about 2077 tons (1,884,000 kg) the whole being designed for the "Heavy" class of Government loading with four lines of stringers as required by C. N. R. practice.

N. W. arm of Miramichi River. Intercolonial Rly.

Pitt River, B. C. C. P. Ry

Rivière des Prairies, C. N. O. Ry.

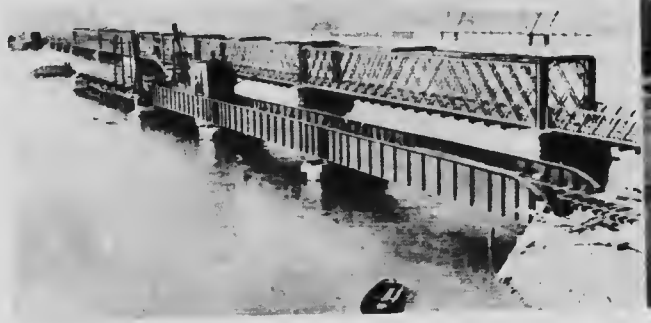
WINDSOR N. S.

The photographs on pages 47-8 illustrate the construction of a group of Dominion Atlantic Railway bridges.

The Bridge at WINDSOR, N. S. is made up of 6 half deck plate girder spans 85 feet 1 inches (26. m) long completely new and 4 through truss spans 157 feet long (47.85 m) taken from the C. P. R. Bridge at St. Rose, Que. (see p. 72.) The loading on this Line is only light, Cooper's E-35 being adopted as covering the present and expected traffic, so that these old spans after being dismantled and repaired were considered strong enough and sufficiently serviceable to be re-erected here. The small cuts on page 48 show the range of tide which was about 40 feet (12.2 m) and in which the falsework piles were held. The girder spans were erected by means of a light truss span which was dropped into place by the derrick and upon which the girders themselves were launched out.

The Bridge at GASPEREAU, N. S. is also composed of old and new work. Again the half deck plate girder spans of which there are two are new, while the two 157 feet (47.85 m) truss spans are taken from the original crossing where was only about 50 feet away (15 m). The girders were erected in the same manner as at Windsor but the truss spans were floated out of their old position into their new. This floating was achieved for both spans on the same day on consecutive tides and of course between trains and this constituted an example of rapid and efficient field work. As seen in the cut two small wooden scows about 80 feet (24.38 m) by 21 feet (7.31 m) by 7 feet (2.13 m) were used, and the rising tides served to lift the spans just as the falling tides served to lower them into place on the new piers.

The BEAR RIVER bridge as rebuilt in 1913-4 consists of one 85 feet (25.9 m) seven 103 feet (31.4 m) and one 50 feet (15.24 m) deck plate girder spans, four 157 feet (47.85 m) deck truss spans and a deck truss swing span 144 feet 10 inches long (44.23 m) centre to centre of bearings. Of these the swing and the 103 feet girders were newly made, the remainder being taken from existing C. P. R. bridges. Floating was again adopted as the means of placing both new and old truss spans all being erected on falsework in one opening and being skidded down a falsework track until they could be picked up on the scows. The cut shows the swing span being moved across to its own position. The weight of the steel in this span is 176 tons (160,000 kg).



Windsor, N. S. D. A. Ry. High tide.
Gaspereau, N. S. D. A. Ry.

Windsor, N. S. D. A. Ry. Low tide.
Bear River, N. S. D. A. Ry.

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The left hand view is of the highway bridge at GRAND FALLS built for the New Brunswick Government during 1914. The main spans 279 feet (85.3 m) and was erected as a cantilever while the smaller span is 139 feet 9 inches (42.6 m). The capacity of the bridge is equal to regular town traffic, a 20 feet (6.096 m) concrete and wood block roadway being provided. Total steel weight 462 tons (419,000 kg).

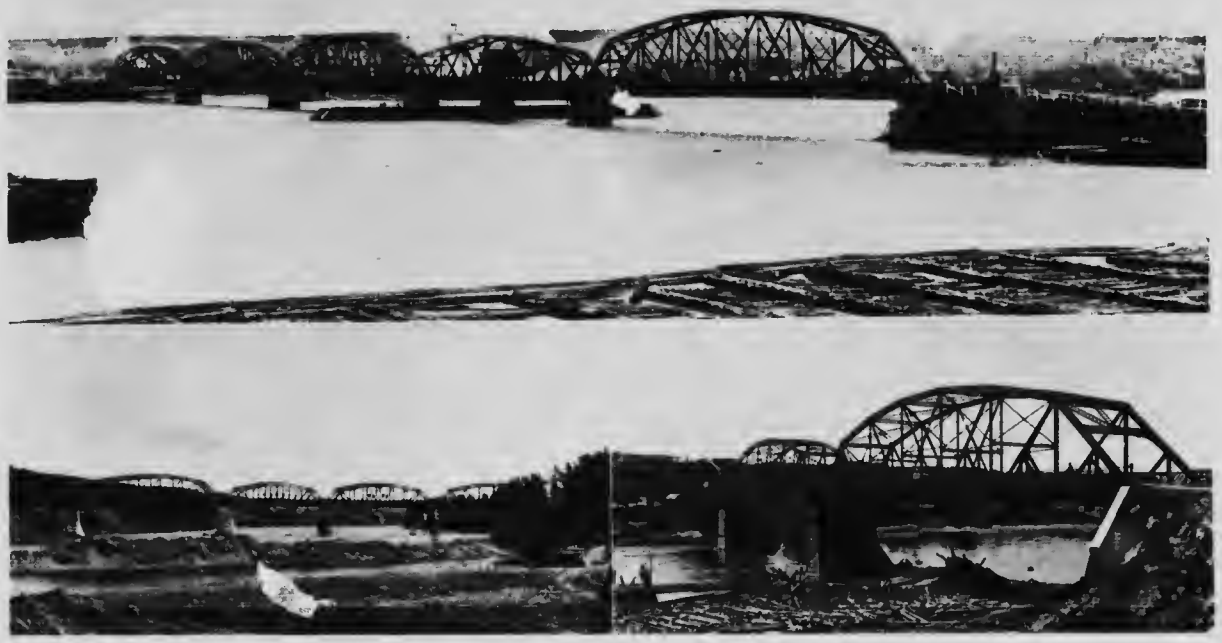
The right hand view shows the INDIANTOWN, N.B. highway bridge. This consists of three spans of 220 feet 6 inches (67.2 m) designed for country traffic and weighing 68 tons (61,700 kg) each

HIGHWAY BRIDGES

The upper picture on page 51 is a view of the recently completed highway bridge over the Miramichi River at NEWCASTLE, N.B. This crossing was built for the Provincial Government to the designs of Mr. W. Chase Thomson as Consulting Engineer. A concrete roadway with wood block surface provides for heavy city traffic, 17 feet (5.18 m) clearance between curbs being allowed, and in addition a sidewalk is carried on brackets outside the upstream trusses. There are four fixed spans 275 feet (83.82 m) long weighing 214 tons (194,000 kg) each, and a centre bearing swing span 228 feet 3 inches long (69.57 m) weighing 182 tons (165,000 kg). The erection of Newcastle Bridge was carried out by means of falsework, piles being driven in the river even when the depth of water reached 58 feet (17.7 m).

The two lower views show highway bridges in EDMONTON, Alberta, over the Saskatchewan River. Marjorie Street bridge built in 1912 consists of one span 96 feet 6 inches long (24.41 m), one span 246 feet 9 inches (75.21 m) and three spans 138 feet 11 inches long (42.35 m) centre to centre of bearings. The crossing is designed to give 26 feet (7.924 m) clear roadway inside the trusses and two sidewalks outside. The loading includes street car traffic and heavy traction engines, the general specification being that of the Department of Railways and Canals as amended by the Alberta Government. The long span weighs 234 tons (221,000 kg) and the whole bridge 639 tons (580,000 kg)

The Fifth Street bridge is of similar capacity to the Marjorie Street bridge and was built in 1943. It consists of three spans 230 feet 5 inches (70.21 m) long each weighing about 212 tons (192,000 kg).



Miramichi River at Newcastle, N. B.

Marjorie St., Edmonton, Alta.

Fifth Street, Edmonton, Alta.

LIGHT HIGHWAY BRIDGES

In addition to the larger and heavier bridges necessitated by the traffic increase and gradual expansion of the cities and larger towns, there is a growing demand for steel spans in the smaller towns and municipalities. These are generally for lighter grades of service and are often built under subsidy from the Provincial Government or even by these Governments direct. The Provinces of the Dominion have in every case their own specifications for this class of structure, and these specifications differ considerably among themselves in various particulars. In the Province of Quebec the Company has built a large number of bridges for country and light town traffic and in recent years the majority of these are designed to meet the Provincial specifications drawn up by Mr. L. A. Vallée. A few typical spans are shown on the opposite page.

The two spans at RICHMOND were built in 1903 and have from that date to this enjoyed the distinction of being the longest riveted highway spans in existence. They are 370 feet 10 inches long (113. m) 20 feet wide (6.096 m) and 40 feet deep (12.192 m). The flooring is of wood as are also the stringer joists, the floor being designed for an 8 ton wagon (7,26 kg) or 100 lbs per square foot, (488 kg per sq. m.) and the trusses for a load of 60 lbs per square foot. (293 kg per sq. m.) Each span weighs 189 tons (171,000 kgs).

The BARSALOU BRIDGE at St. Hyacinthe includes the two spans shown on the cut which were built in 1914. They are 81 feet (24.7 m) and 91 feet 6 inches (27.9 m) long, and weigh about 29 tons (26,300 kg) and 34 tons (30,800 kg) respectively. Each is designed to carry 20 feet of road (6,096 m) at 100 lbs per square foot (488 kg. per sq. m.) and two sidewalks, with the floors system good for 15 ton wagons (13,600 kg).

The MORRISON BRIDGE at St. Hyacinthe consists of two through truss spans 210 feet long (64.01 m) built for similar loading to the Barsalou Bridge but with an 18 feet roadway (5.49 m). The weight of steel to each span is 113 tons (102,500 kg).

The bridge over the Magog River at MAGOG, QUE. is of the pony truss design built for a 20 ton (18,100 kg) wagon and 18 feet (5.49 m) of roadway. It has one sidewalk, and both flooring and stringers are of timber.

The DRUMHELLER BRIDGE was built in 1914 for the Alberta Government and consist of three spans of about 150 feet (45.7m) This bridge was fabricated in the Winnipeg Shop of the company and represents a large number of highway spans manufactured there for the west.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

Richmond, Que.
St. Hyacinthe, Que.
Magog, Que.

Drumheller, Alberta
St. Hyacinthe, Que.

BELOEIL BRIDGE

The Grand Trunk line to St. Hyacinthe and Sherbrooke from Montreal crosses the Richelieu River at Beloeil Station. In 1907 when this line was double tracked the heavy modern bridge, shown in the cut opposite, was constructed at this point to replace the old and light structure. The new spans were designed for the specially heavy class of Dominion Government loading, being built to the Grand Trunk specifications then in force. The crossing is a skew one, and the elevation of grade and river combined to render a somewhat shallow truss inevitable. The spans include a swing span of the bob tail type skewed at one end, and having a maximum length of 150 feet 9 inches (45.95 m) centre to centre of end bearings, six skewed fixed spans of 152 feet 3 inches (46.4 m) span and a short plate girder, all being of deck construction. The depth of the swing span is but 12 feet 8 inches (3.88 m) centres of chords while the fixed truss spans have 21 feet (6.4 m) the widths being 28 feet (8.355 m) and 25 feet (7.62 m) respectively. The swing is rim bearing, the circular drum being loaded at sixteen points and having a diameter of 24 feet (7.315 m).

The steel in the swing span weighs approximately 460 tons (417,000 kg), each 152 feet span about 105 tons (367,000 kg), and the whole bridge 2945 tons (2,672,000 kg).

The illustration taken from the west bank of the river shows the swing span trusses particularly well and gives a satisfying impression of sturdiness and strength throughout the bridge.

A few miles further east at St. Hyacinthe the same line crosses the Yamaska River on a bridge which includes a double track through truss span 167 feet long (50.9 m) 31 feet 6 inches (9.6 m) wide and weighing 419 tons (380,000 kg).

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

KILDONAN BRIDGE

The Kildonan or New Red River Bridge was built during 1913-14 to carry two tracks of the Canadian Pacific Railway over the Red River a few miles outside of Winnipeg. The railway crosses the line of the river in a direction about 35 degrees from the normal thus introducing a considerable skew into the steel layout. In the case of the fixed spans this condition was taken care of with the usual facility, but for the long heavy swing span specially careful study and calculation were necessitated. The magnitude of this latter span is such as to give it premier place among the Canadian swing bridges for actual weight. It is 308 feet 6 inches (94.03 m) centre to centre of end bearings and 32 feet (9.753 m) wide, giving a full 29 feet (8.839 m) clearance for the double track line. Designed to the Canadian Pacific standard loading it weighs in steel and machinery about 953 tons (861,500 kg). The dead load when turning is carried on a centre pivot designed to carry 1135 tons (1,030,000 kg) and having a bearing on the masonry 7 feet 5 inches in diameter. The power for operating is electricity but complete machinery for hand turning is also installed.

The remainder of the bridge symmetrically disposed on either side of the swing span consists of two 134 feet 6 inches (41.0 m) through truss spans, and four double track half deck plate girder spans 85 feet 4 inches long (26.0 m).

The total weight of steel in this bridge is about 4990 tons (4,805,000 kg). The photographs show the whole bridge as completed, the swing span during erection, and the swing span turned to permit the passage of a river steamer.

In 1911-12 the company built for the Canadian Pacific Railway over the Red River at Winnipeg another double track structure of importance including four fixed spans of 421 feet 9 inches (38.03 m) centre to centre and a swing span of 253 feet 6 inches (79.26 m). This bridge was also 32 feet (9.75 m) wide the swing span of steel weighing 715 tons (648,000 kg) inclusive of machinery and the whole crossing some 1810 tons (1,669,000 kg).

LACHINE CANAL SWING SPANS

The presence of an important waterway like the Lachine Canal in the midst of a busy and populated quarter of the chief commercial city of Canada naturally demands an adequate number of movable bridges to serve both railway and city traffic. Of swing spans the company has built twelve over the navigable main channel not including the feeders. The first chronologically was the Lachine Swing on the Canadian Pacific Railway (1885) and as a matter of coincidence the renewal of this span is the most recent, as it is progressing at the present time, January, 1915. The original span is shown in the photograph opposite. The other railway span illustrated is the Grand Trunk crossing at St. Henry. This was built in 1890. The highway swing bridges of which cuts are given are the Wellington Street span and the Atwater Avenue span. A complete list of these twelve spans is appended below where the principal dimensions and other data are tabulated.

Date built.	Location.	Service.	Length Feet.	Length Metres.	Type of centre.	Total Tons.	Weight Kilograms.
1885	Near Rockfield	C. P. R. single track	235'8"	71 83	Rim bear.	215	222,000
1892	Wellington Street	G. T. R. single track	256'11½"	78 32	Rim bearing	176	160,000
1900	St. Henry	G. T. R. double track	209'11½"	63 82	Rim and centre bearing .	535	185,000
1905	Ogilvie's Mills	C. P. R. single track	154'5"	47 07	Centre bearing	111	101,000
1911	Wellington Street	G. T. R. single track.	256'11½"	78 32	Rim bearing	421	382,000
1915	Near Rockfield	C. P. R. double track	238'7"	72 72	Centre Bearing abt	600	544,000
1892	Wellington Street	2 car tracks, 31'6" road, 2 walks .	232'0"	70 71	Rim bearing	333	302,000
1898	Seigneurs Street .	2 " " 25'0" " 2	134'0"	40 84	Rim and center bearing .	124	112,000
1902	Black's Bridge	2 " " 32'0" " 2	150'6"	45 87	Centre Bearing	167	152,000
1903	Cote St. Paul	2 " " 24'0" " 2	200'0½"	60 98	Centre Bearing	196	178,000
1904	Brewster's Bridge	2 " " 24'0" " 2	200'0½"	60 98	Centre bearing	196	178,000
1905	Atwater Avenue .	2 " " 24'0" " 2	202'6"	61 72	Centre bearing	191	173,000

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

Old Lachine Swing Span. C. P. R.
Atwater Avenue, Montreal.

St. Henry. G. T. R.
Wellington Street, Montreal.

SWING SPANS

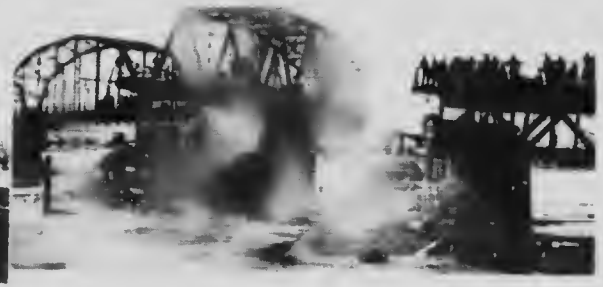
The views given on page 61 are illustrative of typical swing spans for various services.

The small bob-tail skew span at Ottawa on BRONSON AVENUE spans the Rideau Canal and is representative of a class of pony truss, centre bearing, counterweighted swing bridges designed for carrying suburban or rural roads over the numerous canals of the country. This particular span is 85 feet long (25.9 m) with a clear roadway of 18 feet (5.49 m), the weight being 43 tons (39,000 kg) to which the metal counterweight contributes almost exactly half.

The BURLINGTON BAY, Ont., swing was built in 1896 for the Dominion Government to the designs of Mr. H. E. Vautelet, and is of the bobtail type having arms of 160 feet (48.8 m) and 100 feet (30.5 m). It is a light pin connected structure with trusses 20 feet (6.096 m) apart and is somewhat peculiar in its operation. The turning motion is obtained from a motor which causes a sprocket wheel on the land arm to travel along a fixed chain of 74 feet (22.55 m) radius. The centre is of the rim bearing type.

The FREDERICTON, N.B. swing span erected in 1914 for the New Brunswick Government forms part of the long bridge over the St. John River. It is 147 feet long (44.8 m) with a 21 feet (6.4 m) road and one outside footwalk. It has a rim bearing centre and weighs complete about 91 tons (82,500 kg).

The EMERSON, Man. swing span lies on the Canadian Northern Railway but, in addition to the single track railway between the trusses, carries on cantilevered brackets two 13 feet (3.96 m) roadways for highway and pedestrian traffic. This bridge was built to the design of Mr. E. Brydone-Jack as consulting engineer to the Railway Company and has a length of 256 feet 11 inches (78.31 m). It is carried on a combined rim and centre bearing and weighs 440 tons (399,000 kg). There are also two fixed spans of like capacity in the Emerson Bridge as the illustration shows. These are of 120 feet span (36.58 m) and were built partly at Lachine and partly at Winnipeg.



Burlington Bay, ...
Bronson Ave., Ottawa

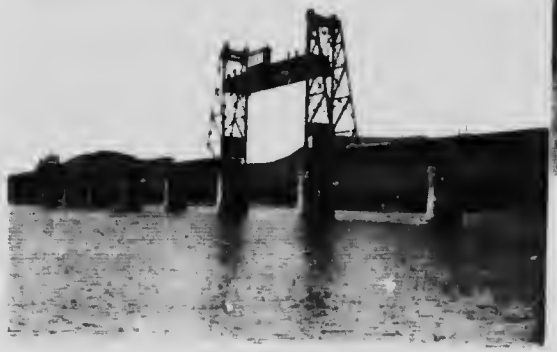
Fredericton, N. B.
Emerson, Man.

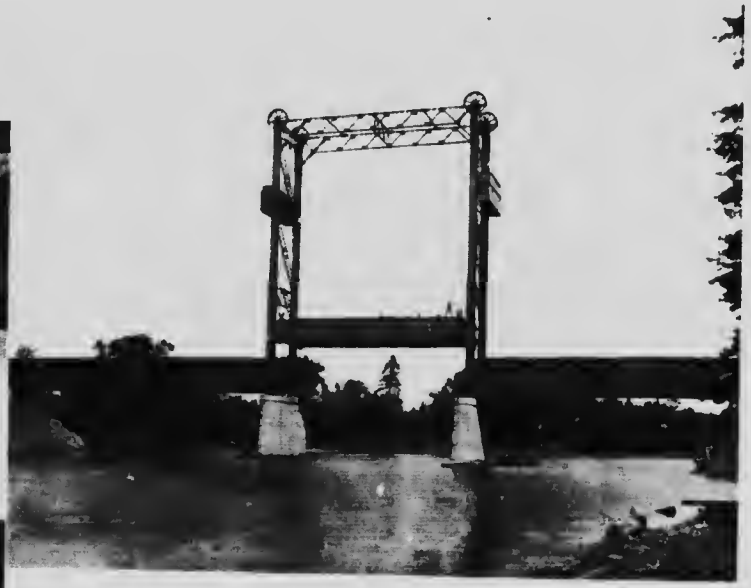
VERTICAL LIFT SPANS

The vertical lift type of movable bridges is as yet without many examples in Canada. The design is one adapted to special conditions only and up to the present the occasions when it has successfully appealed to the judgment of engineers, as to needs, service and appearance have been few.

The accompanying photographs illustrate two bridges of this type recently constructed by the company, one in British Columbia and the other in New Brunswick. The two views of BRIDGE No. 10 on the Canadian Northern Pacific show the structure designed by Messrs. Waddell & Harrington to cross the North Thompson River near Kamloops. The bridge consists of 12 deck plate girder spans 91 feet 6 inches (27.88 m) long and the lift span. This latter is 90 feet long (27.43 m) centre to centre of bearings and weighs 83 tons (75,300 kg) not including machinery, etc. The weight actually lifted approximates to 136 tons (123,000 kg). The towers stand on the side spans, are about 86 feet 4 inches high (26.31 m) from masonry to wheel centres, and the maximum lift is designed to give clearance of 55 feet (16.76 m) above extreme high water. The operation is accomplished by a gas engine situated on the span to be elevated, and the balancing is achieved by a pair of concrete counterweights. The ordinary girder spans weigh 806 tons (731,000 kg) altogether, the two towers 90 tons (81,600 kg) and the complete bridge 1006 tons (912,600 kg).

The ORDMOCTO lift span is on the St. John & Quebec Railway, and was also built to the designs of Messrs. Waddell & Harrington. The moving span is 57 feet 6 inches long (17.52 m) and although 17 feet 6 inches (5.334 m) wide is of half deck construction the ties being 14 inches (35.5 cm) by 18 inches (45.7 cm). The lift is designed to give 78 feet (23.75 m) clearance above summer water which means about 55 feet (16.76 m) travel for span. Hand power is used in this case, slow and infrequent operation being all that is required. The weight to be lifted is about 83 tons (75,300 kg) including timber and track.





VERTICAL LIFT SPANS

Kamloops, B. C. Span down for railway traffic.
Kamloops, B. C. Span up for river traffic.
Oromocto, N. B. Raising Span

BASCULE LIFT BRIDGES

On pages 65-6 are shown several spans of the bascule class. This type of movable span is well adapted to certain sites, and various forms have been developed.

The CROSS-WALL BRIDGE at the Princess Louise Dock, Quebec, is an 88 feet span (26.82 m) carrying a single track railway. The bascule is one of the Strauss types with a concrete counterweight and was built in 1911. The moving leaf weighs 110 tons (99,800 kg) and the whole steel structure including machinery 168 tons (152,400 kg). There is just visible in the left hand lower corner of the same photograph an old "retractile" draw span of 120 feet span (36.5 m) built by the company in 1888.

The ROCKFIELD BASCULE was built in 1913 for the Dominion Government and crosses the Lachine Canal about five miles west of Montreal. It too, is of a Strauss type, but with the counterweight rotating on a separate trunnion. The span is 165 feet (50.3m) long and carries street car tracks and regular highway traffic for which a 30 feet (9.141 m) roadway with sidewalks on brackets is provided. The weight of the moving leaf is 207 tons (187,800 kg) and of the whole steel including counterweight-tower,-truss and-frame, but not operating machinery, 417 tons (378,300 kg). The counterweight is of concrete and weighs about 940 tons (852,800 kg).

The MAIN ST. BASCULE at Vancouver, B. C. was built to the design of Messrs. Waddell & Harrington and is of the simple trunnion type. The span is 127 feet $10\frac{1}{2}$ inches (38.97 m) the clear roadway 12 feet (12.8 m) with two extra sidewalks outside. The weight of the moving steel is 327 tons (296,600 kg) to which about 71 tons (64,400 kg) must be added to include trunnion and supports.

The RED RIVER BASCULE on the National Transcontinental Railway at Winnipeg was built in 1909 and carries a double track designed to accomodate class "Heavy" loading. The span of the lift is 132 feet (40.23 m) and the type is the Strauss. The steel in the moving leaf weighs 301 tons (273,000 kg) not including operating machinery. The counterweight-tower, and-truss weigh 213 tons (193,000 kg) and 199 tons (180,500 kg) respectively.

The DORCHESTER BASCULE over the St. Charles River at Quebec is a highway span carrying a 26 feet (7.92 m) roadway with two sidewalks on brackets. This span is also of the Strauss design, is 148 feet 9 inches long (45.34 m) and weights complete 388 tons (352,000 kg) of which the channel span is 140 tons (127,000 kg).

ROCKFIELD, QUE.

PRINCESS LOUISE DOCK, QUE.

Dorchester Bridge, St. Charles River, Quebec.

...ain St., Vancouver. Red River, Winnipeg.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

CAP ROUGE VIADUCT

RAILWAY VIADUCTS

The photographs on pages 67 and 69 show two of the best known and most important examples of railway viaduct construction built by the Dominion Bridge Company.

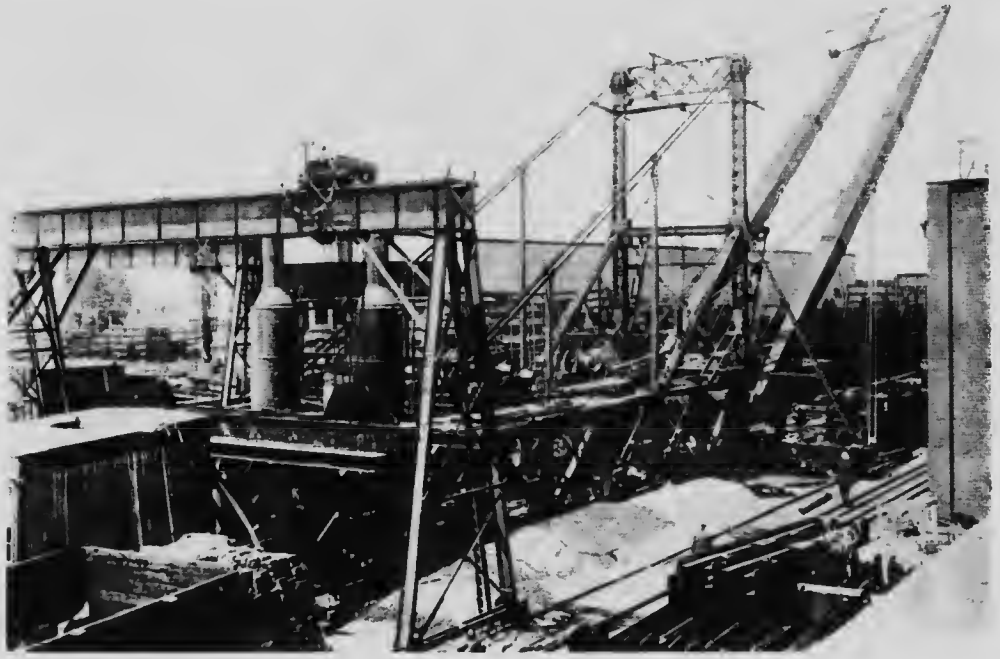
The CAP ROUGE Viaduct on the National Transcontinental Railway 10 miles west of Quebec was built in 1906 and is of the usual deck design. Comprised within the total length of 3335 feet (1016.5 m) are three deck truss spans and 59 plate girder spans, the latter being arranged as 40 feet and 60 feet for tower and open spans respectively. The height of the track is for a large proportion of the viaduct over 130 feet (39.6 m) above the ground level, reaching as high as 154 feet (47. m) above high water in the Cap Rouge River. The towers have the usual batter, but the bracing is not designed in the more generally accepted way, as the diagonals are figured as struts whilst intermediate horizontal members are omitted. The weight of steel in the completed viaduct is 4329 tons (3,927,000 kg).

The LITTLE SALMON Viaduct is situated 185 miles north of Moncton, N. B. and carries the National Transcontinental Railway over a deep and wide depression. Here the girders are built to a half through design 17 feet 6 inches (5.332 m) apart and in lengths of 58 feet 9 inches (17.9 m) and 100 feet 3 inches (30.55 m) for tower and open spans respectively. The height is over 190 feet (58. m) from pedestals to rail level for 700 feet (213 m) and over 150 feet (45.7m) for 2485 feet (757 m) of the total length, which is 3918 feet 2 inches (1194 m). The weight of a typical 100 feet girder was 30 tons (27,500 kg) and of the whole trestle 7188 tons (6,520,000 kg). This viaduct was erected in 1910.

A list follows giving particulars of a few other representative viaducts.

		Feet Long	Metres	Feet high	Metres	Tons weight	Kilograms	Built in
Milieu River	N. T. R	1043	(318.0)	147	(44.81)	1622	(1,471,000)	1908
Boncanne River	N. T. R	788	(240.0)	119	(36.27)	922	(836,000)	1911
Caton Brook	N. T. R	1062	(323.7)	142	(43.28)	1198	(1,088,000)	1911
Don River (91.1)	C. P. R	810	(247.0)	93	(28.34)	875	(794,000)	1914
Otter Creek	G. T. R	1249	(380.7)	93	(28.34)	1332	(1,208,000)	1902
Big Creek	G. T. R	1059	(320.0)	72	(21.95)	1006	912,000)	1902
Anse à Brillant	A. Q. W. R	775	(236.0)	76	(23.17)	681	(618,000)	1909
Anse à Beau Fils	A. Q. W .R	760	(231.7)	71	(21.64)	625	(567,000)	1909

LITTLE SALMON RIVER VIADUCT



2-115 FEET BOOMS

The above cut shows the traveller specially designed and built for the erection of the Little Salmon River Viaduct. The booms were figured to lift one end of a 100 feet girder at 105 feet (32. m) forward reach, that is to say, 8 tons (7,200 kg) per boom, or 10 tons (9,100 kg) each when handling trestle posts 38 feet (11.5 m) from centre line of track. The deck was elevated so that the steel could be brought out underneath on the main track while the traveller ran on heavy special rails placed on the girder flanges 17 feet 6 inches apart (5.331 m). The booms, 115 feet long (35.05 m) between centres of pins, were made of $\frac{1}{4}$ " plate (6.35 mm) 36 inches wide (915 mm) at centre and tapering towards the ends. This traveller gave almost ideal service and only 6 men were required as its crew.

FERRY LANDING, PORT MULGRAVE, N. S.

The Intercolonial Railway crosses the Straits of Canso between the mainland of Nova Scotia and Cape Breton Island by means of a ferry service. The terminal points are Port Mulgrave and Point Tupper respectively and at each point is provided a transfer landing. The installations are practically identical and consist of a 50 feet (15.24 m) apron span, a 50 feet (15.24 m) intermediate span and a 100 feet (30.48 m) shore span built in 1901-2. The tracks spread from one on shore to three at the boat end of the apron span. The necessary vertical motion to accomodate a varying tide of about 40 feet (3. m) range is imparted to the platform by means of screw threaded long rods on which the spans are suspended from overhead gantries. Guides both for the platform and the counterweights are provided, the latter being inside the gantry posts. The total weight in both landings is about 690 tons (625,000 kg).

PLATE-WEB GIRDER SPANS

One of the heaviest plate girders built by the company is shown in the upper two photographs on page 73. The span to which it belongs is on the Canadian Pacific Railway over the Grand Trunk line near ROCKFIELD, Que. This span forms the second track of the C. P. R. and is 113 feet 9¼ inches (34.68 m) long designed for a ballast floor. The single girder as seen seated on yard trucks weighed 53.5 tons (48,500 kg).

The VAUDREUIL BRIDGE illustrated in the lower left hand cut is a double track structure on the Canadian Pacific Railway. It spans the western channel of the Ottawa River and connects the Island of Montreal to the mainland of Quebec. To each track there are two 65 feet spans (19.8 m) seven 70 feet (21.3 m) and eight 100 feet (30.5 m), the whole crossing weighing 1795 tons (1,628,000 kg).

Immediately east of this bridge the line crosses Stocker's Creek between islands in the river and the east channel of the Ottawa thus entering St. Anne's. The ST. ANNE'S BRIDGE includes for each track eight 65 feet (19.8 m) girder spans and five others between 101 feet (30.8 m) and 116 feet (35.4 m) in addition to which there are three 101 feet (30.8 m) double track through trusses, the whole amounting to over 2,000 tons (1,814,000 kg).

The remaining view shows the bridge at ST. ROSE, Que. on the Canadian Pacific during the reconstruction in 1912. The old truss spans having become too light for the traffic on this line were taken out and removed to Windsor, N. S. (see page 46), deck plate girders being placed in their stead. The openings were cut in half by the building of intermediate piers so that eight 78 feet spans (23.8 m) per track constituted the new bridge. The cut shows the means of erection, whereby, between trains, the girder span was moved out on flat cars, slung up to truss, and lowered into place after the floor and lateral system had been taken out of the old span and dropped to the falsework platform below. The weight of the 46 new girder spans totalled 769 tons (697, kg).

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

C. P. R. over G. T. R. at Rockfield, Que.

Vaudreuil Bridge C. P. R.

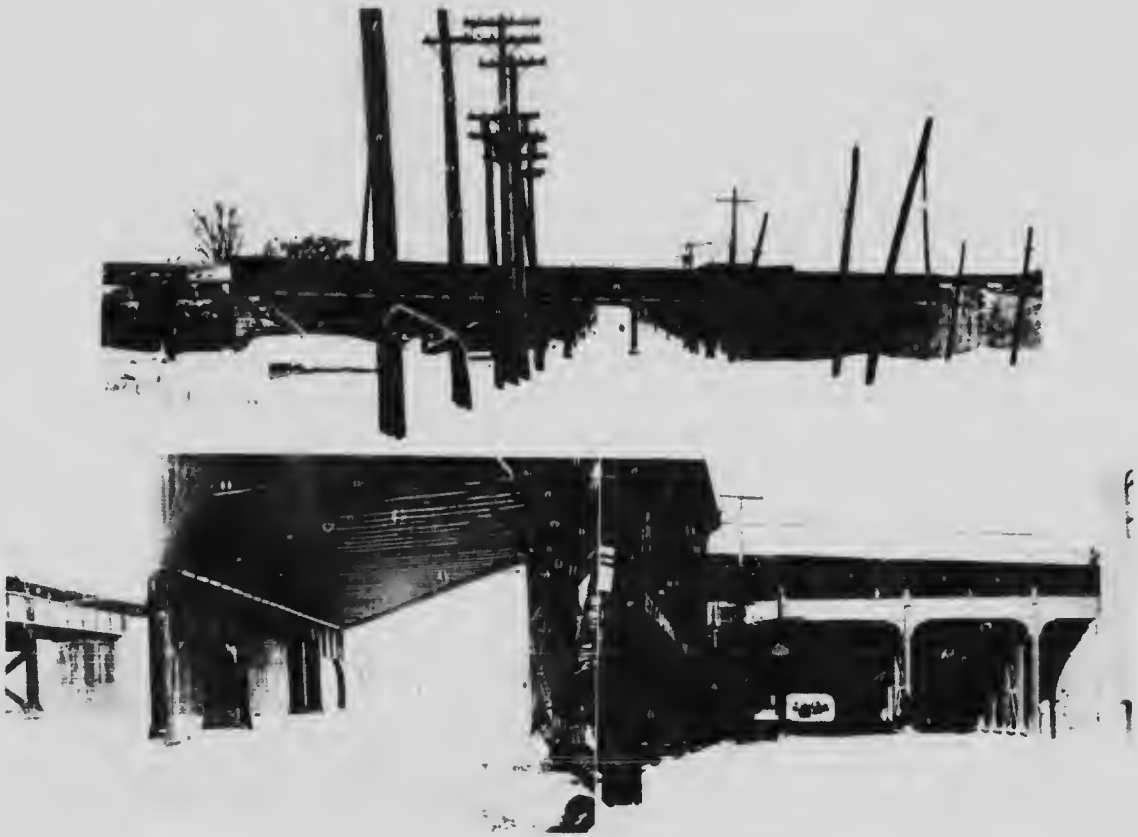
St. Rose Bridge C. P. R

SUBWAYS

On page 75 are shown views of two examples of subway construction. This term is generally applied to the solid plate bridges by which the railways cross the streets of towns and cities. The two illustrated occur in Montreal and are both on the Canadian Pacific Railway. The upper photograph shows the Forsythe Street Subway from the south looking up Moreau Street while the lower left hand cut gives a closer view of the floor system and a glimpse of the Moreau Street subway. The remaining view is of Mountain Street subway, the station roof being seen above the tracks. A list of the principal subways recently built by the company is subjoined, with notes as to their location and service

Location	Railway carried.
City of Montreal	
St. Lawrence Boulevard	C. P. R
St. Catherine St. East	C. P. R.
Notre Dame St. East	C. P. R.
Ontario Street East	C. P. R.
St. Denis Street	C. P. R
Park Avenue	C. P. R.
Iberville Street	C. P. R.
Forsythe Street	C. P. R.
Mountain Street	C. P. R.
Aqueduct Street	C. P. R.
Guy Street	C. P. R.
Decarie Boulevard	C. P. R
Bethune Avenue	C. P. R.
12 others on Forsythe St. Spur	C. P. R.
City of Winnipeg	
Pembina Street	C. N. R.
Main Street	C. N. R
Water Street	C. T. R.
Notre Dame Avenue	N. T. R
Mill Street	N. T. R.
Tache Avenue	N. T. R
Parkside Avenue	C. P. R.
Scotia Street	C. P. R.
Rachel Street	C. P. R
Higgins Avenue	C. P. R

Location	Railway carried.
City of Toronto	
Bathurst Street	C. P. R.
Ossington Avenue	C. P. R.
Shaw Avenue	C. P. R.
Spadina Avenue	C. P. R.
Dovercourt Road	C. P. R.
Davenport Road	C. P. R.
Howland Avenue	C. P. R.
Christie Avenue	C. P. R.
Brock Avenue	C. P. R.
Scarlett Road	C. P. R.
Brock Avenue 2	G. T. R.
Others	
23rd Street, Saskatoon	C. N. R.
19th Street, Saskatoon	C. N. R.
Main Street, Kenora	C. P. R.
Main Street, Hawkesbury	C. N. R.
Ste. Anne's	G. T. R.
Ste. Anne's	C. P. R.
Dufferin Street, Brantford	G. T. R.
Holm Street, Brantford	G. T. R.
West Mill Street, Brantford	G. T. R.
Park Drive, Brantford	G. T. R.
St. Lambert, Que.	G. T. R.
Station Avenue, Shawinigan Falls	C. N. R.



C. P. R. SUBWAYS IN MONTREAL

WINDSOR STATION

The photograph opposite is intended to show the roof steel of the new passenger station which the Canadian Pacific Railway recently built at Windsor St. Montreal. The main train sheds were rebuilt in 1912 and have been extended since until the length under roof reaches 1030 feet (314 m) and accomodation is provided for 11 tracks in a width of 309 feet (94 m). The total weight of steel in the train sheds as supplied by the Dominion Bridge Company amounts to approximately 1778 tons (1,613,000 kg). The station concourse and general office buildings were added to considerably, between 1910 and 1913 when the high tower and all extensions to St. Antoine Street were constructed. For this addition 2831 tons (2,568,000 kg) of structural steel were supplied.

Other railway stations and terminal buildings for which the steel was fabricated by the Dominion Bridge Company include the Union Station for the Canadian Northern and Grand Trunk Pacific Railways in Winnipeg; the Canadian Pacific at Winnipeg originally built in 1901, the train shed and concourse being added in 1906 and still further additions to track platforms in 1914; the Union Station at Ottawa for the Grand Trunk Railway; the Place Viger Station in Montreal for the C. P. R. in 1897 with additions to the freight sheds in 1912; the office and freight sheds for the same company at Quebec.

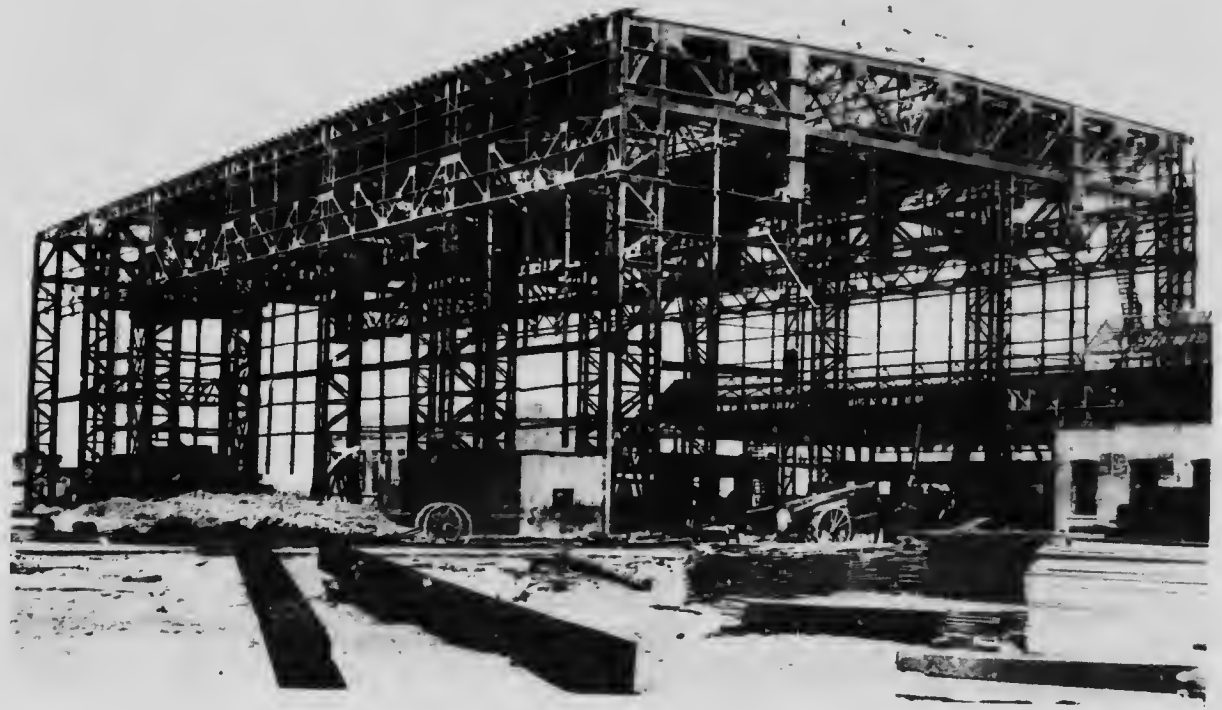
The steelwork was also supplied for the following railway station hotels—Chateau Laurier, G. T. R. at Ottawa; Place Viger in Montreal, C. P. R.; Royal Alexandra in Winnipeg, C. P. R.; Chateau Frontenac, Quebec, C. P. R.; Edmonton Hotel, G. T. P. R.; Banff Hotel, C. P. R.; Vancouver Hotel, C. P. R.; Victoria B. C. Hotel, C. P. R.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

SHIPBUILDING BERTH

A portion of the shipbuilding berth made and erected for the Canadian Vickers Company is shown in the photograph on page 79. This plant is situated at Maisonneuve, Que. and was constructed during 1914. The berth itself is a structure 500 feet long (152.4 m) of which only about half is shown erected in the illustration. A width outside columns of 132 feet (40 m) is maintained with a clear height inside from ground to roof truss of 86 feet (26.2 m). As will be seen, the frame of the berth consists of trussed columns carrying a heavy roof truss from which are suspended the runways for the cranes. The main crane runway girders as well as the purlins are built as trusses spanning one main longitudinal bay of 50 feet (15.24 m). There is an extensive system of bracing and side framing, and at the river end a removable sheet steel door made up in 12 feet sections is installed. The supporting verticals can all be taken out and the whole door dismantled to permit the launching of the vessel lying inside the berth. The steelwork in the ship berth building weighed some 4990 tons (4,806,960 kg). The engineering shops for this plant were also built by the Dominion Bridge Company and they comprise Boiler shops, Machine and Erecting shops, and Foundries besides the necessary smaller buildings for storage purposes, power plant and ventilating machinery. They cover an area of 60,000 square feet (56 ares) and include 4265 tons (4,147,000 kg) of structural steel. This plant was all manufactured to the designs and specifications of Sir William Arrol & Co. Limited, of Glasgow.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.



MONTREAL HARBOUR SHEDS

The rapid development of Montreal as a port has called for continued progress in the provision of harbour facilities. Under the guidance and direction of a specially appointed Harbour Commission the dock and wharf system of Montreal has been extended from time to time until at the present moment a modern and efficient series of piers, warehouses, elevators, conveyors, freight sheds and passenger landings are in existence for the handling of the ever increasing river and ocean traffic of the port. There has naturally been a very considerable amount of structural steelwork necessitated by the erection of the many buildings of every variety which now constitute part of the Harbour Commissioners system, and the Dominion Bridge Company has furnished the great majority of this steel, their share amounting to almost 15,000 tons (13,600,000 kg).

The contracts have covered the sheds for freight handling and storage, the conveyor galleries and coveyor towers, steel in connection with the elevators, bridges between sheds, steel doors, chutes and all such structures. The illustration shows one of the newest sheds No. 21-5 built during 1911, the general dimensions of which are—length 748 feet (228 m), width under roof 113 feet (34.44 m). The floors in all these warehouses are of particularly heavy construction sufficient to permit the stacking and storing of all kinds of ocean freight while conveyors and spouts and travelling derricks are often located on the roofs. The first large sheds and galleries were built in 1906 and since that date additions and extensions have been continual.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

RAILWAY SHOPS

The fabrication and erection of a large proportion of the structural steelwork required in the Locomotive and Car shops of the National Transcontinental Railway at Quebec was taken by the Dominion Bridge Company as a subcontract from a local Quebec firm. The railway shops were designed by the engineers of the N. T. R. Commission, and include the Locomotive building shop, embracing boiler shop, machine shop and erecting shop; the freight car shop; the boiler and power house; and the planing mill, besides office buildings and storage sheds. The portion manufactured by the Dominion Bridge Company amounted to about 1480 tons (1,343,000 kg) and included the heavier material whilst the erection contract was for some 1780 tons (1,615,000 kg) of the engine and car shops. The view given on page 83 presents the Locomotive shop in course of erection, 1911, and gives a fair idea of the proportion of the crane girders. The company is at the present time supplying all the cranes needed for these shops including the heavy machine of 120 tons (109,000 kg) capacity in the Locomotive erecting shop.

Other railway shops built by this company are the Angus Shops of the Canadian Pacific Railway at Hochelaga where the Locomotive shops, Ironfoundries, Switch shops, Smith shops, Boiler shops and the usual subsidiary buildings are located; the C.P.R. shops at Winnipeg, including the same general series of structures though not so extensive; and the Locomotive Erecting shop of the Canadian Locomotive Company, at Kingston, Ont. The Angus Shops comprise some 4150 tons (3,765,000 kg) of steelwork, the Winnipeg shops about 542 tons (492,000 kg) whilst the part of the Kingston shops supplied weighed 500 tons (453,000 kg).

Besides the main buildings for the production of rolling stock, numbers of engine houses, round houses, small machine shops, etc., have been built at the various division points of the chief railways in all parts of the Dominion.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

NATIONAL TRANSCONTINENTAL RAILWAY LOCOMOTIVE SHOPS, QUEBEC

MILL BUILDINGS

An important branch of the company's activities is the design, manufacture and erection of mill buildings and workshops for industrial concerns. The various shops and plants illustrated in the catalogue together with the short list of leading customers given on p. 12 serve to indicate the scope and magnitude of the company's work in this respect. On the page opposite this are shown views of the new plant of the Canadian Car & Foundry Company built during 1913 at Fort William, Ontario. This plant consisted of a main fabricating shop 3 bays wide and 900 feet (274 m.) long, a painting shop 2 bays wide and 700 feet (213 m.) long with machine shop, boiler and power house 100 feet by 340 feet (33.5 x 103.6 m.) attached. The bays in each case are 80 feet (24.38 m.) wide except for the smaller shops. There is also a foundry building 380 feet long (115.8 m.) and 145 feet wide (44.2 m.) and a crane runway with a crane-span of 80 feet (24.38 m.) and a total length of 1020 feet (311 m.). The total weight of steel in the framework of these buildings, not including the cranes, all of which were also supplied by the company, reaches about 1440 tons (1,028,000 kg.). The photographs show the centre aisle of the main shop, the painting shop and the foundry all taken during erection.

The other cut shows a general view of the buildings of the Armstrong Whitworth plant recently installed at Longueuil, on the south shore of the St. Lawrence opposite Montreal. This plant is laid out as the beginning of a much more extensive series of shops for the manufacture of special steels. The general design was supplied by Mr. M. J. Butler, C. M. G., to whose instructions the company prepared plans and manufactured and erected about 693 tons (628,600 kg.) of steel including a number of heavy 93 feet (28.3 m.) roof trusses.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE QUE.

Armstrong Whitworth Shops, Longueuil, Que.
Canadian Car and Foundry Shops, South Aisle.

Canadian Car and Foundry Shops, Paint Shop.
Canadian Car and Foundry Shops, Main Aisle.

THE DOMINION BRIDGE COMPANY LIMITED, LACHINE, QUE.

IMPERIAL WIRE AND CABLE COMPANY

The new buildings for the above company, now part of the Northern Electric Company were commenced in 1913. They are situated on the entire block between Richmond and Shearer Streets and St. Patrick and Richardson Streets, Montreal, and cover a ground area of about 4 acres (1.6 hectares). The steel construction includes an 8 storey building about 73 x 320 feet (22 x 98 m), a 6 storey building about 60 x 255 feet (18 x 78 m) and two 1 storey buildings of approximately 60 x 295 feet (18 x 90 m) the remainder being generally of single storey mill design. The total steel in the contract reached 6371 tons (5,779,000 kg).

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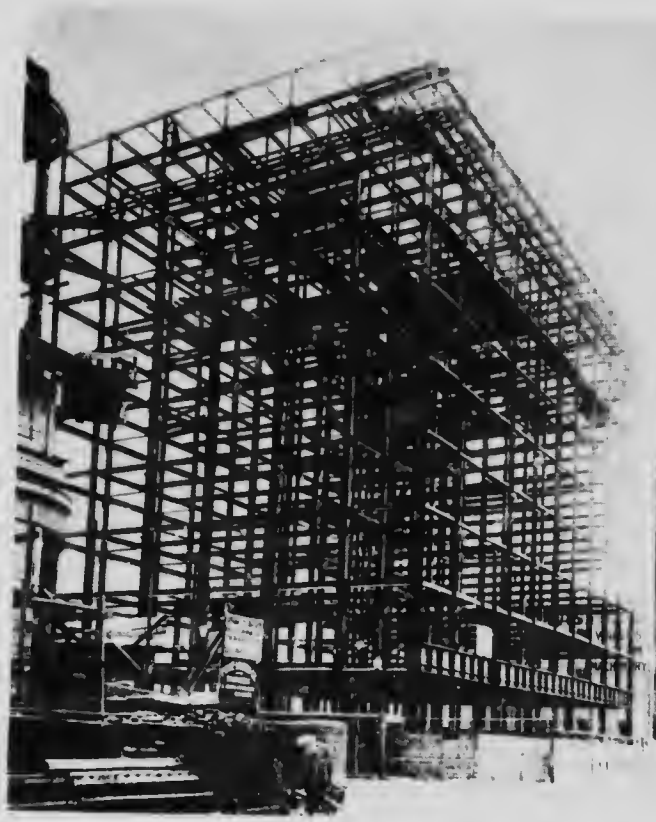
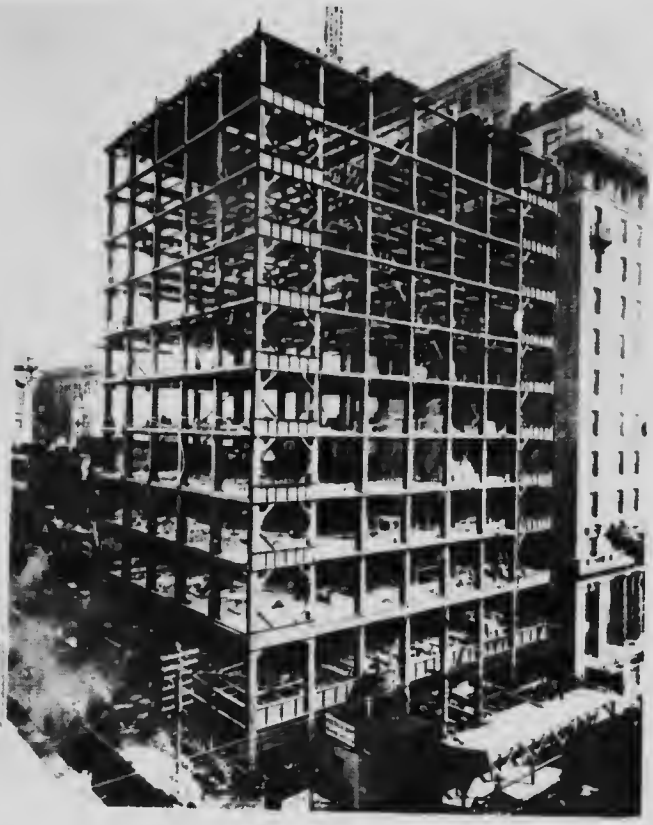


MACKIE BUILDING, CALGARY.



C. P. R. BUILDING, TORONTO.

OFFICE BUILDINGS

The two cuts opposite show the Royal Bank Building at the corner of King and Yonge Streets Toronto. They illustrate the erection of this modern office building which being 20 storeys above street level ranks as the highest structure of its type in Canada or in the British Empire. It was fabricated partly in Lachine and partly in Toronto, built to the designs of Messrs. Purdy & Henderson and erected between February and May 1911. The weight of structural steel supplied was 2961 tons (2,686,000 kg).

On page 87 are shown views of the Canadian Pacific Railway building also at the corner of Yonge and King Streets Toronto, and the Mackie Building in Calgary, Alberta. The former is a 15 storey building weighing about 2,000 tons built partly in Lachine and partly in Toronto, whilst the latter is an 8 storey structure built in Winnipeg.

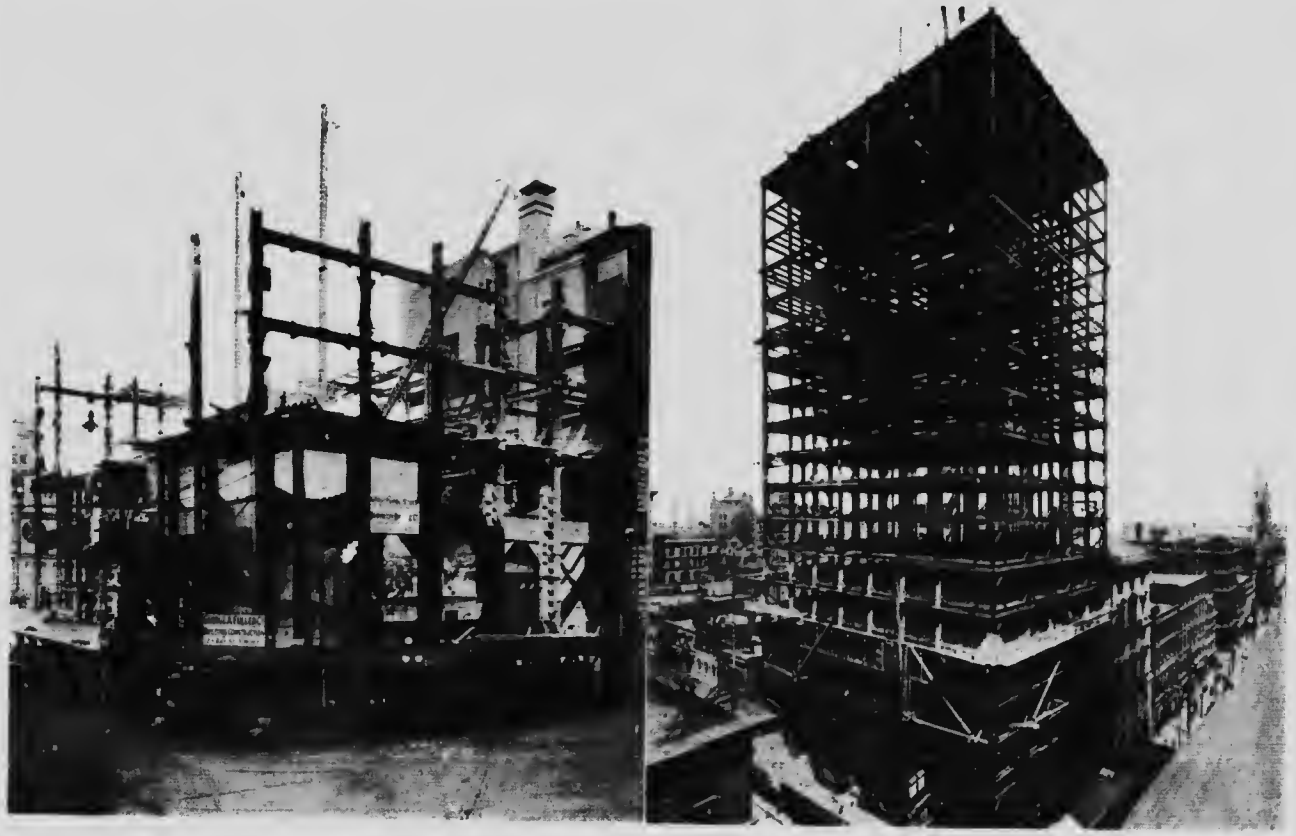
A table is subjoined showing a few of the most important steel cage buildings other than those illustrated for which the company have supplied the steel.

Building	Storeys above Street.
C. P. R. Tower, Windsor Stn., Montreal	16
Imperial Trust Building, Vancouver	11
McArthur Building, Winnipeg	12
Sauvegarde Building, Montreal	12
Union Bank Building, Winnipeg	11
Union Bank Building, Ottawa	10
Winnipeg Electric Building, Winnipeg	10
Great West Permanent Building, Winnipeg	8
McGill Street Building, Montreal	10
Mark Fisher Building, Montreal	9
Sun Life Assurance Co. Building, Montreal	7*
Gravel Building, Montreal	10
Hudson Bay Building, Calgary	8

Building	Storeys above Street.
Power Company Building, Montreal	10
Lumsden Cumming Building, Toronto	10
Parliament Building, Edmonton	
Ritz-Carlton Hotel, Montreal	10
Annex to Windsor Hotel, Montreal	8
Transportation Building, Montreal	10
Lewis Building, Montreal	10
Eastern Townships Bank, Montreal	11*
Yorkshire Insurance, Montreal	11
Drummond Building, Montreal	10
Bell Telephone Building, Montreal	10
Confederation Life Building, Winnipeg	10

* designed for 16 storeys.

In addition to the above the Simpson Building in Toronto although comparatively low is worthy of reference on account of the weight of steel involved, which, for the original building and subsequent extensions reaches the figure of 1652 tons (1,229,000 kg).

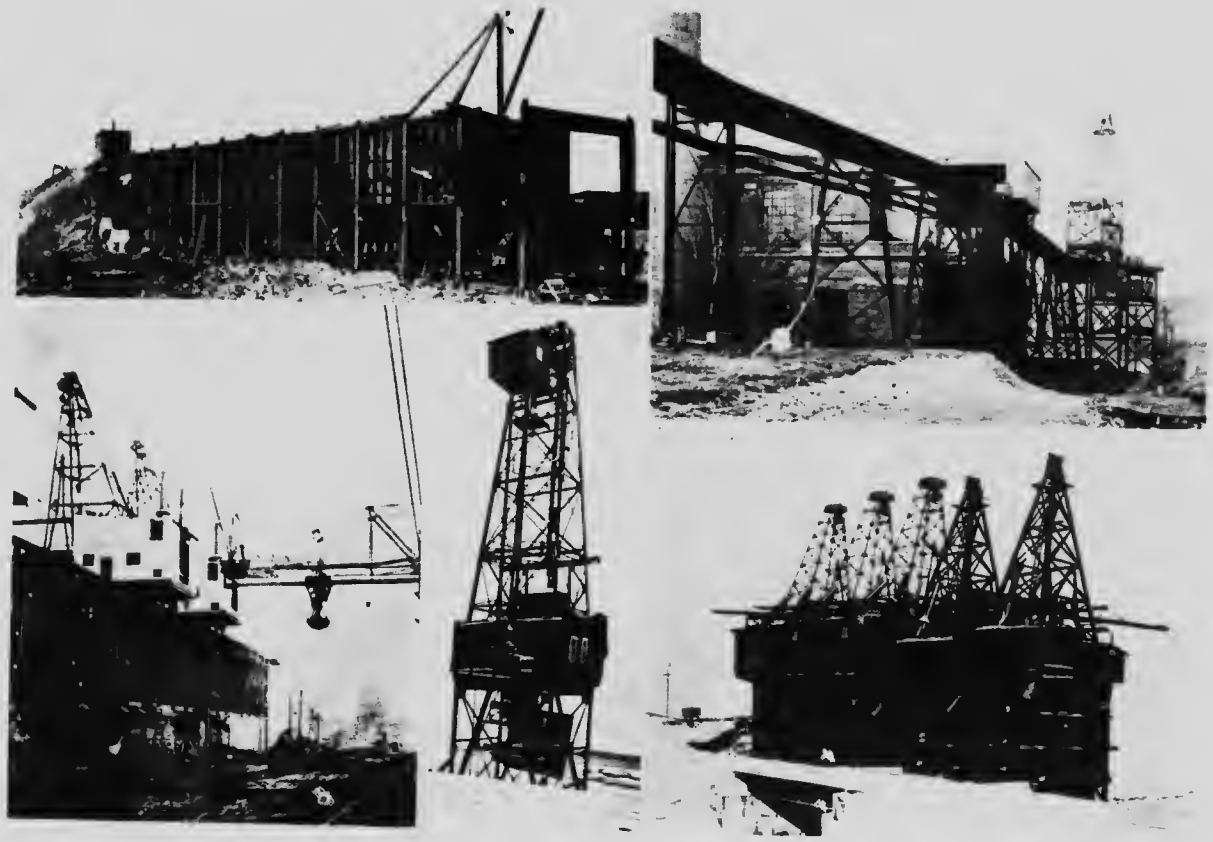


20 STOREY ROYAL BANK BUILDING, TORONTO.

3 Storeys, March 14th, 1914. 19 Storeys May 9th, 1914.

COAL AND ORE-HANDLING PLANTS

The cuts on page 91 show various structures used in the handling and storing of coal and ore. The upper left hand cut illustrates the parabolic ore bins built for the Canadian Copper Company at Copper Cliff, Ontario. Bins of this and other types are designed and fabricated by the Dominion Bridge Company for all purposes such as coal storing in boiler houses and power plants, pulp and chip handling in paper mills, ore handling at mine heads, etc., etc. The lower left hand cut presents a view of part of the coal bunkers and unloading towers at Windmill Point, Montreal, belonging to the Dominion Coal Company. The same company owns and operates the Hochelaga towers and bunkers shown in the cut at the right hand lower corner. In addition to these the Dominion Bridge Company has built for the Coal Company similar coal towers at Three Rivers, Quebec City, and Sydney, C.B., besides various ore handling plants at the latter place and sundry steel structures elsewhere. The remaining two views show work done for the Montreal Light, Heat & Power Company. The coal handling plant recently installed at Ville La Salle on the Lachine Canal in connection with the gas works embraces the tower and conveyor shown in the view opposite, a travelling bridge for coal, a coal storage shed, a coke tower and travelling bridge for coke handling. Coal is picked up from the canal boats and loaded through hoppers into trucks running on the conveyor trestle whence it dumped into the storage piles. The bridge serves to pick it up and deliver it either to the Power house or the Retort house as required. Approximately 3134 tons of steel (2,843,000 kg) were supplied for the various structures comprising the Ville La Salle plant. The remaining picture is of a coal unloading tower and storage bin at Hochelaga.



ROOF TRUSSES

The illustrations seen on page 93 show roof truss construction of the more unusual type either as regards length or appearance. The Grand Stand at Ottawa is situated on the Racecourse and is typical of light covered in structures for seating and shelter purposes. The curved trusses seen in the lower left hand cut are part of the roof of the Convocation Hall of Toronto University.

The other photographs show the Edmonton Stock Pavilion built during 1912. This building is 187 feet 5 inches wide (57.13 m) outside the walls and 315 feet 4 inches (96.11 m) long, and the main roof consists of 10 trusses, 8 of which are at 39 feet (9.11 m) centres and span as a double cantilever the whole width giving a clear central opening of 100 feet (30.5 m). They were designed so that the centre portion was carried as a suspended span seated on the overhanging arms of the cantilevers whilst the anchor columns were in the walls where the weight of the seating, etc., could be obtained to act against any possible uplift. The other two trusses one at each end were simple spans three to the width of the building. The photograph taken during construction shows the design of the long span roof trusses and the detail at the junction of the suspended span and cantilevers. Slotted holes were provided for excessive expansion or distortion but were bolted up to a fair tightness to secure some rigidity. The trusswork was fabricated in Lachine but the columns and framing in Winnipeg. The interior view shows the general pleasing appearance obtained by the use of a curved bottom chord.

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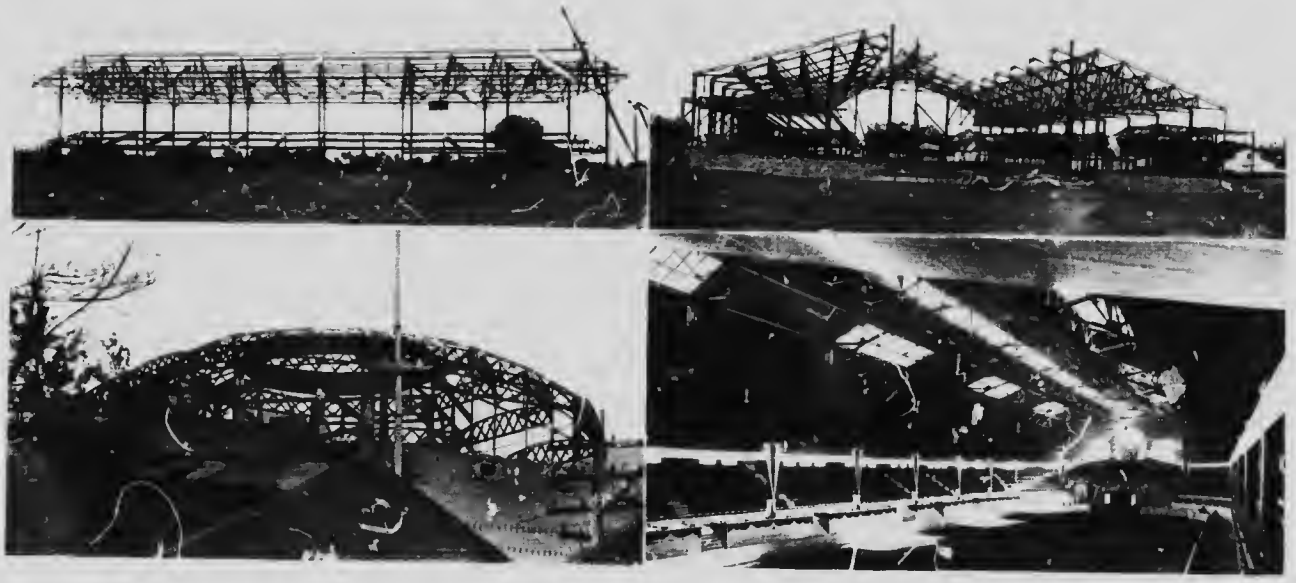
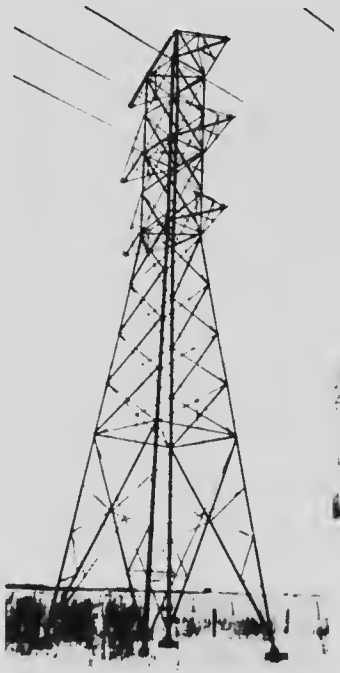
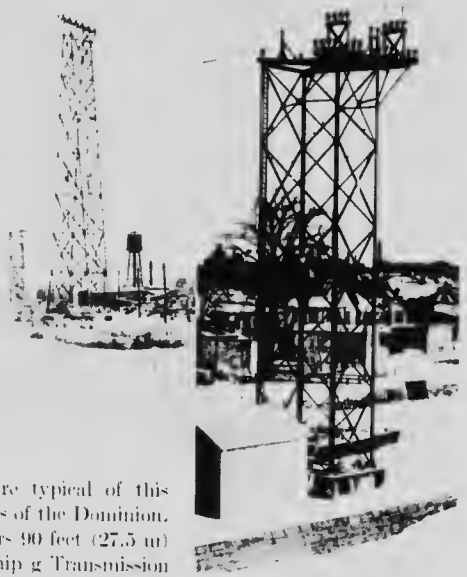


Grand Stand, Ottawa Race Course.
Convocation Hall, University of Toronto.

Edmonton Stock Pavilion,
during erection and completed.





The transmission towers illustrated above are typical of this class of construction as carried out in various parts of the Dominion. The left hand view shows one of a series of towers 90 feet (27.5 m) built by the Winnipeg Shop for the City of Winnipeg Transmission Line. The centre photograph was taken from the C. P. R. crossing of the Lachine Canal at Rockfield and shows four of the larger 165 feet (50.3 m) towers erected for the Montreal Light, Heat & Power Co. while the right hand cut represents a view of the lowest of the towers comprising the crossing of the Ottawa River at St. Anne's.

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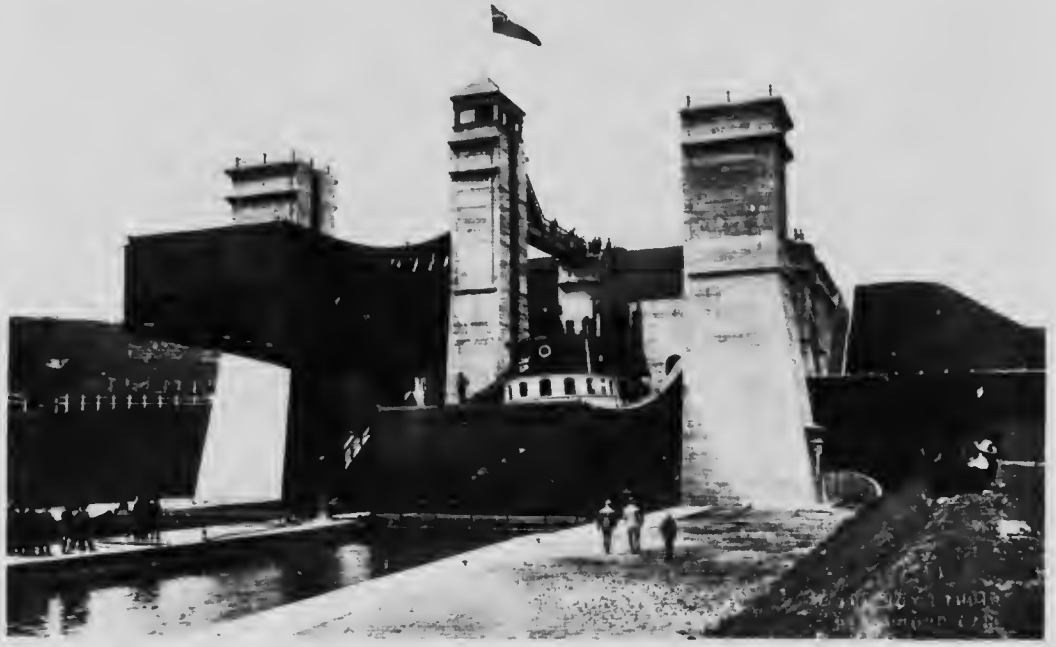
MISCELLANEOUS STEEL WORK

SPHERICAL BOTTOM WATER TANKS Views are shown of the 80,000 Imperial Gallon (364,000 l) tank at Fort Saskatchewan, Alta (left hand) and the 60,000 Imperial Gallon (110,000 l) tank at Carleton Place, Ontario.

The STAND PIPE is in the Dominion Bridge Company's own works at Lachine and holds 345,000 rial gallons (1,570,000 l). It has a diameter of 28 feet (8.534 m) and a height of 90 feet (27.43 m).

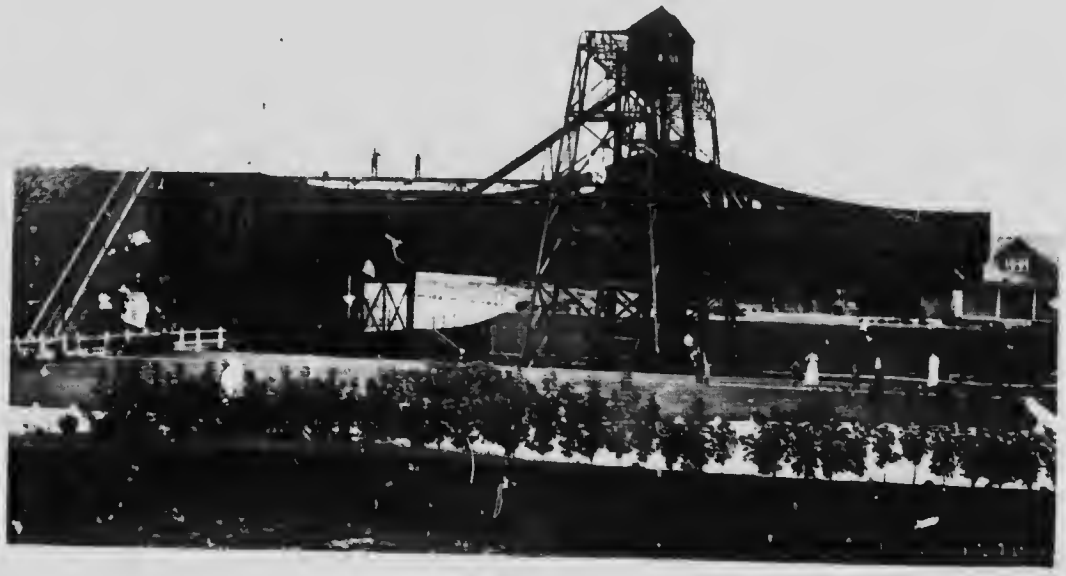
The SMOKE STACK illustrated was built for the Canadian Car & Foundry plant at Fort William It is 110 feet high (33.5 m) and spreads from 9 feet 6 inches (2.895 m) to 16 feet 6 inches (5.03 m) in diameter.

The PENSTOCK PIPE was built for the James McLaren Co of Buckingham, Que., in 1901 The diameter varied from 11 to 15 feet (3.35 to 4.57 m) and the total weight was about 228 tons (207,000 kg).



LIFT LOCK AT PETERBOROUGH, ONT.

The lift lock at Peterboro' on the Trent Canal was built in 1899 and consists of two chambers 140 feet (42.67 m) long, 33 feet (10,06 m) wide and 9 feet 10 inches (3 m) deep. The operation is almost automatic as the descending chamber is always filled to a greater depth than the ascending one. Hydraulic power however can be used when required. The lift is 65 feet (19,81 m) the highest in the world, the hydraulic pressure is 600 lbs per square inch (42. kg per sq. cm) and the whole time occupied to pass a vessel is about twelve minutes. See the special Mechanical Catalogue for further details.



LIFT LOCK AT KIRKFIELD, ONT.

This lock also on the Trent Canal was built during 1905-6. The lift is somewhat less than at Peterboro' but the general design is similar. This lock is also referred to in the special Mechanical Catalogue.

SHAWINIGAN REGULATING GATES

The cut opposite gives a general view of one section of a movable steel dam built for the Shawinigan Water & Power Company at Shawinigan Falls, Que. This dam consists of two portions as the river is divided into two channels by an island. One portion consists of eight gates, and the second portion, which is the one illustrated, consists of 12 large and small gates. All the large gates are 40 feet (12.2 m) wide in the clear between piers, 18 feet (5.49 m) high and 21 feet (6.4 m) lift. The small or regulating gates are contained in the gate house. They are 16 feet (4.88 m) wide and 18 feet (5.49 m) high with 21 feet (6.4 m) lift. The large gates are lifted by means of travelling hoists which run along the bridge, which is supported by towers on the masonry piers. Hoisting is done by means of screws which connect with the vertical end girders of the gates. When lifted to their highest position, the gates are sustained by being connected directly to the bridge through locking pins, which are operated by a hand lever from the platform of the hoist. The hoisting screws may be disconnected and the machine used for lifting other gates. In the illustration all the gates are lifted to their highest position. Two hoists are provided for the 12 gate section of the dam and one hoist for the 8 gate section all of which are operated electrically. The boiler shown in the illustration on the platform of the hoist is used for freeing the gates of ice when this becomes necessary. The small gates in the gate house are provided with individual screw hoists of a similar type to those mentioned above.

General view of four regulating gates, furnished and installed for the Michigan Lake Superior Power Company. Each gate is 49 feet 6 inches (15.1 m) wide and 27 feet (8.23 m) high. Individual hoisting mechanisms are provided, the lift being about 28 feet (8.54 m).

A similar dam consisting of four gates 53 feet 7 inches (16.35 m) wide, 13 feet (3.97 m) high, was furnished for the Lake Superior Power Company.

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This illustration gives a view of the movable emergency dam built in 1895 for the Dominion Government at the Sault Ste Marie Canal for use in case of accident to the lock gates. The log frames can be lowered individually, and to any depth required, up to 30 feet (9.15 m).

The view was taken during a test, under a much lower head, but in 1909 when the gates were damaged, the dam was brought into successful operation against the full head of water.

CRANES

The two cranes shown on page 103 are taken from the special Mechanical Department catalogue and illustrate the plate web and open lattice types of crane girders.

The upper cut presents a 20 ton 4 motor electric travelling crane of 70 feet span equipped with a 5 ton auxiliary hoist. Two of these were furnished to the Canadian Steel Foundries, Limited.

The lower view shows a 20 ton 5 motor travelling crane of 88 feet span carrying two 10 ton trolleys. Five of these are used in the Dominion Bridge Company's own yards.

For a complete survey of the question of cranes—hand power and electric—of any span and any capacity the special catalogue of the Mechanical Department should be consulted.

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INDEX TO ILLUSTRATIONS